APPENDIX A
Notice of Preparation and Comments Received

San Francisco Planning
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103
628.652.7600
www.sfplanning.org

PUBLIC NOTICE

AVAILABILITY OF NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT REPORT AND NOTICE OF PUBLIC SCOPING MEETING

Date:	November 25, 2020
Case No.:	**2020-004398ENV**
Project Title:	**SFO Shoreline Protection Program**
Project Sponsor:	San Francisco International Airport David Kim – 650.821.1426 david.t.kim@flysfo.com
Staff Contact:	Michael Li – 628.652.7538 michael.j.li@sfgov.org

Introduction

The San Francisco Planning Department prepared this notice of preparation of an environmental impact report (EIR) in connection with the San Francisco International Airport (SFO) Shoreline Protection Program. The purpose of the EIR is to provide information about the potential significant physical environmental effects of the proposed project, to identify possible ways to minimize any potentially significant adverse effects, and to describe and analyze possible alternatives to the proposed project. The planning department is issuing this notice to inform the public and responsible and interested agencies about the proposed project and the intent to prepare an EIR, including a public scoping meeting to solicit comments on the scope of the EIR. The planning department will hold the public scoping meeting on Wednesday, December 9, at 5 p.m. The planning department will hold the meeting using an online platform. You can view this notice and join the meeting via the online platform link found on the planning department's webpage, http://www.sfplanning.org/sfceqadocs; or via phone, using the following phone number and meeting identification number: 833 548 0282 (Toll Free); meeting ID: 831 0306 4931.

Project Summary

The project sponsor, San Francisco International Airport (SFO or Airport), proposes to implement the SFO Shoreline Protection Program (proposed project) to address flood protection and future sea-level rise for the expected lifespan of the shoreline improvements. The proposed project would install new shoreline protection infrastructure that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection and incorporate protection for future sea-level rise. The proposed project would remove most of the existing shoreline protection structures and would construct a new shoreline protection system comprised of a combination of concrete walls and steel king and sheet pile walls. These structures would vary from reach to reach, depending on the existing site characteristics, and would range in height from approximately 5.2 to 12.1 feet above the existing ground for the steel sheet pile and concrete walls, given that the elevation and slope of the ground varies for each reach. In total, the proposed project would construct an approximately 40,564-foot-long (approximately 7.6 miles) new shoreline protection system, which would require approximately 27.5 acres of soil fill in the Bay for various reaches and result in approximately 4.4 acres of impacts to wetland areas.

The Airport's 8-mile shoreline and western landside boundary are divided into 16 reaches[1] based on shoreline orientation, existing protection type, existing foreshore[2] conditions, and existing landside conditions. The project proposes to construct shoreline protection improvements specific to 15 of the reaches to eliminate the probability of substantial inundation at the Airport until 2085.

In order to address landside flood protection, Reach 16 would be required to form a continuous, closed flood protection system. However, landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae. As such, while Reaches 1 through 15 will be analyzed at the project level, the analysis of the landside Reach 16 will be analyzed at a programmatic level.

Project Location

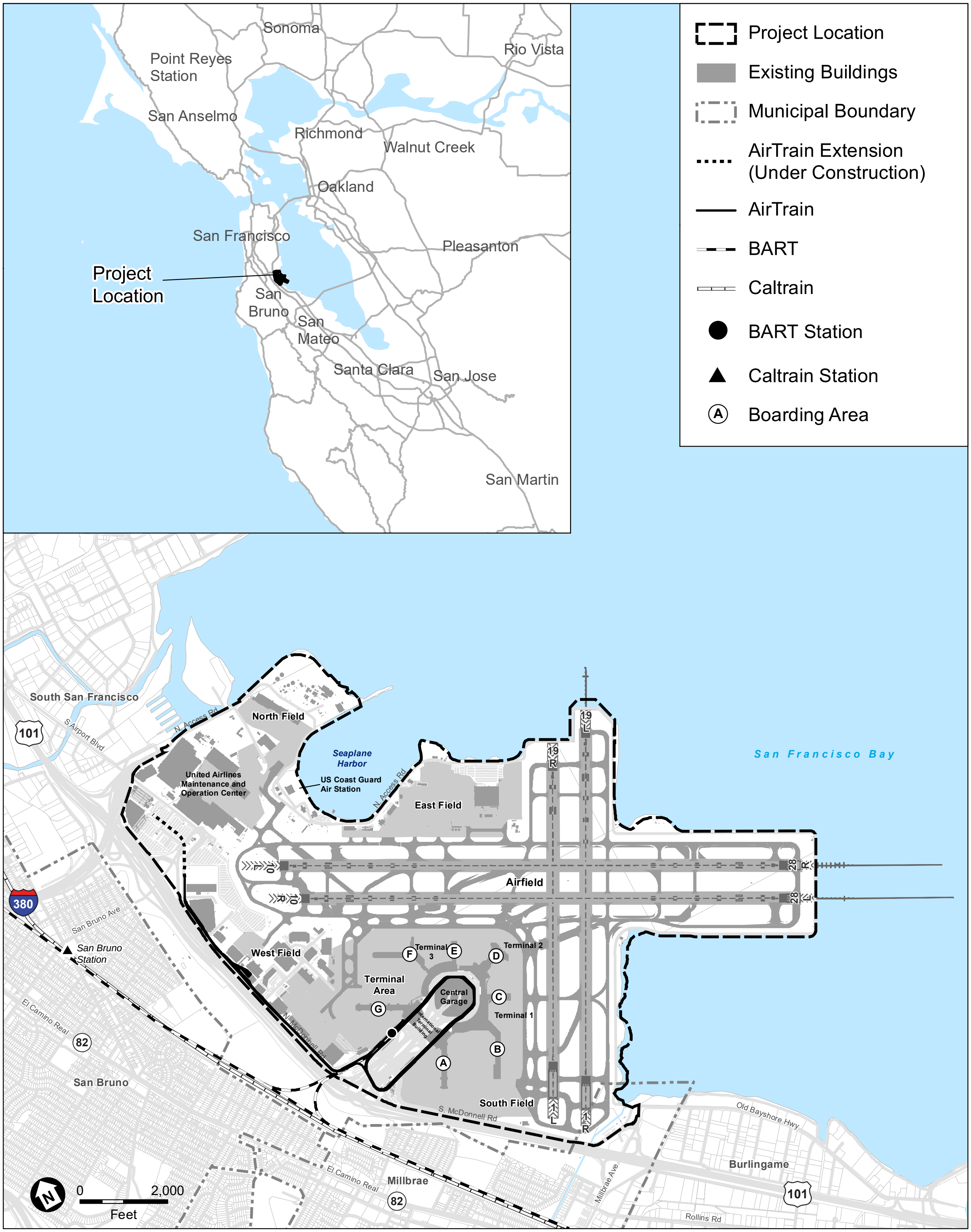
The project site is comprised of the perimeter of the Airport, primarily located in unincorporated San Mateo County, California, approximately 13 miles south of downtown San Francisco, with portions of the Airport within the city boundaries of South San Francisco to the north, San Bruno to the west, Millbrae to the south, and Burlingame to the southeast (see **Figure 1**). The Airport is owned by the City and County of San Francisco (City) and operated by and through the San Francisco Airport Commission (airport commission). The United Airlines Maintenance and Operations Center is located on Airport land but is not owned or operated by the Airport. The U.S. Coast Guard San Francisco Air Station is located entirely on federal land adjacent to Airport's eastern boundary along Seaplane Harbor; the facilities are owned, maintained, and operated by the federal government.

The operational area of the Airport is generally bordered by U.S. Highway 101 (U.S. 101), also referred to as the Bayshore Freeway, to the west and San Francisco Bay (Bay) to the east. Of the 5,100 acres that comprise Airport property, approximately 2,110 acres are located on land east of U.S. 101, 180 acres are located west of U.S. 101, and 2,810 acres are over San Francisco Bay.

SFO is the largest airport serving the San Francisco Bay Area. Other airports in the San Francisco Bay Area include Oakland International and Norman Y. Mineta San Jose International airports. SFO contains two sets of parallel runways, oriented in north/south (Runways 1L-19R and 1R-19L) and east/west (Runways 10L-28R and 10R-28L) configurations; supporting airfield facilities and infrastructure; a passenger terminal area served by access roads,

[1] A *reach* is defined as a longshore segment of a shoreline where influences and impacts, such as wind direction, wave energy, littoral transport, etc., mutually interact.

[2] The foreshore refers to the area between low and high tide along the shoreline.



SOURCE: SFO, 2018

SFO Shoreline Protection Program

Figure 1
Project Location

parking facilities, and ground transportation facilities; and cargo and other facilities typical of a commercial service airport.[3]

SFO, which initially opened in 1927, was constructed in phases beginning in the 1920s and continuing through the 1970s by filling portions of the Bay. The Airport is situated within a fully developed, land-constrained site, and is the legacy of incremental changes that occurred over several decades. The great majority of the project site is paved for aeronautical uses such as runways, taxiways,[4] aircraft aprons,[5] and parking, or occupied by passenger terminal buildings and aircraft hangars. SFO operates 24 hours a day, seven days per week as a public use airport.[6]

Project Background and Shoreline Characteristics

Project Background

FEMA is responsible for the administration of the National Flood Insurance Program (NFIP). Under this program, participating communities agree to implement floodplain management ordinances that limit the risk of future flood damage in flood-prone areas. These ordinances must meet the minimum floodplain management criteria of the federal regulations that govern the NFIP. To support the NFIP, FEMA publishes Flood Insurance Rate Maps (FIRMs), which show areas subject to inundation during floods having a one percent chance of occurrence in a given year (also referred to as the base flood or 100-year flood). These floodplains are referred to as Special Flood Hazard Areas (SFHAs).

In 2010, the City adopted a floodplain management ordinance[7] and joined the NFIP. As such, SFO is required to implement the City's flood-resistant construction requirements per the San Francisco Floodplain Management Program for structures located in SFHAs. In 2015, FEMA issued a preliminary FIRM for the City and County of San Francisco based on an updated study of flood hazards for the Bay. As part of the updated study, FEMA determined that the flood protection system on the perimeter of the Airport property is not adequate to prevent inundation during the one percent annual chance flood. Therefore, the FIRM that covers the Airport shows that most of the property lies within an SFHA and may be inundated during the one percent annual chance flood.

Site Characteristics

The Airport property and shoreline lies on reclaimed land that was once part of the Bay. From 1930 to 1970, the land was developed by placing artificial fill over young bay mud, which is soft, unconsolidated silty clay. The fill is generally composed of silty and clayey sands, silts, and clays. The fill thickness along the shoreline ranges from 4 to 36 feet. Underneath the fill lies a layer of young bay mud, which ranges from 10 to 70 feet thick. Bedrock is present from 5 to 300 feet below the surface of the Bay.

---

[3] A *commercial service airport* is a publicly owned airport that has at least 2,500 passenger boardings each year and receives scheduled passenger service.

[4] *Taxiways* are routes used by airplanes to move to or from a runway.

[5] An *aircraft apron* is a defined area on an airport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance.

[6] A *public use airport* is an airport available for use by the general public without a requirement for prior approval of the airport owner or operator.

[7] Ordinance number 188-08 (enacted in 2008) establishes the floodplain management program by adding article XX, sections 2A.280 through 2A.285, to the San Francisco Administrative Code. The Board of Supervisors approved ordinance number 56-10 to amend the floodplain management program in 2010.

The Airport's shoreline and western landside boundary are divided into 16 reaches based on shoreline orientation, existing protection type, foreshore type, and existing landside conditions (see **Figure 2**). Existing shoreline protection systems for 15 of the reaches vary by reach and include a combination of concrete walls, sheet pile wall,[8] concrete debris, armor rocks, sand bags, K-rail,[9] tidal flats, and earthen and vegetated berms.[10] The existing shoreline protection for each reach typically includes varying combinations of these systems. Some sections of the existing shoreline system show wear and evidence of distress, including seepage through sections of berm, cracks and holes in concrete and vinyl sheet pile walls, and overall deterioration of the sheet pile wall.

Proposed Shoreline Protection Program

The proposed project is designed to protect SFO from the one percent annual chance flood and considers the impact of sea-level rise through 2085. Based on the State of California's adoption of the California Ocean Protection Council's most recent sea-level rise guidance in March 2018, SFO prepared a Conceptual Design Study[11] for the shoreline protection program. The study evaluated six water level design options that would comply with current FEMA requirements for the 100-year flood event in combination with sea-level rise projections ranging from zero to 60 inches (0 inches, 11 inches, 24 inches, 36 inches, 48 inches, and 60 inches). The evaluation of each water level design option considered: the timing of future sea-level rise and the probability of reaching the level sooner than the predicted value; the anticipated lifespan of the shoreline protection improvements; and how much advanced warning SFO will have to plan future shoreline protection in the event sea-level rise occurs more quickly than anticipated. Based on this evaluation, SFO determined that, in general, designs that meet current FEMA requirements, which is up to 24 inches, plus 36 inches (FEMA+36 inches), particularly those that use steel sheet pile wall construction, are most appropriate to accommodate up to 60 inches of sea-level rise during a 100-year flood event.

The proposed project would remove most of the existing shoreline protection structures and would construct a new shoreline protection system comprised of a combination of concrete walls and steel king and sheet pile walls, some with armor rock revetments[12] and/or soil fill. These structures would vary from reach to reach, depending on the existing site characteristics, and would range in height from approximately 5.2 to 12.1 feet above the existing ground for the steel sheet pile and concrete walls, given that the elevation and slope of the ground varies for each reach. The king pile walls would extend approximately 26 feet above the Bay floor, and the crest of the king pile walls would range from approximately 13 to 20 feet above the Bay's typical tidal water levels, depending on the phase of the tide. Storm surge, waves, and sea-level rise would further raise water levels, thereby reducing the height of the king pile walls above the Bay.

---

[8] A sheet pile wall is made of interlocking sheet piles that form a wall. The wall is driven into the ground and meant to retain earth, water, or other filling material. Sheet pile can be made of a number of materials including but not limited to timber, concrete, steel or polyvinyl chloride, typically referred to as a vinyl sheet pile.

[9] A K-rail is a modular concrete barrier typically used to separate lanes of traffic.

[10] A berm acts as a barrier and is a raised bank or terrace bordering a road, river, canal, or other body of water.

[11] San Francisco International Airport, *Shoreline Protection Program: Conceptual Design Study*, prepared by AECOM, Telamon Engineering, and ESA, March 2018.

[12] Revetments are sloping structures meant to barricade or prevent erosion due to wave action. Rock armor is a rock used to reinforce or "armor" shorelines and shoreline structures like pilings against erosion.

SOURCE: SFO, 2018

SFO Shoreline Protection Program

Figure 2
Reach Locations

Concrete caps[13] are proposed for Reaches 2 through 14 to protect the steel sheet pile and king pile walls. In total, the proposed project would construct an approximately 40,564-foot-long (approximately 7.6 miles) new shoreline protection system for Reaches 1 through 15, which would require approximately 27.5 acres of soil fill in the Bay for various reaches and result in approximately 4.4 acres of impacts to wetland areas. The steel sheet piles would be driven approximately 10 to 25 feet below grade, and the steel king pile walls, including the H-shaped steel piles and interlocking sheets, would be driven approximately 50 feet below grade.

Armor rock revetments would be used in tandem with walls, to dissipate wave energy and prevent sediment scour[14] for existing sections of shoreline that are steeply sloped and may be prone to erosion. Soil fill, intended to stabilize the shoreline and create a necessary slope for the shoreline protection system, would be placed in the Bay for some of the reaches. **Table 1** lists the shoreline protection system proposed for the 15 reaches, including Sub-reaches 2A, 2B, 2C, 7A, 7B, and 7C, that constitute the Airport's entire shoreline, and **Table 2** identifies design characteristics for each reach and sub-reach.

Note that because Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to a neighboring shoreline protection system in South San Francisco and Millbrae,[15] this reach will be analyzed at a programmatic level in the EIR. CEQA Guidelines section 15168(c) states that subsequent activities must be examined in light of the program EIR to determine whether an additional environmental document must be prepared. Thus, the EIR for the proposed project will consider Reach 16 as a subsequent activity that would be evaluated when a project for that reach is proposed, in order to determine whether additional environmental documentation is required. The subsequent project-level analysis of Reach 16 would take into account any updated information relevant to the environmental analysis of the project (e.g., changes to the environmental setting, regulations, etc.).

Concrete Wall

As shown in Table 1, concrete walls are proposed for Reaches 1 and 15. For Reach 1, a new concrete wall with a shallow foundation is proposed along North Access Road, following the boundary of the Airport's property. The proposed concrete wall would turn south at North Access Road, and would follow along the east side of North McDonnell Road for approximately 150 feet. The proposed wall would total approximately 3,400 feet in length, range from 2.4 to 5.2 feet in height above the existing ground, and would require a maximum of five gaps to allow vehicle and pedestrian access between North Access Road and the project site (see **Figure 3**). These gaps would be closed using deployable flood gates.[16] To close the system and ensure continuous flood protection at the transition between Reaches 1 and 2, the Reach 1 flood protection wall on the south side of North Access Road would need to connect to the new Reach 2 flood protection wall located on the north side of North Access Road, east of the junction of North Access Road and North Field Road. The form of closure would entail a deployable flood gate.

---

[13] Concrete wall caps are a block or slab that horizontally "caps" a wall to prevent damage to the wall by deflecting environmental elements including rain.

[14] Sediment scour is the erosion of sediment including sand or silt from around an object.

[15] Note that any shoreline protection system proposed by an adjacent city would likely have to undergo its own environmental review.

[16] Deployable floodgates are gates meant to protect against flooding; they are adjustable and can be either raised or slid into position for flood protection.

Table 1 Proposed Shoreline Protection Structures by Reach

REACH NUMBER	REACH NAME	ARMOR ROCK (OVERLAY, REPLACEMENT, OR NEW)	CONCRETE WALL	SHEET PILE WALL AND CONCRETE CAP	KING PILE WALL	SOIL FILL
1	San Bruno Channel		●			
2A	Treatment Plant Sub-reach 2A			●		●
2B	Treatment Plant Sub-reach 2B			●		
2C	Treatment Plant Sub-reach 2C	●		●		
3	Seaplane Harbor 1	●		●		●
4	Coast Guard	●		●		●
5	Seaplane Harbor 2	●		●		●
6	Superbay	●		●		
7A	19 End Sub-reach 7A				●	●
7B	19 End Sub-reach 7B				●	●
7C	19 End Sub-reach 7C			●		
8	19 Edge	●		●		●
9	Intersection 1	●		●		●
10	Intersection 2			●		●
11	28R	●		●		●
12	28 End	●		●		●
13	28L	●		●		●
14	Mudflat	●		●		
15	Millbrae Channel		●			

SOURCE: San Francisco International Airport, *Shoreline Protection Program: Conceptual Design Study*, March 2018

For Reach 15, a new concrete floodwall would be constructed along the northern side of Millbrae Channel using the foundations of the existing aircraft operations area[17] barrier as part of the wall and as the foundation for the new wall (see Figure 3). A closeable gap would be required in the floodwall to allow an access point to remain between the vehicle service road[18] on Airport property and South McDonnell Road. The new, approximately 1,400-foot-long, approximately 7-foot-tall concrete wall would follow the route of Millbrae Channel, and would be connected to Reach 16, if necessary, thereby closing the gap between the shoreline protection and landside protection.

[17] The *aircraft operations area* is defined as the area of the Airport bounded by a fence to which access is otherwise restricted and which is primarily used or intended to be used for landing, takeoff, or surface maneuvering of aircraft, and related activities.
[18] A *vehicle service road* is a designated roadway in a non-movement area, which is an area used for loading, unloading, and parking aircraft.

Table 2 Design Characteristics of Each Reach

REACH NO.	REACH NAME	MAXIMUM HEIGHT OF THE WALL ABOVE EXISTING GROUND (FEET)	LENGTH OF WALL (FEET)
1	San Bruno Channel	5.2	3,448
2A	Treatment Plant Sub-reach 2A	6.3	665
2B	Treatment Plant Sub-reach 2B	12.1	3,142
2C	Treatment Plant Sub-reach 2C	6.4	608
3	Seaplane Harbor 1	6.7	1,375
4	Coast Guard	8.6	1,451
5	Seaplane Harbor 2	7.1	2,754
6	Superbay	4.9	2,961
7A/7B	19 End Sub-reach 7A/7B (king pile wall)	25.7[a]	4,068
7C	19 End Sub-reach 7C	11.8	548
8	19 Edge	10.2	1,532
9	Intersection 1	8.7	795
10	Intersection 2	10.0	925
11	28R	6.7	3,281
12	28 End	7.7	2,116
13	28L	7.8	4,160
14	Mudflat	9.6	4,438
15	Millbrae Channel	6.7	2,297[b]
	TOTAL		**40,564**

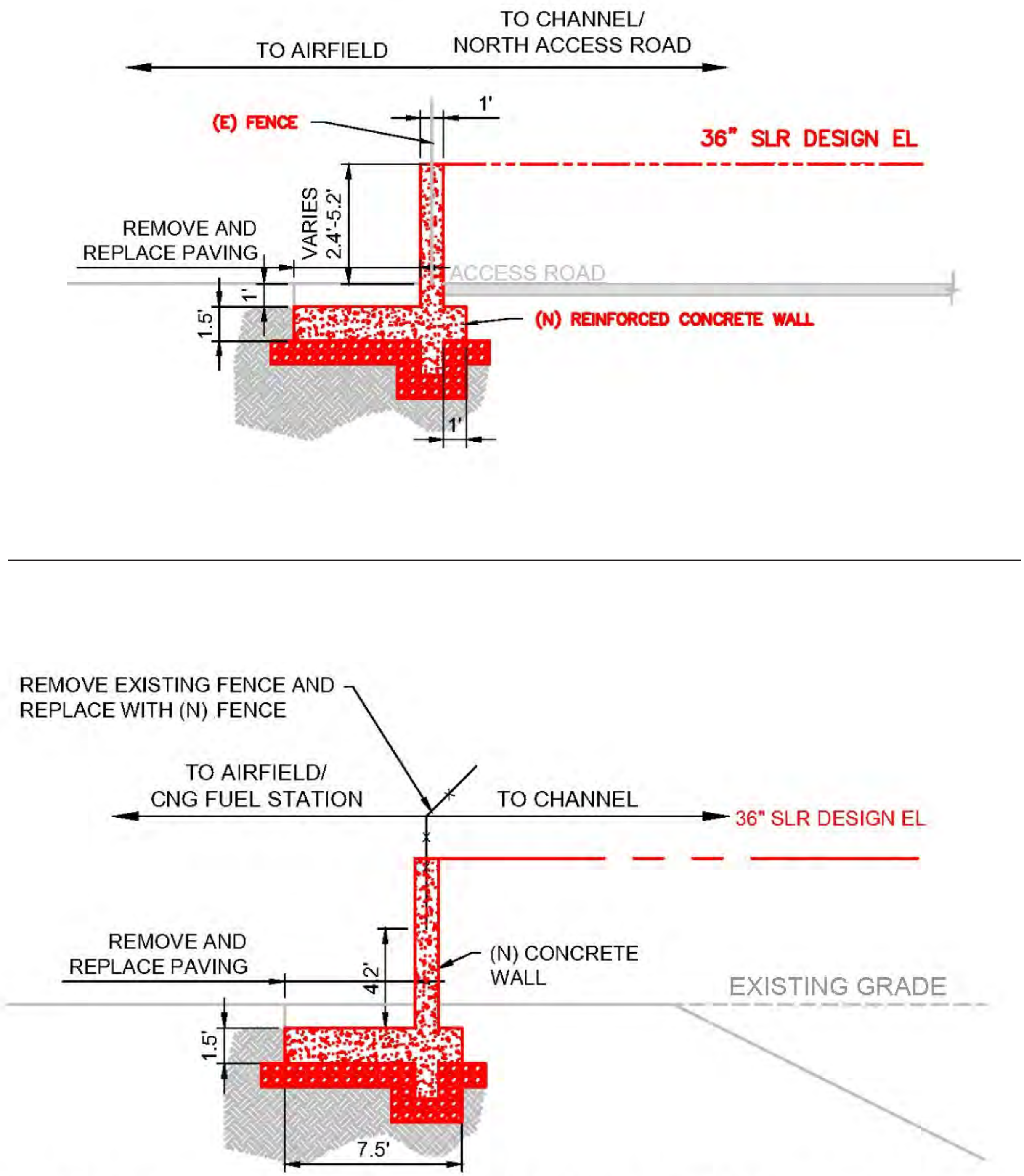
SOURCE: San Francisco International Airport, *Shoreline Protection Program: Conceptual Design Study*, March 2018

NOTES:

a The proposed steel king pile walls would extend a maximum height of 25.7 feet above the existing Bay floor, and would range from approximately 13 to 20 feet above sea level depending on the tide.

b The length for the proposed concrete wall for Reach 15 would be 1,441 feet, and the length of the proposed concrete wall around the Trillium CNG fuel station would be 856 feet.

The design for Reach 15 also proposes to construct a concrete wall around the perimeter of the Trillium CNG fuel station to provide flood protection for the facility. The proposed approximately 850-foot-long, approximately 7-foot-tall concrete wall would be constructed with two deployable flood gates to allow ingress to and egress from the facility.



SOURCE: AECOM, 2018

Figure 3
Reach 1 (top) and Reach 15 (bottom) Concrete Wall Cross Section

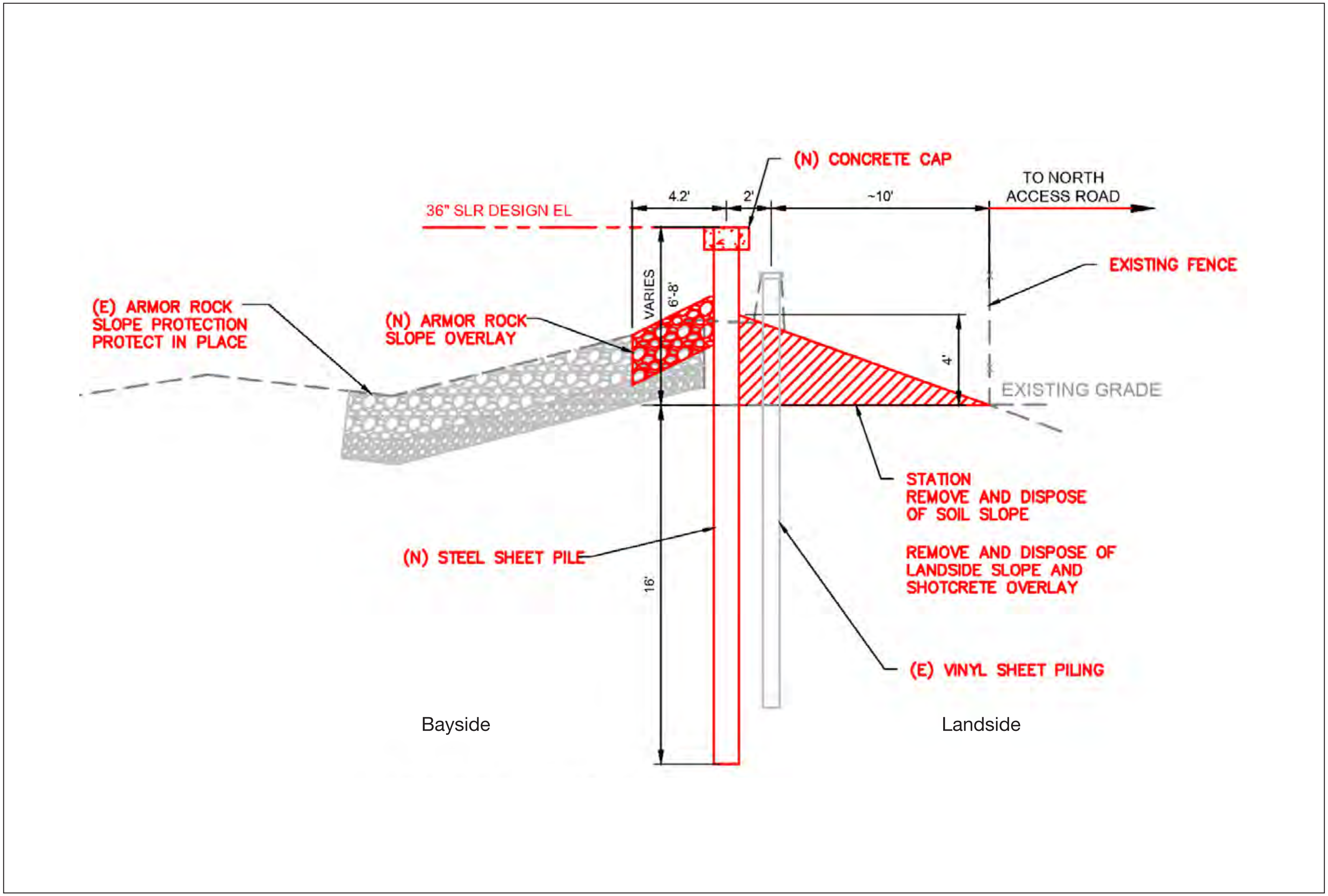
Sheet Pile Wall

The proposed shoreline protection system for a majority of the Bay-facing shoreline, including Reaches 2 (Sub-reaches 2A and 2C), 3 through 6, and 8 through 14, consists of a combination of soil fill and/or armor rock revetment between a steel sheet pile wall with a concrete cap. Removal of existing armor rock would occur in combination with soil fill of the area where armor rock existed for various reaches. As shown in **Table 1**, Sub-reach 2C and Reaches 6, 8, and 14 would include construction of a new sheet pile wall and concrete cap with only armor rock revetments. **Figure 4** shows a typical sheet pile wall employing this method of construction. Sub-reach 2A and Reaches 10 and 12 would include construction of a new steel sheet pile wall and concrete cap with only soil fill (see **Figure 5**). Reaches 3, 4, 5, 9, 11, and 13 would include construction of a new steel sheet pile wall and concrete cap with both soil fill and armor rock revetment, while Sub-reach 2B and Sub-reach 7C would include construction of new sheet pile wall and concrete cap with no soil fill or armor rock revetment (see **Figure 6** and **Figure 7**). Proposed armor rock revetments would be sloped and would either augment an existing sloping armor rock revetment or would be overlaid over the existing revetment. Proposed armor rock revetments would abut the steel pile wall on one end and slope into the Bay on the other end. The shoreline reaches would range from 5.2 to 12.1 feet in height above the existing ground.

The sheet pile walls for these reaches would consist of preformed profiles constructed from steel that would be driven and/or vibrated into the ground by a piling crane. The profiles of each sheet would interlock to a designated pattern, forming a continuous wall, and the reinforced-concrete caps would help stabilize the top of the wall in order to keep the profiles connected and act as a continuous structure. In general, steel sheet pile walls have a shorter lifespan than concrete walls because of corrosion in the marine environment. As such, a protective coating would be applied to the proposed sheet pile wall to minimize corrosion prior to installation.

King Pile Wall

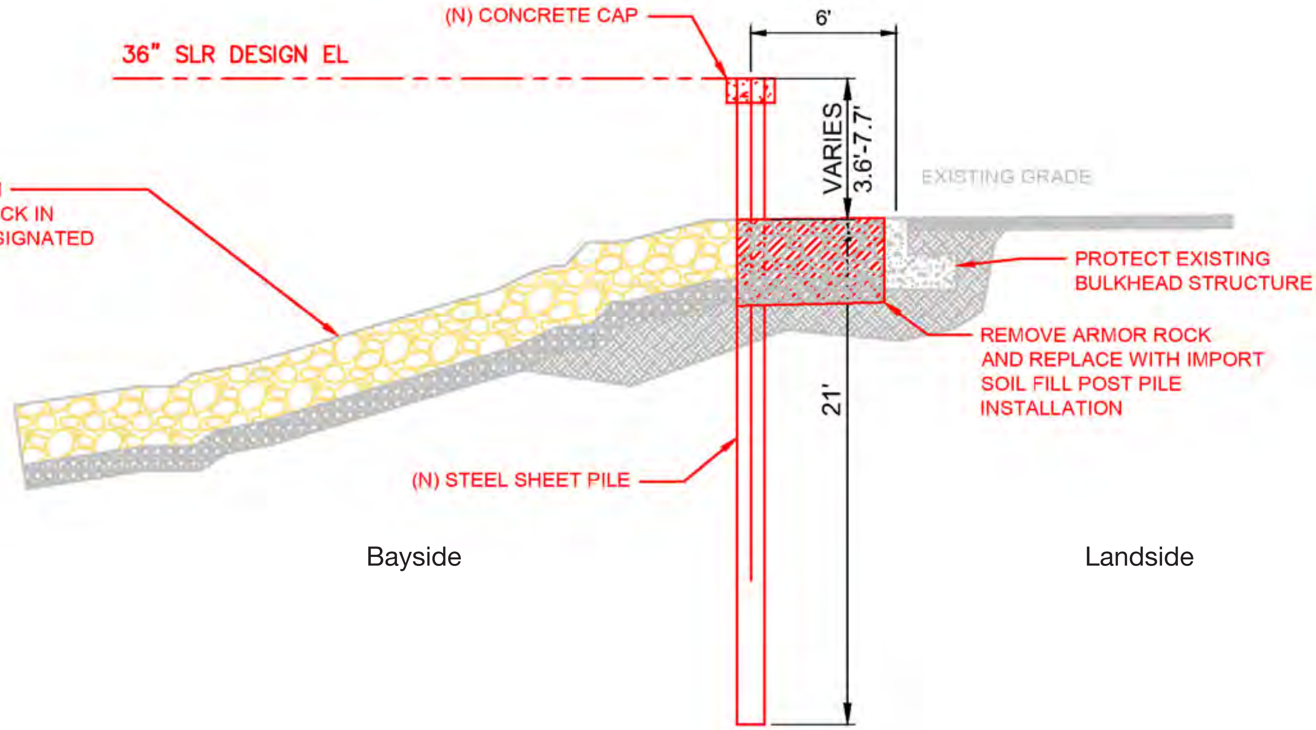
Only Sub-reaches 7A and 7B would employ steel king pile walls for shoreline protection structures (see **Figure 8**). King pile walls are similar in construction to sheet pile walls; however, the preformed steel sheet profiles are reinforced and supported by "I" and/or "H" beam steel sections at a designed spacing along the wall. This construction method provides greater strength to resist larger forces and allows the wall to be constructed to a greater height, thereby providing protection from higher waves. The length of the proposed king pile wall for both sub-reaches would be approximately 4,100 feet (approximately 0.75 miles) and would be composed of H-shaped steel piles with concrete caps placed at intervals with accompanying interlocking steel sheet piles placed between the H-shaped piles. The H-shaped piles are more rigid than the sheet piles and would accommodate the majority of the lateral loads caused by soil fill and wave action, with the sheet piles acting as load transferring elements. The area between the existing shoreline and proposed flood defense would be infilled with soil fill, and dredging may be required. The king pile walls would extend approximately 26 feet above the Bay floor, and the crest of the king pile walls would range from approximately 13 to 20 feet above the Bay's typical tidal water levels, depending on the phase of the tide. Storm surge, waves, and sea-level rise would further raise water levels, thereby reducing the height of the king pile walls above the surface of the Bay.



SOURCE: AECOM, 2018

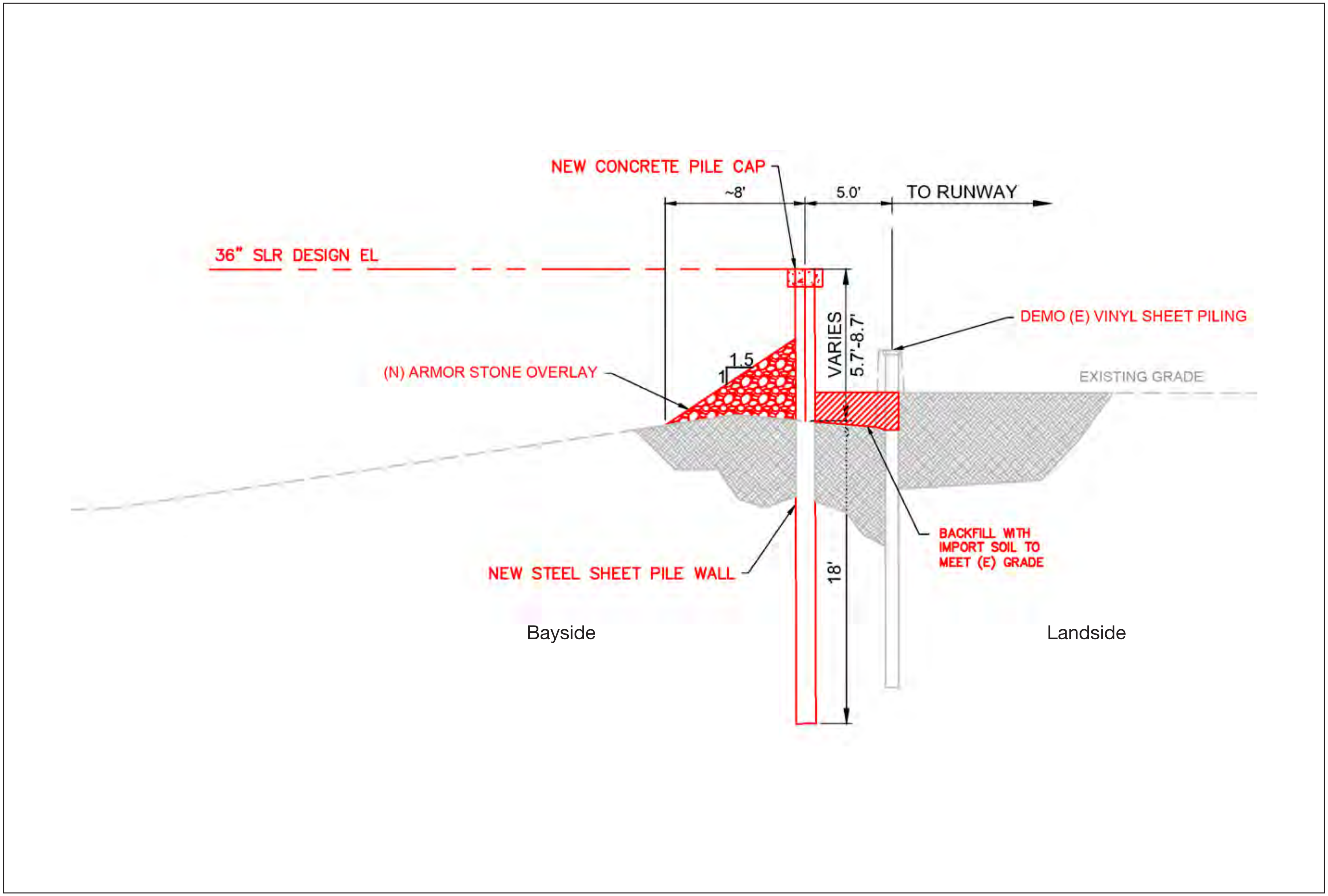
SFO Shoreline Protection Program

Figure 4
Typical Sheet Pile Wall With Armor Rock Revetment



SOURCE: AECOM, 2018

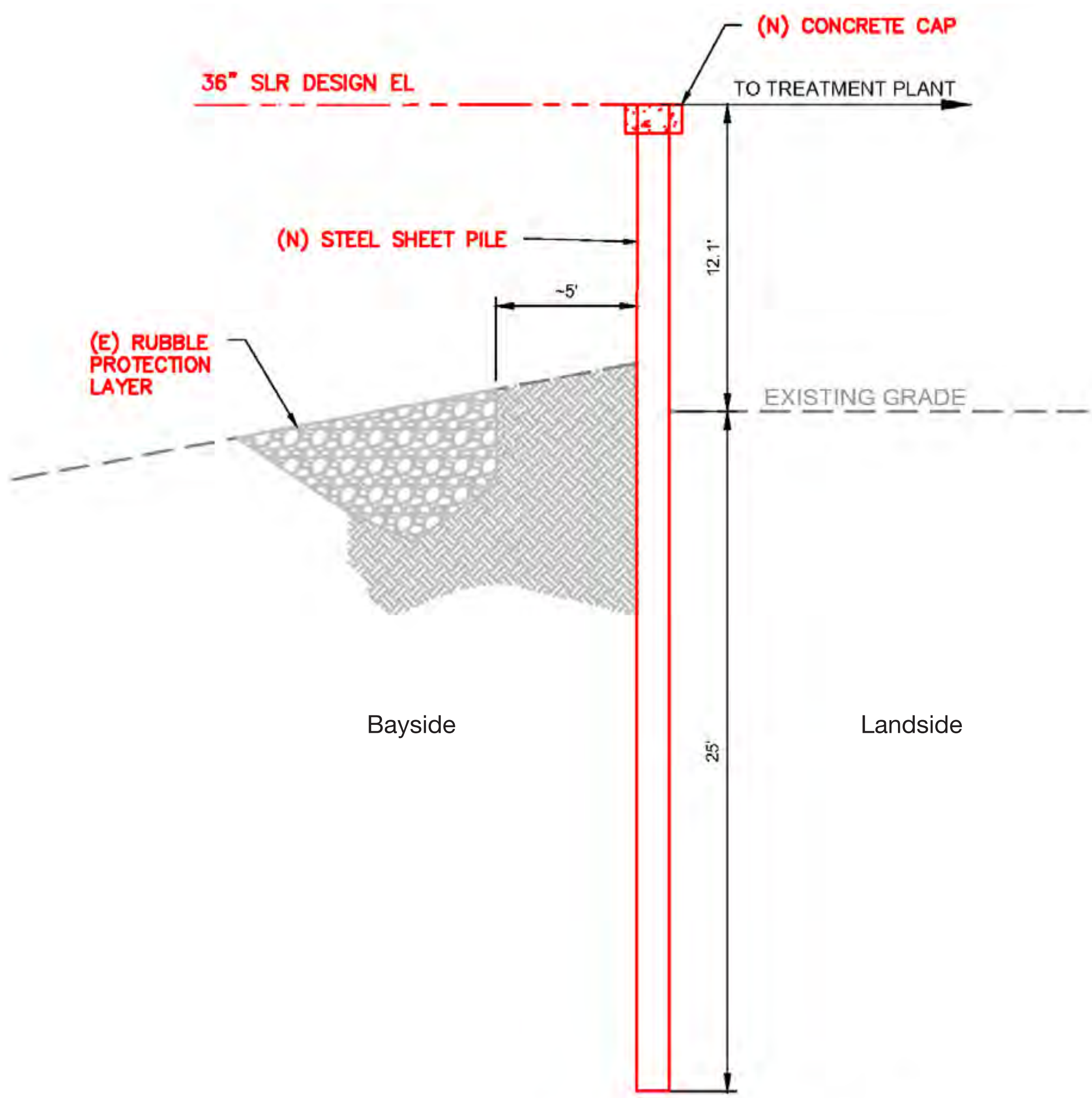
Figure 5
Typical Sheet Pile Wall With Soil Fill



SOURCE: AECOM, 2018

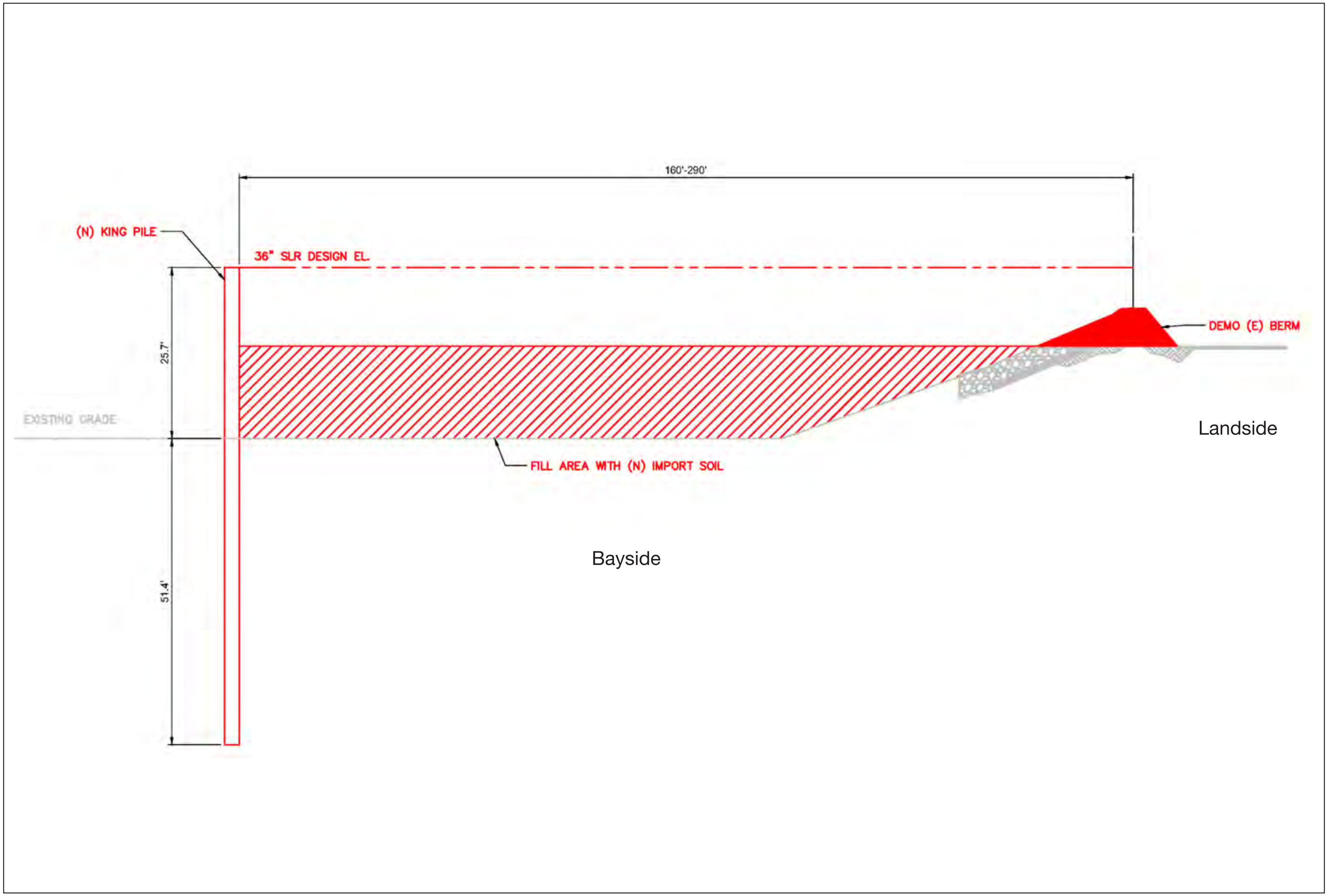
SFO Shoreline Protection Program

Figure 6
Typical Sheet Pile Wall With Armor Rock Revetment and Soil Fill



SOURCE: AECOM, 2018

Figure 7
Typical Sheet Pile Wall Only



SOURCE: AECOM, 2018

SFO Shoreline Protection Program

Figure 8
Typical Sheet King Pile Wall With Soil Fill

Stormwater Outfall Reconstruction

As part of construction of the proposed project, nine of the 10 stormwater outfalls located on Airport property would need to be raised over the height of the proposed wall to ensure their functionality in tandem with the shoreline protection program system (see Figure 2). The United Airlines North Slough outfall, which is located in the area of Reach 1, would not need to be raised. Rasing the stormwater outfalls would require cutting the outfalls on the landside of the proposed wall and installing one or two additional concrete piles in the Bay, depending on the reach, to a maximum depth of approximately 80 feet. The outfalls would then rest and extend over the proposed wall and slope down to reconnect with the outfalls on the Bay side of the shoreline protection programsystem.

Vehicle Service Road Relocation

The vehicle service road (VSR) along Sub-reach 7C, as well as Reaches 8, 9, 10, 11, 13, and 14, would be relocated to meet existing Federal Aviation Administration (FAA) Taxiway and Taxilane Object-Free Area (TOFA) standards.[19] The relocated VSRs would be shifted towards the San Francisco Bay, away from the existing taxiways to maintain a required separation distance of 193 feet per FAA design standards, and would have a new shoulder. Relocating the VSRs in conjunction with the shoreline improvements would avoid having to reconstruct the shoreline improvements under a separate project. Shifting the VSR towards the Bay would also help minimize delays to aircraft operations during the construction of the shoreline protection as construction equipment would use the VSRs. Currently, vehicles on certain sections of the VSR that are not at least 193 feet away from the taxiways must yield to passing aircraft. Moreover, building shoreline protection without shifting the VSR with a new shoulder would pose safety challenges for vehicles using the VSR. The new shoulder would allow for a margin of safety for vehicles using the VSR. The relocated VSRs would have two 12-foot lanes (one for each direction) and a 12-foot shoulder, resulting in a total width of 36 feet. The alignment of the VSRs would follow the sheet pile walls for roughly 200 feet of Sub-reach 7C and the entirety of Reaches 8, 9, 10, 11, 13, and 14. The existing VSR along those reaches would be removed and backfilled with with soil fill.

Reach 2 Roadway

A new non-publicly accessible road would be constructed along the alignment of Reach 2, east of the Mel Leong Wastewater Treatment Plant. The roadway would support fire safety capabilities for the wastewater treatment facility and allow for greater connectivity of the roadways on Airport property. Building the road in conjunction with the shoreline improvements would avoid having to reconstruct the shoreline improvements under a separate project. Furthermore, construction of the shoreline protection system for Reach 2 would require a temporary roadway along the alignment to allow access for construction equipment to build the sheet pile walls. Thus, construction of the Reach 2 shoreline protection system would facilitate the construction of a permanent roadway to support fire safety. The new roadway would connect to North Access Road, continue along the entirety of Reach 2, and connect to North Access Road again at the east end of Reach 3. In addition, a new roadway would also be constructed to connect the new roadway along Reach 2 to Clearwater Drive. The new roadways would include two lanes (one lane for each direction).

Lighting Trestle Reconstruction

In order to accommodate construction of Sub-reach 7B, the existing lighting trestle at the end of Runway 19L would be demolished, and a new lighting trestle would be constructed in the same location and at the same

[19] The *taxilane object-free area* is a clearing standard to prohibit service vehicle roads, parked aircraft, and other objects, except for objects that need to be located in the object-free area for air navigation or aircraft ground maneuvering purposes.

elevation of the proposed king pile wall. Reconstruction of the lighting trestle also would be necessary to ensure that the king pile wall would not obstruct the light plane from the approach lights, which facilitates the landing and take-off of aircraft. Additionally, the existing lighting trestle is at an elevation that would be subject to wave overtopping during a 100-year flood event.

The project proposes to remove the existing approach lights, demolish the existing lighting trestle, and remove the wood piles in the Bay that support the lighting trestle. The proposed project would install new, longer composite or plastic lumber piles in the Bay and reconstruct the lighting trestle platform, which would be approximately 8.5 feet taller than the current platform. The reinstalled approach lights would be approximately 7 feet taller than the existing approach lights. The increased height of the reinstalled approach lights would not affect aircraft operations.

Construction and Maintenance

Construction of Reaches 1 through 15 of the proposed project would begin in 2025 and is expected to be completed by 2032. The preliminary construction phasing is anticipated to begin at Reach 6 and move west towards Reach 1. Work would then commence on Reach 15, followed by Reaches 14 through 9 (in reverse numerical order). Construction of Reaches 7 and 8 is anticipated to run concurrently with the other reaches as a separate undertaking, starting shortly after Reach 6. Work is anticipated to overlap for adjacent reaches; for example, work on Reach 5 would begin prior to full completion of Reach 6 to ensure a seamless construction process. Sheet pile walls in a marine environment with even relatively low maintenance have an expected lifespan of approximately 60 years. The proposed project would be generally maintenance free for the first 10 years. After that, the sheet pile and concrete wall segments would be visually inspected every 5 years, and any damage would be repaired. With these regular maintenance activities, which would include routinely reapplying corrosion-resistant coatings roughly every 10 years and inspecting the concrete cap for cracks and repairing as necessary, it is estimated that the lifespan of the wall would extend for up to 85 years. In addition, all passive flood gates would be inspected annually for visible damage or misuse, and would be repaired as needed.

Approvals and Other Actions Required for the Shoreline Protection Program

The proposed project is subject to review and approvals by several local, regional, state, and federal agencies. Certification of the Final EIR by the San Francisco Planning Commission, which would be appealable to the San Francisco Board of Supervisors, is required before any discretionary approval or permits would be issued for the proposed project. The proposed project would require project approvals and other actions, including the following:

Federal Aviation Administration (FAA)

- Approval of updates to the Airport Layout Plan set[20] and environmental review under the National Environmental Policy Act (NEPA). As a federally obligated public use airport, SFO shall coordinate with the FAA

[20] An Airport Layout Plan (ALP) is a comprehensive set of drawings that depicts the existing physical site, planned future development, critical airspace surfaces, land ownership and rights of way. The ALP set is used by both the Airport and the FAA to guide facility development, anticipate federal budgetary needs, and assist with airspace planning. A current, FAA-approved ALP set must be maintained by all federally obligated, public use airports. The ALP submittal requirements are detailed in FAA Advisory Circular 150/5070-6, Airport Master Plans, Order 5100.38, Airport Improvement Program Handbook, and various FAA Standard Operating Procedures.

for environmental review per FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, as it pertains to NEPA.

- Approval of Form 7460-1, Notice of Proposed Construction or Alteration, to construct on the Airport, as applicable for the proposed project.

San Francisco Regional Water Quality Control Board (RWQCB)

- The Airport has a National Pollutant Discharge Elimination System (NPDES) permit, under Section 402 of the Clean Water Act, from the RWQCB and an associated Storm Water Pollution Prevention Plan (SWPPP) for the entire Airport. Prior to the construction of projects that would disturb more than 1 acre of soil, the Airport would need to obtain coverage under the State Water Resources Control Board's Construction General Permit (Order No. 2009-0009-DWQ) and prepare a site-specific SWPPP.
- Issuance of Section 401 Water Quality Certification.

San Francisco Bay Conservation and Development Commission

- Issuance of Major Permit.

United States Army Corps of Engineers

- Issuance of Section 10/404 Individual Permit.

United States Fish and Wildlife Service

- Preparation of a Biological Opinion.

National Marine Fisheries Service

- Preparation of a Biological Opinion.

California Department of Fish and Wildlife

- Issuance of an Incidental Take Permit under Section 2081(b) of the California Endangered Species Act.

San Francisco Planning Commission

- Certification of the Environmental Impact Report .

San Francisco Airport Commission

- Adoption of findings under CEQA, statement of overriding considerations (if applicable), and a mitigation monitoring and reporting program.
- Adoption of public trust doctrine findings.
- Determination to proceed with the project.
- Approval to issue design and construction bids and contracts.

San Francisco International Airport Building Inspection and Code Enforcement (BICE)

- Review and approval of demolition, grading, and building permits. All plans, specifications, calculations, and methods of construction shall meet the code requirements found in the California Uniform Building Code and

SFO standards in accordance with the Airport Building Regulations (Appendix F of the SFO Rules and Regulations).

Summary of Potential Environmental Issues

The proposed project could result in potentially significant environmental effects. As such, the San Francisco Planning Department will prepare an initial study (IS) and EIR to evaluate the physical environmental effects of the proposed project. As required by CEQA, the EIR will further examine those issues identified in the IS to have potentially significant effects, identify mitigation measures, analyze whether the proposed mitigation measures would reduce the environmental effects to less-than-significant levels, and identify alternatives to the proposed project that would reduce those impacts. The IS will be published as an appendix to the draft EIR and will be considered part of the EIR. Every reach for the proposed project will be analyzed at a project-level in the EIR, with the exception of Reach 16, which will be analyzed at a programmatic level. Thus, the EIR for the proposed project will consider Reach 16 as a subsequent activity that would be evaluated when a specific project for that reach is proposed.

The EIR (including the IS) will be prepared in compliance with CEQA (California Public Resources Code, sections 21000 et seq.), the CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code. The EIR is an informational document for use by governmental agencies and the public to aid in the planning and decision-making process. The EIR will disclose any physical environmental effects of the proposed Shoreline Protection Program and identify possible ways of reducing or avoiding potentially significant impacts.

The EIR will evaluate the environmental impacts of the proposed project resulting from construction and operation activities, and will propose mitigation measures to reduce or avoid impacts determined to be significant. The EIR will also identify potential cumulative impacts that consider impacts of the proposed project in combination with impacts of other past, present, and reasonably foreseeable future projects. The EIR will address all environmental topics in the planning department's CEQA environmental checklist, including the following environmental topics:

- Land Use and Planning
- Aesthetics
- Population and Housing
- Cultural Resources
- Tribal Cultural Resources
- Transportation and Circulation
- Noise
- Air Quality
- Greenhouse Gas Emissions
- Wind
- Shadow
- Recreation
- Utilities and Service Systems
- Public Services
- Biological Resources
- Geology and Soils
- Hydrology and Water Quality
- Hazards and Hazardous Materials
- Mineral Resources
- Energy
- Agriculture and Forestry Resources
- Wildfire

In addition, the EIR will include an analysis of the comparative environmental impacts of feasible alternatives to the proposed project that would reduce or avoid one or more of the significant impacts of the project while still meeting most of the project objectives. Alternatives to be considered include a No Project Alternative, as described in CEQA Guidelines section 15126.6, which considers reasonably foreseeable conditions at the project site if the proposed project is not implemented. Other alternatives will be evaluated as necessary, depending on the results of the impact analyses of the various environmental topics listed above. The EIR will also include a discussion of topics required by CEQA, including significant unavoidable impacts and significant irreversible impacts, any known controversy associated with the project and its environmental effects, and issues to be resolved by decision-makers. The EIR will fully analyze the proposed project at a sufficient level of detail such that the proposed project or any of the alternatives would be available for selection by the decision-makers and the project sponsors as part of the project approval actions.

Finding

This project could have a significant effect on the environment and a focused EIR will be prepared. This finding is based upon the criteria of the Guidelines of the State Secretary for Resources, sections 15064 (Determining Significant Effect) and 15065 (Mandatory Findings of Significance). The purpose of the EIR is to provide information about potential significant physical environmental effects of the proposed project, to identify possible ways to minimize the significant effects, and to describe and analyze possible alternatives to the proposed project. Preparation of an NOP or EIR does not indicate a decision by the City to approve or disapprove the project. However, prior to making any such decision, the decision makers must review and consider the information contained in the EIR.

Public Scoping Meeting

Pursuant to California Public Resources Code section 21083.9 and CEQA Guidelines section 15206, the planning department will hold a public scoping meeting to receive oral comments concerning the scope of the EIR. You may participate in the first public process concerning the project's environmental effects by attending a video or teleconference public scoping meeting on Wednesday, December 9, at 5 p.m. The planning department will hold the meeting using an online platform. You can join the meeting via the online platform link found on the department's webpage, www.sfplanning.org/sfceqadocs; or via phone, using the following phone number: 833 548 0282 (Toll Free); meeting ID: 831 0306 4931. To request assistance in additional languages, please contact candace.soohoo@sfgov.org or 628.652.7550 at least 72 hours in advance of the meeting to ensure availability. Written comments will also be accepted at this meeting and until 5 p.m. on December 28, 2020. Written comments should be sent to Michael Li, San Francisco Planning Department, 49 South Van Ness Avenue, Suite 1400, San Francisco, California 94103; or emailed to michael.j.li@sfgov.org. If you have questions or comments concerning this notice, contact Michael Li at michael.j.li@sfgov.org or 628.652.7538 by December 28, 2020.

If you work for an agency that is a Responsible or a Trustee Agency, we need to know the views of your agency as to the scope and content of the environmental information that is relevant to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use the EIR when considering a permit or other approval for this project. We will also need the name of the contact person for your agency. If you have questions concerning environmental review of the proposed project, contact Michael Li at 628.652.7538.

Members of the public are not required to provide personal identifying information when they communicate with the planning commission or the planning department. All written or oral communications, including submitted personal contact information, may be made available to the public for inspection and copying upon request and may appear on the department's website or in other public documents.

Anyone receiving this notice is encouraged to pass on this information to others who may have an interest in the project.

November 18, 2020
Date

Lisa Gibson
Lisa Gibson
Environmental Review Officer

NATIVE AMERICAN HERITAGE COMMISSION

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

November 30, 2020

Michael Li
San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

Re: 2020110456, SFO Shoreline Protection Program Project, San Mateo County

Dear Mr. Li:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements.** If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

- **a.** A brief description of the project.
- **b.** The lead agency contact information.
- **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
- **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).

- **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

- **a.** Alternatives to the project.
- **b.** Recommended mitigation measures.
- **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:

- **a.** Type of environmental review necessary.
- **b.** Significance of the tribal cultural resources.
- **c.** Significance of the project's impacts on tribal cultural resources.
- **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:

- **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
- **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:

- **a.** The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
- **b.** A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

- **a.** Avoidance and preservation of the resources in place, including, but not limited to:
  - **i.** Planning and construction to avoid the resources and protect the cultural and natural context.
  - **ii.** Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
- **b.** Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
  - **i.** Protecting the cultural character and integrity of the resource.
  - **ii.** Protecting the traditional use of the resource.
  - **iii.** Protecting the confidentiality of the resource.
- **c.** Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
- **d.** Protecting the resource. (Pub. Resource Code §21084.3 (b)).
- **e.** Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
- **f.** Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

- **a.** The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
- **b.** The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
- **c.** The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf.

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).

2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.

3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).

4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:

- **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
- **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/.

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:

- **a.** If part or all of the APE has been previously surveyed for cultural resources.
- **b.** If any known cultural resources have already been recorded on or adjacent to the APE.
- **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
- **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.

- **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
- **b.** The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:

a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.

b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.

c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Nancy.Gonzalez-Lopez@nahc.ca.gov.

Sincerely,

Nancy Gonzalez-Lopez
Cultural Resources Analyst

cc: State Clearinghouse

State of California
Native American Heritage Commission
1550 Harbor Blvd., Ste. 100
West Sacramento, CA 95691

SACRAMENTO CA 957
5 DEC 2020 PM 3 L

UNITED STATES POSTAGE
PITNEY BOWES
02 1P $ 000.50⁰
0002717131 DEC 03 2020
MAILED FROM ZIP CODE 95691

RECEIVED
DEC 0 7 2020
CITY & COUNTY OF S.F.
PLANNING DEPARTMENT
RECEPTION DESK

94103-379950

OFFICE OF THE CITY MANAGER

December 8, 2020

Mr. Michael Li
City and County of San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

RE: SFO Shoreline Protection Program (Case No.: 2020-004398ENV)

Dear Mr. Li,

Thank you for the opportunity to comment on the City of San Francisco's SFO Shoreline Protection Program Notice of Preparation. The City of South San Francisco (the City) values our partnership with the San Francisco International Airport (SFO) as it relates to Sea Level Rise mitigation efforts and we are supportive of efforts to prepare for a 100-year flood.

The City wishes to convey our hope that SFO and the San Francisco Planning Department will continue to keep the City involved in ongoing discussions regarding mitigation efforts as the CEQA process proceeds. The Water Quality Control Plant (WQCP) serves the communities of South San Francisco, San Bruno, Colma and parts of Daly City for residential and industrial wastewater treatment. The WQCP also serves as a shared dechlorination facility and final effluent pumping station for our regional partners, Millbrae, Burlingame, and the San Francisco International Airport. The WQCP is essential to the health and safety of its regional communities and safeguards the San Francisco Bay ecosystem from pollution.

Some areas of the study that the City is particularly interested in learning more about include the interaction of roads with planned concrete walls at North Access Road. Additionally, the approach along Highway 101 at Reach 16 has still yet to be determined and is dependent on the City's current work with the U.S. Army Corps of Engineers as they proceed with a Shoreline Feasibility Study along our City's shoreline. From a regional benefit perspective, the ideal layout for a sea level rise and flood protection wall would be to extend the proposed flood protection system from the proposed alignment on North Access Road at its intersection with SamTrans Island, extend northerly across SamTrans island and across the Colma Creek mouth. This type of system would require some type of tide gate and pump system to accommodate the tidal fluctuations and stormwater discharge. The potential level of protection would greatly benefit this region including significant portions of South San Francisco, San Bruno, and SFO. Additionally, South San

Francisco's wastewater treatment facility would be protected which also serves Millbrae, Colma and Burlingame. Separate efforts by the affected jurisdictions to address this regional challenge are currently being coordinated to explore the most efficient use of resources and provide the highest level of community benefit.

It is imperative that the City be included in ongoing discussions regarding the SFO Shoreline Protection Program, ensuring that all future and planned work may be coordinated through the U.S. Army Corps of Engineers.

The City of South San Francisco is committed to safeguarding our shoreline against current and future threats of Sea Level Rise to our residents, businesses, and community. Our team stands ready to work with SFO to ensure the best plan possible for our region. Please contact my Director of Public Works, Eunejune Kim, with any questions you might have regarding this letter in addition to including him in future discussions. Eunejune may be reached at eunejune.kim@ssf.net.

Thank you for the opportunity to comment on the SFO Shoreline Program Notice of Preparation. We look forward to continuing our partnership in our shared goals of combatting Sea Level Rise and the adverse effects of climate change.

Sincerely,

Mike Futrell
City Manager
City of South San Francisco

Cc: Supervisor Dave Pine, San Mateo County Board of Supervisors
South San Francisco City Council
Len Materman, Executive Director, Sea Level Rise and Flood Resiliency District
Eunejune Kim, Director of Public Works, City of South San Francisco

San Francisco Bay Conservation and Development Commission
375 Beale Street, Suite 510, San Francisco, California 94105 tel 415 352 3600 fax 888 348 5190
State of California | Gavin Newsom – Governor | info@bcdc.ca.gov | www.bcdc.ca.gov

Transmitted Via Electronic Mail

December 21, 2020

San Francisco International Airport
City and County of San Francisco
Post Office Box 8097
San Francisco, California 94128

San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, California 94103

SUBJECT: San Francisco Bay Conservation and Development Commission (BCDC) NOP Scoping Comments, Case Number 2020-004398ENV – San Francisco International Airport Shoreline Protection Program

To Whom It May Concern:

Thank you for the opportunity to comment on the San Francisco International Airport's ("Airport's) Notice of Preparation (NOP) for the Shoreline Protection Program (Project), Case Number 2020-004398ENV, distributed on November 25, 2020 and received in our office on November 30, 2020. The San Francisco Bay Conservation and Development Commission (BCDC or Commission) has not reviewed the NOP, but the following comments provided by staff are based on the *San Francisco Bay Plan* (Bay Plan) as amended through May 2020 and the McAteer-Petris Act. When evaluating projects, the Commission considers all applicable policies. The goal of this letter is to highlight some laws and policies that are relevant to the Project for consideration in the environmental review process. We recommend that the Airport continue to engage with Commission staff early in the development of the project to ensure that the proposed Project design is consistent with Commission policies. In reviewing of your permit application, Commission staff may raise additional relevant policies.

Commission Jurisdiction

The Commission is responsible for granting or denying permits for any proposed fill (e.g., earth or any other substance or material, including pilings or structures placed on pilings, and floating structures moored for extended periods of time); extraction of materials; or change in use of any water, land, or structure within the Commission's jurisdiction. Generally, the Commission's jurisdiction over San Francisco Bay extends from the Golden Gate to the confluence of the San

Joaquin and Sacramento Rivers and includes tidal areas up to mean high tide, including all sloughs, and in marshlands up to five feet above mean sea level; a shoreline band consisting of territory located between the shoreline of the Bay and 100 feet landward and parallel to the shoreline; salt ponds; managed wetlands; and certain waterways that are tributaries to the Bay. The Commission can grant a permit for a project if it finds that the project is either (1) necessary to the health, safety, and welfare of the public in the entire Bay Area, or (2) is consistent with the provisions of the McAteer-Petris Act and the Bay Plan. The Commission has jurisdiction over the Bay waters and shoreline areas on or around several parts of the project site and a permit from the Commission will be required.

Commission Law and Bay Plan Policies Relevant to the Project

1. **Bay Fill**
   Section 66605 of the McAteer-Petris Act (MPA) sets forth the criteria necessary to authorize placing fill in the Bay and certain waterways. It states, among other things, that further filling of the Bay should only be authorized if it is the minimum necessary to achieve the purpose of the fill and if harmful effects associated with its placement are minimized. According to the MPA, fill should be limited to water-oriented or minor fill for improving shoreline appearance or public access and should be authorized only when no alternative upland location is available for such purpose. The NOP anticipates that the Project will include installation of an approximately 40,564-foot-long (approximately 7.6 miles) new shoreline protection system, which would require approximately 27.5 acres of soil fill in the Bay for various reaches and result in approximately 4.4 acres of impacts to wetlands. In the environmental review process, the MPA fill requirements should be evaluated, including alternatives that were considered to minimize bay fill and an alternative upland location.

2. **Climate Change and Safety of Fills**
   Climate Change Policy No. 2 states that, “When planning shoreline areas or designing larger shoreline projects, a risk assessment should be prepared…based on the estimated 100-year flood elevation that takes into account the best estimates of future sea level rise and current flood protection and planned flood protection…for the proposed project or shoreline area. A range of sea level rise projections for mid-century and end of century based on the best scientific data available should be used in the risk assessment.” Policy No. 3 states that where such assessments show vulnerability to public safety, projects “should be designed to be resilient to a mid-century sea level rise projection” and an “adaptive management plan” should be prepared if it is likely the project will remain in place longer than mid-century.

   In addition, Policy No. 4 in the Bay Plan Safety of Fills section states that structures on fill or near the shoreline should have adequate flood protection including consideration of future relative sea level rise as determined by qualified engineers. The policy states that, “[a]dequate measure should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project…. New projects on fill or near the shoreline should either be set back from the edge of the shore so that the project will not be subject to dynamic wave energy, be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project, be specifically designed to tolerate periodic flooding, or employ other effective means of addressing the impacts of future sea level rise and storm activity."

The State of California Sea Level Rise Guidance document (http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf), recommends that project proponents decide which sea-level rise projection to select and the necessary adaptation pathways and contingency plans to ensure resilience to sea level rise. These determinations are based on a variety of factors, including location, lifespan of the project, adaptive capacity and risk tolerance/aversion. The Guidance summarizes the best available sea level rise science, which includes probabilistic projections based on several greenhouse gas emissions scenarios, as well as an extreme scenario that accounts for total arctic ice loss. It recommends project proponents consider the risks associated with various sea-level rise projections and determine tolerance for, or aversion to, those risks when planning for the future. The Guidance also promotes an "adaptation pathway" as a planning approach to address the uncertainty and challenges of climate change decision-making. Finally, given that future sea-level rise is uncertain, the Guidance enables consideration of multiple possible futures and allows analysis of the robustness and flexibility of various adaptation approaches across those multiple futures.

As required by Bay Plan Climate Change policies, the Airport should undergo an analysis of the appropriate risk aversion criteria for the Project based on the high public safety risks associated with flooding of the airport. The Airport should evaluate the total water level of flooding for the site, including wave action. Factors such as additional water from storm surges and seasonally high tides, as well as groundwater rise, should also be considered. The environmental review process should include a discussion of how the Project has been designed to adapt to, tolerate, and/or manage sea level rise and shoreline flooding at the site to ensure the Project is resilient to mid-century sea level rise projections, and how it can adapt to end of the century projections. An adaptation plan for the project should include a framework for evaluating the project over time to accommodate updates in sea level rise science, guidance, and planning. The Airport should also consider the adaptability of the Project over time. For example, the Airport should consider whether the existing shoreline or fill components of the Project could sustain the loads associated with raising the shoreline protection system or incorporating other adaptation measures. If necessary, an adaptation plan should indicate whether adaptation strategies would have the potential to adversely affect public access areas and wildlife habitat, and methods for minimizing these effects.

3. **Shoreline Protection**

Shoreline Protection Policy No. 1 states, "[n]ew shoreline protection projects and the maintenance or reconstruction of existing projects and uses should be authorized if: (a) the project is necessary to provide flood or erosion protection for (i) existing development, use or infrastructure, or (ii) proposed development, use or infrastructure that is consistent with other Bay Plan policies; (b) the type of the protective structure is appropriate for the project site, the uses to be protected, and the causes and conditions of erosion and flooding at the site; (c) the project is properly engineered to provide erosion control and flood protection for the expected life of the project based on a 100-year flood event that takes future sea level rise into account; (d) the project is properly designed and constructed to prevent significant impediments to physical and visual public access; (e) the protection is integrated with current or planned adjacent shoreline protection measures; and (f) adverse impacts to adjacent or nearby areas, such as increased flooding or accelerated erosion, are avoided or minimized. If such impacts cannot be avoided or minimized, measures to compensate should be required. Professionals knowledgeable of the Commission's concerns, such as civil engineers experienced in coastal processes, should participate in the design." Shoreline Protection Policy 2 states equitable and culturally-relevant community outreach and engagement should be conducted to meaningfully involve nearby communities for all shoreline protection project planning and design processes – other than maintenance and in-kind repairs to existing protection structures or small shoreline protection projects – in order to supplement technical analysis with local expertise and traditional knowledge and reduce unintended consequences. In particular, vulnerable, disadvantaged, and/or underrepresented communities should be involved. If such previous outreach and engagement did not occur, further outreach and engagement should be conducted prior to Commission action. Shoreline Protection Policy No. 5 requires that "all shoreline protection projects should evaluate the use of natural and nature-based features such as marsh vegetation, levees with transitional ecotone habitat, mudflats, beaches, and oyster reefs, and should incorporate these features to the greatest extent practicable. Ecosystem benefits, including habitat and water quality improvement, should be considered in determining the amount of fill necessary for the project purpose. Suitability and sustainability of proposed shoreline protection and restoration strategies at the project site should be determined using the best available science on shoreline adaptation and restoration. Airports may be exempt from incorporating natural and nature-based features that could endanger public safety by attracting potentially hazardous wildlife."

The environmental review process should incorporate information to evaluate how the Project would be consistent with the Commission's shoreline protection policies, including an evaluation of nature-based alternatives. Any public safety issues associated with nature-based alternative should also be evaluated. The environmental review should also include a discussion of outreach and engagement that was conducted regarding this aspect of the Project.

4. **Biological Impacts**
   Protection of biological resources, including wildlife and habitat, is addressed through several sections of the Bay Plan. Fish, Other Aquatic Organisms, and Wildlife Policy No. 1 states "To assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored and increased." Furthermore, Tidal Marshes and Tidal Flats Policy No. 2 states that "Any proposed fill, diking, or dredging project should be thoroughly evaluated to determine the effect of the project on tidal marshes and tidal flats, and designed to minimize, and if feasible, avoid any harmful effects." Additional policies in these Bay Plan sections, and policies in the Subtidal Areas section, provide further requirements on protection of the Bay's natural resources.

   The NOP describes several activities that may impact subtidal habitat, tidal marshes and tidal flats, and the organisms that rely on these habitats. The environmental review should address Bay Plan policies on Fish, Other Aquatic Organisms, and Wildlife; Tidal Marshes and Tidal Flats; and Subtidal Areas, and Bay Plan mitigation policies (described in more detail below) to describe how impacts to wildlife, tidal marsh, and tidal flats will be consistent with these policies.

5. **Mitigation**
   Bay Plan policies on Mitigation require projects to "compensate for unavoidable adverse impacts to the natural resources of the Bay…" The policies provide specific criteria for how compensatory mitigation projects should be sited and designed, community involvement in providing compensatory mitigation, when compensatory mitigation should occur relative to the impacts, and how to determine whether banking or in-lieu fee programs are acceptable. The policies also state that "Mitigation programs should be coordinated with all affected local, state, and federal agencies having jurisdiction or mitigation expertise to ensure, to the maximum practicable extent, a single mitigation program that satisfies the policies of all the affected agencies." The environmental report should discuss proposed mitigation measures, and any other mitigation determined to be necessary to compensate for Project impacts, is consistent with Bay Plan Mitigation policies. Mitigation could include removal of fill, restoration of habitat, or a combination thereof. Additionally, the Airport should coordinate with all regulatory agencies that have jurisdiction over the Project to develop a mitigation program that is agreeable to all of these agencies.

6. **Public Access / Appearance, Design, and Scenic Views**
   Section 66602 of the McAteer-Petris Act states, in part, "that maximum feasible public access, consistent with a proposed project, should be provided." The Commission can only approve a project within its jurisdiction if it provides maximum feasible public access, consistent with the project. The Bay Plan policies on public access state, in part, that "in addition to the public access to the Bay provided by waterfront parks, beaches, marinas, and fishing piers, maximum feasible access to and along the waterfront and on any permitted fills should be provided in and through every new development in the Bay or on the shoreline...Public access to some natural areas should be provided to permit study and

enjoyment of these areas…Public access should be sited, designed, managed and maintained to avoid significant adverse impacts from sea level rise and shoreline flooding. Whenever public access to the Bay is provided as a condition of development, on fill or on the shoreline, the access should be permanently guaranteed…Diverse and interesting public access experiences should be provided which would encourage users to remain in the designated access areas to avoid or minimize potential adverse effects on wildlife and their habitat." Additionally, the Bay Plan policies on Appearance, Design, and Scenic Views state, in part, that: "Maximum efforts should be made to provide, enhance, or preserve views of the Bay and shoreline, especially from public areas…"

Depending on the impact to existing or future public access from the Project, maximum feasible public access may be required to be incorporated into the Project. In the event that public access is required, public access impacts should be evaluated.

7. **Environmental Justice**
Our Commission recently approved several new Bay Plan policies on Environmental Justice and Social Equity. Policy No. 2 of the new Bay Plan Environmental Justice and Social Equity chapter states "…the Commission should support, encourage, and request local governments to include environmental justice and social equity in their general plans, zoning ordinances, and in their discretionary approval processes." Policy No. 3 says "[e]quitable, culturally-relevant community outreach and engagement should be conducted by local governments and project applicants to meaningfully involve potentially impacted communities for major projects and appropriate minor projects in underrepresented and/or identified vulnerable and/or disadvantaged communities… Evidence of how community concerns were addressed should be provided." Policy No. 4 states "[i]f a project is proposed within an underrepresented and/or identified vulnerable and/or disadvantaged community, potential disproportionate impacts should be identified in collaboration with the potentially impacted communities." Revised Public Access Policy No. 5 states "[p]ublic access that substantially changes the use or character of the site should be sited, designed, and managed based on meaningful community involvement to create public access that is inclusive and welcoming to all and embraces local multicultural and indigenous history and presence…" The updated policies go further to state that public access improvements should not only be consistent with the project, but also incorporate the culture(s) of the local community, and provide "…barrier free access for persons with disabilities, for people of all income levels, and for people of all cultures."

The environmental review process should incorporate culturally-relevant community outreach and engagement efforts, identify whether the Project is in a vulnerable community, and if so, should identify potential disproportionate impacts. If necessary, the environmental review process should incorporate community involvement to determine how public access provided as part of the Project will be sited, designed, and managed, and how it will ensure that the access is inclusive and welcoming to all.

Thank you for your consideration of these comments. Again, we encourage the Airport to continue its pre-application engagement with Commission staff. If you have any questions regarding this letter, please do not hesitate to contact me at erik.buehmann@bcdc.ca.gov.

Sincerely,

DocuSigned by:
Erik Buehmann
DE28A8DB779F45C...

ERIK BUEHMANN
Bay Resources Permit Program Manager

EB/ra

cc: State Clearinghouse, <state.clearinghouse@opr.ca.gov>

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
OFFICE OF TRANSIT AND COMMUNITY PLANNING
P.O. BOX 23660, MS-10D
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
TTY 711
www.dot.ca.gov

Making Conservation a California Way of Life.

December 23, 2020

SCH #: 2020110456
GTS #: 04-SF-2020-00330
GTS ID: 21373
Co/Rt/Pm: SM/101/18.51

Michael Li
San Francisco Planning Department
49 South Van Ness Avenue #1400
San Francisco, CA 94103

Re: SFO Shoreline Protection Program – Notice of Preparation (NOP) of an Environmental Impact Report (EIR)

Dear Michael Li:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the SFO Shoreline Protection Program. We are committed to ensuring that impacts to the State's multimodal transportation system and to our natural environment are identified and mitigated to support a safe, sustainable, integrated and efficient transportation system. The following comments are based on our review of the December 2020 NOP.

Project Understanding
The San Francisco International Airport (SFO), proposes to implement the proposed project to address flood protection and future sea-level rise for the expected lifespan of the shoreline improvements. The proposed project would install new shoreline protection infrastructure in compliance with current Federal Emergency Management Administration (FEMA) requirements. Also, it would construct shoreline protection improvements specific to 15 of the reaches to eliminate the probability of substantial inundation at the Airport until 2085. SFO is located within the vicinity of US-101 and State Route (SR)-380. Reach 16, located directly adjacent to US-101, will be considered in the EIR at the programmatic level.

Hydraulics
Reach 16, if constructed, could have potential impacts on US-101. The EIR shall consider the base floodplain resulting from the bay as well as landward sources adjacent to the project location.

Sea Level Rise
The effects of sea level rise may have impacts on transportation facilities located within the project area. Executive Order (EO) S-13-08 directs State agencies planning construction projects in areas vulnerable to sea level rise to begin planning for potential impact by considering a range of sea level rise scenarios for years 2050 and 2100. Higher water levels may increase erosion rates, change environmental characteristics that affect material durability, lead to increased groundwater levels, and change sediment movement along shores and at estuaries and river mouths, as well as affect soil pore pressure at dikes and levees on which transportation facilities are constructed. All of these factors should be addressed through geotechnical and hydrological studies conducted in coordination with Caltrans.

Lead Agency
As the Lead Agency, the San Francisco Planning Department is responsible for all project mitigation, including any needed improvements to the State Transportation Network (STN). The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Encroachment Permit
Please be advised that any permanent work or temporary traffic control that encroaches onto the State Right-of-Way (ROW) requires a Caltrans-issued encroachment permit. If any Caltrans facilities are impacted by the project, those facilities must meet American Disabilities Act (ADA) Standards after project completion. As part of the encroachment permit submittal process, you may be asked by the Office of Encroachment Permits to submit a completed encroachment permit application package, digital set of plans clearly delineating the State ROW, digital copy of signed, dated and stamped (include stamp expiration date) traffic control plans, this comment letter, your response to the comment letter, and where applicable, the following items: new or amended Maintenance Agreement (MA), approved Design Standard Decision Document (DSDD), approved encroachment exception request, and/or airspace lease agreement. Your application package may be emailed to D4Permits@dot.ca.gov.

To download the permit application and to obtain more information on all required documentation, visit https://dot.ca.gov/programs/traffic-operations/ep/applications.

Thank you again for including Caltrans in the environmental review process. Should you have any questions regarding this letter, please contact Yunsheng Luo at Yunsheng.Luo@dot.ca.gov. Additionally, for future notifications and requests for review of new projects, please contact LDIGR-D4@dot.ca.gov.

Sincerely,

MARK LEONG
District Branch Chief
Local Development - Intergovernmental Review

c: State Clearinghouse

ANN SCHNEIDER
Mayor

ANNE OLIVA
Vice Mayor

GINA PAPAN
Councilmember

ANDERS FUNG
Councilmember

REUBEN D. HOLOBER
Councilmember

City of Millbrae

621 Magnolia Avenue, Millbrae, CA 94030

December 24, 2020

San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103
Attention: Michael Li

Subject: Case No. 2020-004398ENV
SFO Shoreline Protection Program

Dear Mr. Li:

The City of Millbrae (Millbrae) appreciates the opportunity to review the Environmental Impact Report (EIR) for the SFO Shoreline Protection Program.

We are excited that SFO is undertaking this monumental project to address climate change, flood protection and sea level rise; however, we request SFO to work with the surrounding cities to collaborate on a regional approach to address sea level rise, especially for Millbrae. We do not disagree with the technical analysis provided, but regional collaboration with Millbrae is urgently needed in order to agree on the type and height of the sea wall to be consistent with what Millbrae is planning. The SFO SPP must not have an negative impact on the City of Millbrae and we look forward to SFO ensuring full mitigation of impacts.

We are also requesting you to also include the High Line Canal in your planning project. The High Line Canal is located immediately to the south of SFO and any breach along High Line Canal will negatively impact operations at SFO.

Please contact Khee Lim at klim@ci.millbrae.ca.us if you have further questions.
Thank you and we wish you a successful project.

Sincerely,

Khee Lim
Public Works Director

CC: Ann Schneider, Mayor
Millbrae City Council
Thomas C. Williams, City Manager

December 23, 2020

Michael Li
San Francisco Planning Department
Sent via email to: michael.j.li@sfgov.org

RE: SamTrans Comments on SFO Shoreline Protection Program Notice of Preparation

Dear Mr. Li,

Thank you for the opportunity to provide comment on the Notice of Preparation of the forthcoming Environmental Impact Report for SFO's Shoreline Protection Program, which is designed to mitigate future climate change impacts on airport operations and facilities. SamTrans is threatened by the same climate change forces as SFO. SamTrans has recently studied the impacts that sea level rise will have on our North Base Bus Yard (North Base), located off of North Access Road.

We are concerned about the NOP, which details a sea wall that extends around the perimeter of the SFO property. This structure could have the effect of cutting off the only current access point to North Base, which houses nearly 40% of SamTrans fleet, making the property unusable.

Though we are submitting these formal comments we would appreciate the opportunity to work with SFO and San Mateo County to come to consensus on the best path forward for all involved. We look forward to continuing to work closely with SFO, San Mateo County and other stakeholders regarding coordinated shoreline protection measures for SFO and North Base.

SamTrans is an Essential Service

SamTrans bus service is a critical element of the emergency response and preparedness in San Mateo County. SamTrans provides mutual aid assistance when required in transporting residents displaced by large building fires, and is a key component of San Mateo County's Multi-Casualty Incident Response Plan. To effectively provide these emergency response functions, the maintenance of access to our North Base facility is essential. The flooding and/or closure of the North Base driveway or the North Access

Road would negatively impact SamTrans during an emergency and this would constitute a significant impact under CEQA requiring consideration of mitigation measures. SamTrans staff has reviewed the Notice of Preparation (NOP) for the SFO Shoreline Protection Program and offers further specific and detailed comments below.

Clarification of Project Description

Figure 2 of the NOP appears to show the Reach 1 flood wall on the south side of the North Access Road east of the entrance to North Base, which would leave the portion of the road that is used by SamTrans unprotected from flooding. Prior coordination with SFO indicated the flood wall would be on the north side of the access road. We request that the EIR clarify the location of the Reach 1 flood wall alignment and flood gates potentially impacting SamTrans property.

Consideration of Regional Alternatives

The objectives of Reach 1 of the SFO Flood Protection Program could more efficiently be addressed as part of a regional tide gate between North Base, the Bay Trail and Littlefield/Utah Ave. as was shown in the San Bruno Creek/Colma Creek Resiliency Study. The tide gate would protect multiple high priority assets that are at-risk, including portions of North Base, SFO, and South San Francisco's San Bruno Water Quality Control Plant. We recognize that the tide gate solution will need to involve leadership from multiple entities, including the San Mateo County Flood and Sea Level Rise Resiliency District. The alternative is for each entity in the San Bruno/Colma Creek area to develop their own independent flood protection measures, potentially shifting impacts to one another and adding unnecessary costs, which ultimately need to work cohesively to ensure closed systems. Given the extent of environmental impacts associated with shoreline protection measures (including fill in the Bay), CEQA and other substantive environmental requirements (such as Section 404 of the Clean Water Act and McAteer-Petris Act, for example) require consideration of lower impact alternatives. The regional tide gate concept is such a lower impact alternative and should be evaluated in the EIR as a means to reduce cumulative impacts on fill placed within the Bay.

North Access Road Protection

The EIR should consider alternatives that would protect North Access Road, such as building the sea wall on the north side of the North Access Road, raising the elevation of the roadway, and/or improving drainage. Otherwise, even after a flood event is over, North Base could remain inaccessible. If these alternatives are infeasible, the EIR should describe the engineering and cost factors supporting their elimination.

Mitigation of North Base Access
Flooding of SamTrans buses would likely result in the complete loss of the vehicles. In conjunction with an anticipated tide gate closure, SamTrans requests that SFO consider providing an alternative secure location for temporary bus storage within or outside the airport to mitigate for the loss of access to North Base and support operations.

Coordination with North Base Shoreline Protection Measures
SamTrans requests that the EIR include a discussion of the measures that will be taken to coordinate the design, staging and timing of SFO project with SamTrans' proposed flood protection measures at North Base. For example, SFO should commit to remove the flood gate at the entrance to North Base once the SamTrans connecting levy system around North Base is in place, or a different regional solution is identified and constructed. SamTrans also requests that SFO plan to commence implementation of the Shoreline Protection Program's North Access road element as one of the final projects in the program to maximize the time available to put alternatives in place.

Please contact me at wegenerc@samtrans.com of 650-533-0902 should you have any questions on our comments.

Sincerely,

Christy Wegener

Christy Wegener
Director of Planning

CC:
Hilda Lafebre, SamTrans
San Mateo County Flood and/ Sea Level Rise Resiliency District
San Mateo County Office of Sustainability
City of South San Francisco

OneShoreline
Building Solutions for a Changing Climate

December 24, 2020

Via email to michael.j.li@sfgov.org

Mr. Michael Li
San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

Re: SFO Shoreline Protection Program (Case No. 2020-004398ENV) Notice of Preparation

On behalf of the San Mateo County Flood and Sea Level Rise Resiliency District (District), thank you for accepting this comment letter on the Notice of Preparation for the SFO Shoreline Protection Program. The objectives of SFO's project – to protect against flooding and future sea level rise (SLR) – align with the new independent District's efforts to enhance the entire county shoreline by bringing together public and private entities to share in the costs of protection and mitigation, and the benefits of working regionally.

Toward these ends, the District is working closely with SFO's neighbors. To the north and west of the airport, we are working with the cities of South San Francisco and San Bruno through the long-standing Colma Creek Flood Zone and San Bruno Creek Flood Zone that are District assets and responsibilities. The portions of SFO's project referred to as *Reach 1 – San Bruno Channel* and *Reach 16 – Airport Landside Protection* should be planned in the context of Flood Zone needs and activities.

Southeast of the airport, the District is developing a regional shoreline and creeks project with the cities of Millbrae and Burlingame. The aim of our project is to protect against a FEMA 100-year storm event with freeboard and a water level in San Francisco Bay six feet above the current FEMA 100-year tide event. We appreciate SFO's Director writing last month in support of this District project. By aligning the objectives and land rights associated with the District project and SFO's *Reach 15 – Millbrae Channel* and *Reach 16 – Airport Landside Protection*, both efforts can reduce costs and impacts, particularly those related to your *Reach 16.* As a first step in this alignment, please ensure the level of SLR protection planned for these Reaches matches the Bay water level objective of the District's adjoining project.

Thank you for the opportunity to comment on the Shoreline Protection Program Notice of Preparation. We look forward to working with SFO to protect people and property within San Mateo County from the adverse effects of climate change.

Sincerely,

Len Materman
Chief Executive Officer

cc: District Board of Directors

SAN FRANCISCO Bay Trail

December 14, 2020

Mr. Michael Li, Senior Planner
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Subject: **Notice of Preparation of Environmental Impact Report for the San Francisco International Airport Shoreline Study**

Dear Mr. Li:

Thank you for the opportunity to comment on the above referenced project. The Bay Trail Project is a nonprofit organization administered by the Association of Bay Area Governments (ABAG) that plans, promotes and advocates for the implementation of a continuous 500-mile bicycling and hiking path around San Francisco Bay. When complete, the trail will pass through 47 cities, all nine Bay Area counties, and across seven toll bridges. Over 350 miles of the Bay Trail have been constructed.

The objective of the proposed SFO shoreline protection project is to manage the potential impacts of climate change on the airport by protecting key infrastructure from sea level rise and flooding. It will maintain the continuity of operations for the San Francisco International Airport and ensure the greater Bay Area region remains a competitive economic and transportation hub. The proposed project will harden eight miles of shoreline and further constrain public access, while creating an unprecedented 27.5 acres of fill in the bay. As a result, the proposed project does not incorporate the typically required shoreline public access that completes the Bay Trail or address the demand for shoreline public access in the area.

We request that the EIR evaluate and analyze the above impacts resulting from the Shoreline Protection Project and consider opportunities to mitigate for these impacts by committing to complete the Bay Trail between San Bruno and Milbrae, which will support ongoing efforts to advance regional bicycle/pedestrian connectivity, equitable multi-modal access, and green-house gas reductions.

One timely opportunity is to collaborate with San Mateo County and the Bay Trail Project on a focused feasibility study that will launch in 2021. This study will evaluate multiple trail alignment options for closing the 3.5-mile gap in the San Francisco Bay Trail around SFO. Completion of this gap in the vicinity of SFO will open nearly 40 miles of continuous trail between Brisbane and San Carlos, and improve upon existing transit and commuting options.

We invite SFO to participate in the conversation with local partners namely the County of San Mateo in achieving a safe, equitable, and accessible active transportation corridor. SFO has the opportunity to mitigate for the project impacts on shoreline public access and bay fill while also helping to realize the vision outlined in local, county and regional initiatives for cleaner air, equitable access, and a robust bicycle and pedestrian network.

Below are the local, regional and county-wide plans and initiatives that support the closure of the Bay Trail gap and/or otherwise advocate for a connected and robust bicycle and pedestrian network alongside SFO. The project should evaluate its consistency with these plans.

- Unincorporated San Mateo County Active Transportation Plan (draft, 2020)
- San Mateo County Green Infrastructure Plan (2019)
- San Mateo County Commute Alternatives Program (CAP)
- County of San Mateo General Plan (2013)
- San Francisco Bay Trail Plan (2015)
- City of San Bruno Walk and Bike Plan (2016)

The Bay Trail Project appreciates the opportunity to comment on the NOP for the SFO Shoreline Protection Program. If you have any questions, regarding the Bay Trail Project, I can be reached at (510) 646 6118 or by e-mail at vkesavan@bayareametro.gov

Respectfully,

VKesavan

Vijaylaxsmi Kesavan
Bay Trail Planner

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Marine Region
1933 Cliff Drive, Suite 9
Santa Barbara, CA 93109
www.wildlife.ca.gov

December 30, 2020

Michael Li
San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103
michael.j.li@sfgov.org

Subject: SFO Shoreline Protection Program Notice of Preparation (SCH No. 2020110456)

Dear Mr. Li:

The California Department of Fish and Wildlife (CDFW) has reviewed the Notice of Preparation (NOP) for the San Francisco International Airport (SFO) Shoreline Protection Program (Project). The Project is located within unincorporated San Mateo County approximately 13 miles south of downtown San Francisco along the western shoreline of San Francisco Bay and is proposed to occur from 2025 to 2032. The purpose of the Project is to address flood protection and future sea-level rise at SFO. The Project would install new shoreline protection infrastructure that complies with Federal Emergency Management Administration standards. The infrastructure would include concrete walls, steel king and sheet pile walls, stormwater outfall reconstruction, road relocation, lighting trestle reconstruction, and associated construction and maintenance of the infrastructure. The shoreline protection infrastructure is estimated to be approximately 40,564 feet long (roughly 7.6 miles). The Project will impact approximately 4.4 acres of wetlands and will require approximately 27.5 acres of bay fill.

Department Jurisdiction

As a trustee for the State's fish and wildlife resources, CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. In this capacity, CDFW administers the California Endangered Species Act (CESA), the Native Plant Protection Act, and other provisions of the California Fish and Game Code that afford protection to the State's fish and wildlife trust resources. CDFW is the State's fish and wildlife "Trustee Agency" under the California Environmental Quality Act (CEQA guidelines §15386). CDFW is responsible for marine biodiversity protection under the Marine Life Protection Act (Fish and Game Code Section 2850) and the Marine Managed Areas Improvement Act (Public Resources Code Section 36700-36900) in coastal marine waters of California

CDFW is also submitting comments as a Responsible Agency under CEQA. (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381.) CDFW expects that it may need to exercise regulatory authority as provided by the Fish and Game Code. As proposed, the Project may be subject to CDFW's lake and streambed alteration regulatory authority (Fish & Game Code, § 1600 et seq.) Likewise, to the extent implementation of the Project as proposed may result in take[1] as defined by State law of any species protected under the CESA (Fish & Game Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required.

Biological Significance

The San Francisco Bay-Delta is the second largest estuary in the United States and supports numerous aquatic habitats and biological communities. It encompasses 479 square miles, including shallow mudflats. This ecologically significant ecosystem supports both state and federally threatened and endangered species and sustains important commercial and recreational fisheries.

Regulatory Requirements

California Endangered Species Act: Please be advised that a CESA permit will be recommended if the project has the potential to result in "take" of plants or animals listed under CESA, either during construction or over the life of the project. Issuance of a CESA permit is subject to CEQA documentation; the CEQA document must specify impacts, mitigation measures, and a mitigation monitoring and reporting program. If the Project will impact CESA listed species, early consultation is encouraged, as significant modification to the Project and mitigation measures may be required to obtain a CESA Permit.

CEQA requires a Mandatory Finding of Significance if a project is likely to substantially impact threatened or endangered species (CEQA section 21001(c), 21083, & CEQA Guidelines section 15380, 15064, 15065). Impacts must be avoided or mitigated to less-than-significant levels unless the CEQA Lead Agency makes and supports Findings of Overriding Consideration (FOC). The CEQA Lead Agency's FOC does not eliminate the Project proponent's obligation to comply with Fish and Game Commission section 2080.

Lake and Streambed Alteration (LSA) Program: Notification is required, pursuant to CDFW's Lake and Streambed Alteration Program (Fish and Game Code section 1600 et. seq.) for any Project-related activities that will substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank including associated riparian or wetland resources; or deposit or dispose of material where it may pass into a river, lake, or stream. Work within ephemeral streams, washes, watercourses with a subsurface flow, and floodplains are subject to notification requirements. CDFW, as a Responsible Agency under CEQA, will consider the CEQA document for the Project.

---

1 Take is defined by Fish and Game Code Section 86 as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.

CDFW may not execute the final LSA Agreement until it has complied with CEQA (Public Resources Code section 21000 et seq.) as the responsible agency.

State and Federally Listed and Commercially/Recreationally Important Species

Protected species under the State and Federal Endangered Species Acts that could potentially be present near Program activities include:

- Chinook salmon (*Oncorhynchus tshawytscha*), state and federally threatened (Spring-run), state and federally endangered (Winter-run)
- Steelhead (*Oncorhynchus mykiss*), federally-threatened (Central California Coast and Central Valley ESUs)
- Green sturgeon (*Acipenser medirostris*), federally-threatened (southern DPS)
- Longfin smelt (*Spirinchus thaleichthys*), state-threatened
- Peregrine falcon (*Falco pereinus anatum),* state fully protected
- Brown pelican (*Pelecanus occidentalis californicus*)**,** state fully protected
- American peregrine falcon (*Falco peregrinus anatum*), state fully protected
- Alameda song sparrow (*Melospiza melodia pusillula*), state species of special concern
- California red-legged frog (Rana draytonii), federally-threatened, state species of special concern
- California Ridgway's rail (*Rallus obsoletus obsoletus*), state fully protected
- Pallid bat (Antrozous pallidusi), state species of special concern
- San Francisco owl's-clover (Triphysaria floribunda), moderately threatened (CNPS rank and threat - 1B.2)
- San Francisco garter snake (Thamnophis sirtalis tetrataenia), federally endangered, state endangered, and state fully protected

Several species with important commercial and recreational fisheries value that could potentially be impacted by Project activities include:

- Dungeness crab (*Cancer magister*)
- Pacific herring (*Clupea pallasii*)
- Rockfish (*Sebastes* spp.)
- California halibut (*Paralichthys californicus*)
- Surfperches (*Embiotocidae***)**

Habitat descriptions and species profiles should include information from multiple sources: aerial imagery, historical and recent survey data, field reconnaissance, scientific literature and reports, and findings from "positive occurrence" databases such as California Natural Diversity Database (CNDDB). Based on the data and information from the habitat assessment, the CEQA document can then adequately assess which special-status species are likely to occur in the Project vicinity.

CDFW recommends that prior to Project implementation surveys be conducted for special-status species with potential to occur in the Project area. Survey and monitoring protocols and guidelines for some species are available at: https://www.wildlife.ca.gov/Conservation/Survey-Protocols.

Botanical surveys for special-status plant species, including those listed by the California Native Plant Society (http://www.cnps.org/cnps/rareplants/inventory/), must be conducted during the blooming period for all sensitive plant species potentially occurring within the Project area and require the identification of reference populations. Please refer to CDFW protocols for surveying and evaluating impacts to rare plants available at: https://www.wildlife.ca.gov/Conservation/Plants.

Impacts to State Listed and Commercially/Recreationally Important Species

Due to the scope and duration of the proposed Project, there are likely to be substantial impacts to state listed and commercially/recreationally important species. CDFW recommends that the draft environmental impact report (DEIR) provide specific details of the anticipated impacts to the special status species present in the area and how Project activities will avoid, minimize, or mitigate potential significant impacts to those species. This information and discussion will determine whether CDFW may need to exercise its regulatory authority as provided by the Fish and Game Code Section 2081(b) for potential incidental take of Longfin smelt and winter and spring run Chinook. The DEIR should discuss the following types of potential impacts in detail to provide CDFW with enough information to determine if the proposed avoidance, minimization, and mitigation measures will be sufficient:

- Hydroacoustic impacts caused by pile driving
- Potential for entrainment and/or impingement of fish
- Utilization of sheet pile corrosion prevention coating and placement of treated wood piles into waters of San Francisco Bay
- Potential impacts to Pacific herring and commercial Pacific herring fishing activities
- Potential impacts to Pacific herring spawning habitat at SFO and in adjacent areas
- Impacts to wetland habitat and how those impacts affect listed terrestrial and marine species

Mitigation for Impacts to Special Status Species and Bay and Wetland Habitat

Given the amount of potential impact to special status species and bay and wetland habitat, CDFW recommends that the lead agency and applicant begin early discussion with CDFW to determine mitigation for Project related impacts. CDFW authorization for the Project may require an Incidental Take Permit (Fish and Game Code section 2081(b)) in which a Project’s impacts must be fully mitigated. Determining what full mitigation for take may be, given the scope of potential impacts, will require an additional amount of time and discussion leading up to Project implementation. CDFW recommends that early consultation with CDFW take place to discuss mitigation options that may be proposed within the DEIR.

Impacts to San Francisco Garter Snake and California Red-legged Frog

San Francisco garter snake and California red-legged frog are known to occur on the west side of Highway 101. The NOP Project Description is unclear whether the proposed project will impact San Francisco garter snake and/or California red-legged frog. CDFW recommends that the DEIR disclose all direct and indirect impacts the Project may have on San Francisco garter snake and California red-legged frog.

California Ridgway's Rail

California Ridgway's rail, a state fully protected species, has the potential to occur within the Project area. CDFW has jurisdiction over fully protected species of birds, mammals, amphibians, reptiles, and fish pursuant to Fish and Game Code §§ 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited. CDFW cannot authorize incidental take of fully protected species unless the take is for scientific purposes pursuant to Fish and Game Code Section 2081(a) or for species recovery. To avoid impacts to Ridgway's rail, CDFW recommends that the proposed Project avoid encroachment into marsh or mudflat habitat.

Concrete Wall Alternatives Analysis

Installation of concrete walls within the streambank may have direct and cumulative adverse impacts on fish and wildlife resources within the Millbrae and San Bruno Channels. Concrete walls (e.g., streambank armoring) could alter stream flow (e.g., stream deflection), cause stream erosion, and decrease fish and wildlife habitat.

Armoring streambanks with riprap or concrete alters natural stream processes, such as, hydrology, geomorphology, biology, water quality, and connectivity (Instream Flow Council, 2004). The effects of streambank armoring include but are not limited to altering stream velocity and channel roughness. For example, water flowing along armored streambanks tends to flow fast and turbulent, causing increased erosion and scour potential both at the toe and at the ends of the armored streambank. In contrast, vegetated banks provide complexity and contribute to channel roughness. Changes in stream velocity can also change channel width, depth, discharge, slope, sediment load, and/or sediment size within a channel (Rosgen 1994, e.g., bank slumping, accelerated erosion, channel migration and complete shifts in channel shape).

CDFW recommends exploring all other flood control techniques (e.g., setbacks) before installing concrete walls or hardscape within the streambank. If concrete walls or hardscape are deemed necessary, CDFW recommends that effects to biological resources and stream processes are analyzed in the DEIR and mitigation measures are included to address significant impacts.

Nesting Birds

Project construction could result in disturbance of nesting birds. Noise can impact bird behavior by masking signals used for bird communication, mating, and hunting (Bottalico et al. 2015). Birds' hearing can also be damaged from noise and impair the ability of birds to find or attract a mate and prevent parents from hearing calling young (Ortega 2012).

If ground-disturbing or vegetation-disturbing activities occur during the bird breeding season (February through early-September), the Project applicant is responsible for ensuring that implementation of the Project does not result in violation of Fish and Game Codes. To evaluate and avoid for potential impacts to nesting bird species, CDFW recommends incorporating the following mitigation measures into the Projects DEIR and that these measures be made conditions of approval for the Project.

- Nesting Bird Surveys: To maximize the probability that nests are detected, CDFW recommends that a qualified avian biologist conduct pre-Project activity nesting bird surveys no more than seven days prior to the start of ground or vegetation disturbance and if there is a lapse of four days or more between construction, CDFW recommends that nesting bird surveys cover a sufficient area around the Project area to identify nests and determine their status. A sufficient area means any area potentially affected by the Project. During nesting bird surveys, CDFW recommends that a qualified avian biologist establish behavioral baseline of all identified nests. During Project activities, CDFW recommends having the qualified avian biologist continuously monitor nests to detect behavioral changes resulting from Project activities. If behavioral changes occur, CDFW recommends stopping the activity, that is causing the behavioral change, and consulting with a qualified avian biologist on additional avoidance and minimization measures.
- Nesting Bird Buffers: During Project activities, if continuous monitoring of nests by a qualified avian biologist is not feasible, CDFW recommends a minimum no-disturbance buffer of 250 feet around active nests of non-listed bird species and a 1,000-foot no disturbance buffer around active nests of non-listed raptors. These buffers are advised to remain in place until the breeding season has ended or until a qualified avian biologist has determined that the birds have fledged and are no longer reliant upon the nest or on-site parental care for survival. Variance from these no disturbance buffers is possible when there is compelling biological or ecological reason to do so, such as when the Project area would be concealed from a nest site by topography. CDFW recommends that a qualified avian biologist advise and support any variance from these buffers.

Additional Recommendations

- The DEIR should address species specific in-water work windows and whether the proposed project will comply with those windows.
- Fish and Game Code states that it is unlawful to deposit into, permit to pass into, or place where it can pass into waters of the state any substance or material deleterious to fish, plant life, or bird life (FGC Section 5650(6)). CDFW recommends avoiding the use of treated wood materials in or above the waters of San Francisco Bay. The DEIR should address alternatives for pile materials for the lighting trestle reconstruction.
- CDFW recommends the DEIR include discussion on softer shoreline protection alternatives incorporating natural features and why these alternatives are not proposed to be included.
- CDFW recommends that the DEIR address whether eelgrass habitat could be impacted by Project related activities by providing information on recent surveys and whether potential habitat existing within the Project footprint.

Filing Fees

CDFW anticipates that the Project will have an impact on fish and/or wildlife, and assessment of filing fees is necessary (Fish and Game Code Section 711.4; Pub. Resources Code, section 21089). Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW.

Conclusion

The Department appreciates the opportunity to comment on SFO Shoreline Protection Program NOP. If you have any questions or comments, please contact Arn Aarreberg, Environmental Scientist – Marine Region (707) 791-4195, Arn.Aarreberg@wildlife.ca.gov or Wes Stokes, Senior Environmental Scientist – Bay-Delta Region (707) 339-6066, Wes.Stokes@wildlife.ca.gov.

Sincerely,

Craig Shuman, D. Env
Marine Regional Manager

ec: Gregg Erickson, Regional Manager Bay Delta Region
Department of Fish and Wildlife
(Gregg.Erickson@wildlife.ca.gov)

Becky Ota, Program Manager
Department of Fish and Wildlife
(Becky.Ota@wildlife.ca.gov)

Eric Wilkins, Senior Environmental Scientist
Department of Fish and Wildlife
(Eric.Wilkins@wildlife.ca.gov)

Wesley Stokes, Senior Environmental Scientist
Department of Fish and Wildlife
(Wesley.Stokes@wildlife.ca.gov)

Tami Schane, Senior Environmental Scientist
Department of Fish and Wildlife
(Tami.Schane@wildlife.ca.gov)

Arn Aarreberg, Environmental Scientist
Department of Fish and Wildlife
(Arn.Aarreberg@wildlife.ca.gov)

Habitat Conservation Program Branch CEQA Program Coordinator
California Department of Fish and Wildlife
(ceqacommentletters@wildlife.ca.gov)

Erik Buehmann
San Francisco Bay Conservation and Development Commission
(Erik.Buehmann@bcdc.ca.gov)

Xavier Fernandez
Regional Water Quality Control Board, San Francisco Bay Region
(Xavier.Fernandez@waterboards.ca.gov)

Katerina Galacatos
U.S. Army Corps of Engineers, San Francisco District
(Katerina.Galacatos@usace.army.mil)

Brian Meux
National Marine Fisheries Service
(Brian.Meux@NOAA.gov)

State Clearinghouse (SCH No. 2020110456)
(state.clearinghouse@opr.ca.gov)

References

Bottalico, Pasquale & Spoglianti, Dorina & Bertetti, Carlo & Falossi, Marco. 2015. Effect of noise generated by construction sites on birds, paper presented at Internoise 2015, International Congress and Exposition on Noise Control Engineering.

Instream Flow Council. 2004. Instream flows for riverine resource stewardship.

Rosgen, D.L. 1994. A classification of natural rivers. Catena 22 (1994) 169-199, Elsevier Science B.V.

Ortega, C. P. 2012. Chapter 2: Effects of noise pollution on birds: A brief review of our knowledge. Ornithological Monographs 47: 6-22.

APPENDIX B

Initial Study

APPENDIX B

INITIAL STUDY
SAN FRANCISCO INTERNATIONAL AIRPORT
SHORELINE PROTECTION PROGRAM
PLANNING DEPARTMENT CASE NO. 2020-004398ENV

Contents

Figures

Tables

A. Project Description

The project description for the San Francisco International Airport (SFO) Shoreline Protection Program (proposed project) is included as Chapter 2, Project Description, in the draft environmental impact report (Draft EIR) to which this initial study is appended.

B. Project Setting

The project setting is included in Draft EIR Chapter 2, Project Description, to which this initial study is appended.

C. Compatibility with Existing Zoning and Plans

	Applicable	Not Applicable
Discuss any variances, special authorizations, or changes proposed to the planning code or zoning map, if applicable.	☐	☒
Discuss any conflicts with any adopted plans and goals of the City or region, if applicable.	☒	☐
Discuss any approvals and/or permits from city departments other than the planning department or the Department of Building Inspection, or from regional, state, or federal agencies.	☒	☐

No variances, special authorizations, or changes to the San Francisco Planning Code or zoning map are proposed or required for the proposed project. See Draft EIR Chapter 3, Plans and Policies, for a discussion of plans and policies applicable to the proposed project and identification of the proposed project's potential to conflict with any of those plans or policies. Draft EIR Chapter 2, Project Description, lists the required approvals and permits from federal, state, regional, and City and County of San Francisco agencies.

D. Summary of Environmental Effects

The proposed project could potentially result in adverse physical effects on the environmental resources checked below, and where those impacts are significant or potentially significant, the California Environmental Quality Act (CEQA) requires identification of mitigation measures to reduce the severity of the impacts to less-than-significant levels to the extent feasible. The initial study and the Draft EIR present a more-detailed checklist and discussion of each environmental resource. This initial study evaluates the potential for the proposed project to result in significant environmental impacts and identifies which environmental resource topics are appropriately analyzed in the initial study and those that warrant more detailed analysis in the Draft EIR.

☐ Land Use/Planning	☐ Greenhouse Gas Emissions	☒ Hydrology/Water Quality
☐ Aesthetics	☐ Wind	☐ Hazards & Hazardous Materials
☐ Population and Housing	☐ Shadow	☐ Mineral Resources
☒ Cultural Resources	☐ Recreation	☐ Energy
☒ Tribal Cultural Resources	☐ Utilities /Service Systems	☐ Agriculture and Forestry Resources
☐ Transportation and Circulation	☐ Public Services	☐ Wildfire
☒ Noise	☒ Biological Resources	☒ Mandatory Findings of Significance
☒ Air Quality	☒ Geology/Soils	

EFFECTS FOUND TO BE POTENTIALLY SIGNIFICANT

Resource topics for which there is a potential for impacts to be significant or for which the analysis requires additional detail are analyzed in the Draft EIR and are as follows:

- Cultural Resources (historic architectural resources)
- Noise
- Air Quality
- Biological Resources
- Geology and Soils
- Hydrology and Water Quality

EFFECTS FOUND NOT TO BE SIGNIFICANT

This initial study determined that the potential individual and cumulative environmental effects related to the following resource topics are either less than significant or would be reduced to a less-than-significant level with the mitigation measures identified in this initial study:

- Land Use and Planning
- Aesthetics
- Population and Housing
- Cultural Resources (archeological resources)
- Tribal Cultural Resources
- Transportation and Circulation
- Greenhouse Gas Emissions
- Wind

- Shadow
- Recreation
- Utilities and Service Systems
- Public Services
- Hazards and Hazardous Materials
- Mineral Resources
- Energy Resources
- Agriculture and Forestry Resources
- Wildfire

Impacts and mitigation measures associated with these topics are discussed in Section E, Evaluation of Environmental Effects, of this initial study, and are not discussed further in the Draft EIR.[1] All mitigation measures identified in this initial study are listed in Section F, Mitigation Measures, and the project sponsor has agreed to implement the mitigation measures as part the proposed project. For each checklist item, the evaluation considers both project-specific and cumulative impacts of the proposed project.

CUMULATIVE IMPACTS

The cumulative impact analyses for topics addressed in Section E, Evaluation of Environmental Effects, uses the list-based approach. Reasonably foreseeable development and infrastructure projects that could potentially contribute to cumulative impacts on various resource topics are listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8.

[1] Reaches 1–15 are analyzed at the project level and Reach 16 is analyzed at a program level. However, when the impacts are the same for both the project-level and program-level analyses, the impact statement has been combined. In most cases, the analyses in this initial study focus on construction impacts as there would be minimal operational activities associated with the proposed project.

E. Evaluation of Environmental Effects

1. Land Use and Planning

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
1. LAND USE AND PLANNING. Would the project:					
a) Physically divide an established community?	☐	☐	☒	☐	☐
b) Cause a significant physical environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐	☐

Impact LU-1: The proposed project would not physically divide an established community. ***(Less Than Significant)***

The division of an established community typically involves the construction of a physical barrier to neighborhood access, such as a new freeway, or the removal of a means of access, such as a bridge or a roadway. The proposed project would not result in the construction of a physical barrier to neighborhood access or the removal of an existing means of access. The project site is located along the shoreline of the San Francisco International Airport (Airport). There are no residential neighborhoods or communities on or immediately adjacent to the project site. Therefore, the proposed project would not physically divide an established neighborhood or community. Construction of the proposed project would temporarily close a lane along North Access Road to accommodate construction of Reaches 1–6 and would relocate the San Francisco Bay Trail (Bay Trail) in a closed lane on North Access Road to accommodate construction of Reach 1. However, these temporary closures would not impede the passage of persons or vehicles. For these reasons, the proposed project would not physically divide an established community. Therefore, this impact would be ***less than significant***.

Impact LU-2: The proposed project would not cause a significant physical environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. ***(Less than Significant)***

Land use impacts could be considered significant if the proposed project would conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental impact. Environmental plans and policies are those that directly address environmental issues and/or contain targets or standards that must be met to preserve or improve the characteristics of the physical environment. Conflicts with plans, policies, and regulations do not necessarily indicate a significant environmental land use impact under CEQA, unless the project would substantially conflict with a land use plan or policy that was adopted for the purpose of avoiding or mitigating an environmental effect, such that a substantial adverse physical change in the environment would result. To the extent that such substantial physical environmental impacts may result from such conflicts, this initial study and the Draft EIR disclose and analyze the physical impacts under the relevant environmental topic sections.

As discussed in Chapter 3, Plans and Policies, of the Draft EIR, the proposed project would not conflict with any adopted land use plan or policy.

Consistency between the proposed project and the plans, policies, and regulations of agencies with jurisdiction over the proposed project would continue to be analyzed and considered as part of the respective agencies' permit application review and approval process required for the proposed project, independent of CEQA review. Any such potential conflicts also would be considered by decision-makers during their deliberations on the merits of the proposed project and as part of their actions to approve, modify, or disapprove the project. In addition, the proposed project would not conflict with any adopted environmental plan or policy, nor any of the local plans and policies identified in Chapter 3, Plans and Policies, of the Draft EIR. Therefore, this impact would be ***less than significant***.

Impact C-LU-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact related to land use and planning. ***(Less than Significant)***

The geographic context for the analysis of potential cumulative impacts related to land use and planning includes the development and infrastructure projects located within 0.25 mile of the project site are listed in Table 4-1, p. 4-6, in Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. The proposed project would not physically divide an established community, and therefore would have no potential to combine with cumulative projects to result in a significant physical environmental impact related to the division of an established community. In addition, the cumulative projects either would maintain existing land uses in the project vicinity, or if a land use change is proposed, would be required to comply with applicable land use plans, policies, and regulations, like the proposed project. Implementation of the proposed project in combination with the cumulative projects would be consistent with relevant plans and policies adopted for the purpose of avoiding or mitigating and environmental impact. Therefore, this impact would be ***less than significant***.

---

2. Aesthetics

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
2. AESTHETICS. Except as provided in Public Resources Code section 21099, would the project:					
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒	☐
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage points.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☒	☐	☐
d) Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area?	☐	☐	☒	☐	☐

This section describes the existing visual characteristics of the project site and vicinity and evaluates potential effects to scenic resources, scenic vistas, public views, and the visual character of the site and its surroundings that could result from implementation of the proposed project. This section also evaluates the potential for the proposed project to create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area. The impact discussion evaluates potential impacts to aesthetic and visual resources in the context of existing conditions based on analyses of photographs, site reconnaissance, and visual simulations.

CONCEPTS AND TERMINOLOGY

Visual character is a general description of the visual attributes of a particular setting. The purpose of defining the visual character of an area is to provide the context within which the visual quality of a particular site or locale is most likely to be perceived by the viewing public. For urban areas, visual character is typically described on the neighborhood level, or in terms of areas with common land use, development intensity, and/or urban design features. For natural and open space settings, visual character is most commonly described in terms of areas with common landscape attributes (e.g., landform, vegetation, water features).

Visual quality is defined as the overall visual impression or attractiveness of a site or locale as determined by its aesthetic qualities (such as color, variety, vividness, coherence, uniqueness, harmony, and pattern).

Scenic vistas are locations from which the public can experience unique and exemplary views, typically from elevated vantage points that offer panoramic views of great breadth and depth.

Viewer exposure addresses the variables that affect the viewing conditions of a site. Viewer exposure considers some or all of the following factors: landscape visibility (the ability to see the landscape); viewing distance (i.e., the proximity of viewers to the project); viewing angle (whether the project would be viewed from a superior, inferior, or level line of sight); extent of visibility (whether the line of sight is open and panoramic to the project area or restricted by terrain, vegetation, and/or structures); and duration of view.

A *viewshed* is an area of land, water, or other urban or environmental element that is visible to the human eye from a fixed vantage point.

ENVIRONMENTAL SETTING

The Airport's operational area is generally bordered by U.S. 101 to the west and by San Francisco Bay (the bay) to the east. The majority of the Airport is paved for aeronautical uses such as runways, taxiways, aircraft aprons, and parking, or occupied by passenger terminal buildings and aircraft hangars. The project site consists of the perimeter of the Airport. The Airport's 8-mile shoreline and western landside boundary are divided into 16 reaches. Existing shoreline protection features vary by reach and generally include a combination of concrete walls, interlocking wood or vinyl sheet walls, concrete debris, armor rocks, sandbags, and earthen and vegetated berms.

The project area is generally level, and views of San Francisco Bay provide visual relief from the built environment of the Airport and surrounding areas. Numerous publicly accessible locations within the Airport and vicinity offer expansive views of San Francisco Bay, as well as views of the San Bruno Channel, the U.S. Coast Guard Air Station San Francisco (a historic resource), San Bruno Mountain, and the East Bay hills. These views are available from the Bay Trail, North Access Road, Old Bayshore Highway, and Bayfront Park in the City of Millbrae.

The areas to the north, west, and south of the Airport are primarily built-out, and a significant amount of artificial light from urban uses already exists. Existing light sources on the Airport are primarily for pilot navigation on the taxiways and runways and for arriving aircraft. Existing light sources include the approach lighting system on trestles in San Francisco Bay, runway lighting, high-intensity runway edge lights, standard centerline lights, and touchdown zone lights.

APPROACH TO ANALYSIS

The analysis of potential aesthetic impacts involves a qualitative comparison of the existing built and natural environment to the future built and natural environment and an evaluation of the visual changes that would result from implementation of the proposed project. Key views are examined, and existing views are compared to those that would be expected to occur with implementation of the proposed project. Visual simulations for the proposed project were prepared to show, in as realistic a manner and context as possible, the physical elements of the proposed project from key viewpoints. **Figure 1** shows the locations for which visual simulations were prepared. Figure 2, p. 10, through Figure 7, p. 19, show existing views from key viewpoints and views expected to occur with implementation of the proposed project. Potential impacts to the visual character of the project site and its surroundings that could result from implementation of the proposed project are considered, as well as the potential for the proposed project to create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the project area.

SOURCE: SFO, 2021

SFO Shoreline Protection Program

FIGURE 1

VISUAL SIMULATION LOCATION MAP

IMPACTS AND MITIGATION MEASURES

Impact AE-1: The proposed project would not have a substantial adverse effect on a scenic vista. ***(Less than Significant)***

As described above, scenic vistas are locations from which the public can experience unique and exemplary views. Publicly accessible locations within the Airport and vicinity offer expansive views of San Francisco Bay, as well as views of the San Bruno Channel, the U.S. Coast Guard Air Station, San Bruno Mountain, and the East Bay hills. These views are available from the Bay Trail, North Access Road, Old Bayshore Highway, and Bayfront Park in the City of Millbrae.

VIEWS FROM THE BAY TRAIL

The Bay Trail lies adjacent to Reach 1 for approximately 1,000 feet. Along this segment of the Bay Trail, recreational users are afforded close-up, mid-range, and long-range views of San Francisco Bay when looking north or east. In addition, long-range views of San Bruno Mountain to the north are available from this segment of the Bay Trail.

Figure 2 shows the existing and proposed views from the Bay Trail looking east along Reach 1. Recreational users of the Bay Trail are afforded views of the San Bruno Channel from this vantage point, as well as North Access Road and cargo and aircraft maintenance facilities located south of North Access Road behind a chain-link fence. As shown in Figure 2, implementation of the proposed project would introduce a new reinforced concrete wall extending up to 6.1 feet above the existing ground surface. The proposed reinforced concrete wall for Reach 1 would not obstruct views of the San Bruno Channel and would only partially obstruct views of North Access Road, which is not considered a scenic vista. The proposed reinforced concrete wall for Reach 1 would not obstruct views of San Francisco Bay or San Bruno Mountain when looking north or east. Therefore, existing scenic views from the Bay Trail in this location would remain largely unchanged with the proposed project.

VIEWS FROM NORTH ACCESS ROAD

Long-range panoramic views of San Francisco Bay, the U.S. Coast Guard Air Station, and the East Bay hills are available from North Access Road, which runs along the perimeter of the Airport from Reach 1 to Reach 6. North Access Road has one travel lane in each direction and no sidewalks, and although publicly accessible, is a private road owned and maintained by the Airport. The road is used primarily by Airport employees traveling to various destinations on Airport property.

Existing and proposed views from North Access Road are shown in **Figure 3**, p. 11, through **Figure 5**, p. 13. Figure 3 shows the existing views from the San Mateo County Transit District (SamTrans) peninsula, looking east toward Reach 2. Scenic views of natural vegetation, wetlands, and expansive long-range views of San Francisco Bay and the East Bay hills are available to the east and north. As shown in **Figure 4**, p. 12, and Figure 5, existing panoramic views of San Francisco Bay and the U.S. Coast Guard Air Station are partially obstructed by an approximately 7-foot-tall chain-link fence.

As shown in the proposed views in Figure 4 and Figure 5, views of San Francisco Bay and portions of the U.S. Coast Guard Air Station along this portion of North Access Road would be entirely blocked by the shoreline protection system proposed for Reach 3, which would consist of a new steel sheet pile wall that would

SOURCE: Prevision Design, 2021

SFO Shoreline Protection Program

FIGURE 2

VIEW 1: EXISTING AND PROPOSED VIEWS FROM THE SAN FRANCISCO BAY TRAIL, LOOKING EAST TOWARD REACH 1

SOURCE: Prevision Design, 2021

SFO Shoreline Protection Program

FIGURE 3

VIEW 2: EXISTING AND PROPOSED VIEWS FROM SAMTRANS ISLAND, LOOKING EAST TOWARD REACH 2

SOURCE: Prevision Design, 2021

SFO Shoreline Protection Program

FIGURE 4

VIEW 3: EXISTING AND PROPOSED VIEWS FROM NORTH ACCESS ROAD, LOOKING EAST TOWARD REACH 3

SOURCE: Prevision Design, 2021

SFO Shoreline Protection Program

FIGURE 5

VIEW 4: EXISTING AND PROPOSED VIEWS FROM NORTH ACCESS ROAD, LOOKING SOUTHWEST TOWARD REACH 3

extend up to 6.9 feet above the existing ground surface, on top of which would be a 3.1-foot-tall chain-link fence. Vehicles traveling along this portion of North Access Road would no longer experience scenic vistas of San Francisco Bay or the East Bay hills, and views of the U.S. Coast Guard Air Station would be partially obstructed. Views of these scenic resources would be fully obstructed by the proposed shoreline protection system for Reaches 4 and 5. However, given that North Access Road[2] is used primarily by motorists and not people walking or bicycling, views of scenic vistas and historic resources from this portion of North Access Road are generally fleeting and temporary. Therefore, because of the relatively short duration of their exposure, motorists who travel on North Access Road do not have as high degree of sensitivity to the loss of these views as people walking, people bicycling, or recreational users. In addition, views of San Francisco Bay and the East Bay hills would remain along the portion of North Access Road adjacent to Reach 6. Motorists traveling along North Access Road in this location would still be afforded panoramic views of the bay and the East Bay hills over the top of the proposed steel sheet pile wall when looking east or southeast.

Overall, although scenic vistas of San Francisco Bay, the East Bay hills, and the U.S. Coast Guard Air Station would be obstructed for motorists traveling along the portions of North Access Road adjacent to Reaches 3, 4, and 5 with implementation of the proposed project, given the relatively short duration of their exposure, their views do not have a high degree of sensitivity. In addition, views of these scenic vistas are already partially obstructed by the existing chain-link fence along North Access Road for Reaches 3 and 4. Moreover, motorists traveling along North Access Road adjacent to Reach 6 would still be afforded panoramic views of the bay, the East Bay hills, and portions of the U.S. Coast Guard Air Station over the top of the proposed steel sheet pile wall when looking east or southeast. For these reasons, the proposed project would not have a substantial adverse effect on these scenic vistas.

VIEWS FROM BAYFRONT PARK/OLD BAYSHORE HIGHWAY

Bayfront Park, a public park located in the City of Millbrae immediately east of Reach 15, is a recreational destination for walkers, joggers, and people watching aircraft takeoffs and landings. The park is located adjacent to South McDonnell Road/Old Bayshore Highway, a four-lane road (two travel lanes in each direction) that generally follows the shoreline between Millbrae and Burlingame. Scenic vistas from this location include panoramic views of San Francisco Bay, San Bruno Mountain, and the East Bay hills.

Figure 6 shows the existing view from Bayfront Park looking north toward Reach 14. Short-range views of the project area in this location are dominated by wetlands and natural vegetation. Mid-range views include SFO’s runways and Superbay Hangar. Long-range panoramic views include San Francisco Bay and San Bruno Mountain. The proposed shoreline protection system for Reach 14 would consist of a new steel sheet pile wall for the majority of the reach, and a new double steel sheet pile wall for an approximately 250-foot section near the southern end of the reach, with an armor rock revetment located on the bay side of the wall for the entire length of the reach. The proposed steel sheet pile wall would be a maximum height of 10.5 feet above the existing ground surface. As shown in the proposed view in Figure 6, the shoreline protection system proposed in this location would not obstruct any scenic vistas, including views of San Francisco Bay, San Bruno Mountain, and the East Bay hills. Views for recreational users of Bayfront Park and motorists traveling along Old Bayshore Highway would remain largely unchanged with implementation of the proposed shoreline protection system for Reach 14.

[2] North Access Road, although publicly accessible, is a private Airport road for use by Airport and airlines employees.

SOURCE: Prevision Design, 2021

FIGURE 6

VIEW 5: EXISTING AND PROPOSED VIEWS FROM BAYFRONT PARK, LOOKING NORTH TOWARD REACH 14

REACH 16

In order to address landside flood protection, Reach 16 may be required to form a continuous, closed flood protection system. However, Reach 16 would only be necessary to construct if the proposed shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae. As shown in Figure 1, p. 8, Reach 16 would extend southwest from where Reach 1 connects with South Airport Boulevard around the western perimeter of SFO, east of U.S. 101. The reach would continue southeast along North McDonnell Road and South McDonnell Road and connect to the western end of Reach 15. Due to its location along the western perimeter of the Airport, and the presence of buildings, structures, and fencing along the east sides of North McDonnell Road and South McDonnell Road, existing views of San Francisco Bay, San Bruno Mountain, and the East Bay hills from the proposed location of Reach 16 are substantially limited. As such, while the exact design and configuration of Reach 16 has yet to be determined, it is not anticipated that implementation of Reach 16 would have a substantial adverse effect on a scenic vista.

CONCLUSION

The proposed project would obstruct scenic vistas of San Francisco Bay, the East Bay hills, and the U.S. Coast Guard Air Station for motorists along portions of North Access Road adjacent to Reaches 3, 4, and 5. However, given the relatively short duration of their exposure, these views do not have a high degree of sensitivity. In addition, motorists traveling along North Access Road adjacent to Reach 6 would still be able to experience panoramic views of the bay, the East Bay hills, and portions of the U.S. Coast Guard Air Station. Moreover, views of scenic vistas for recreational users of the Bay Trail and Bayfront Park would remain largely unchanged. Due to its location along the western perimeter of the Airport and the presence of intervening buildings, structures, and fencing, it is not anticipated that landside flood protection along Reach 16 would have a substantial adverse effect on a scenic vista. Therefore, this impact would be ***less than significant***.

Impact AE-2: The proposed project would not damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway. *(No Impact)*

There are no state-designated scenic highways located on or adjacent to the Airport. The closest designated state scenic highway is I-280, approximately 1.3 miles west of the project site. Given the distance, topography, and intervening vegetation, the proposed project would not be noticeable from I-280. For this reason, the proposed project, including Reaches 1–16, would have ***no impact*** related to damaging scenic resources within a state scenic highway corridor.

Impact AE-3: The proposed project would not substantially degrade the existing visual character or quality of public views of the site and its surroundings. *(Less than Significant)*

A project is considered to substantially degrade the visual character or quality of a site if it would have a strongly negative influence on the public's experience and appreciation of the visual environment. Visual changes are considered in the context of public views of the site and locale's visual sensitivity, or how noticeable the changes might be to public views based on the distance from a viewer, the nature of the changes, and the duration that a particular view would be available to the viewer.

The proposed project would involve construction activities consisting of removal of armor rock revetment, concrete demolition, berm or soil removal, pipe outlet removal and reattachment, replacement and relocation of the lighting trestle, and steel sheet pile installation. Over the seven-year construction period, most of the proposed project's construction activities and equipment would not be visible from public streets or other public vantage points given the location of the project site along the Airport's shoreline. Construction activities for landside Reach 16, if required, would be intermittently visible to motorists on U.S. 101, North McDonnell Road, South McDonnell Road and from other publicly accessible locations west of the Airport. However, this activity would be temporary, typical of construction activities that regularly occur on and around the Airport, and would not be expected to permanently degrade the existing visual character of the site. Consequently, construction activities associated with the proposed project would not substantially degrade the existing visual character or quality of public views of the site and its surroundings.

The overall visual character of the project area in Figure 2, p. 10, is that of an industrial/commercial area with a canal. The area contains Airport-related hangars, and mid-rise commercial, industrial, and airport buildings in long-range views. The view contains both natural features, such as the water, mud shoreline, trees, and vegetation, and built features, such as North Access Road, fencing, and buildings. As shown in Figure 2, the proposed concrete wall along Reach 1 would extend up to 6.1 feet above the existing ground surface. The concrete wall would replace the existing guardrail along North Access Road and would be visible from public areas such as the Bay Trail, and motorists along North Access Road. The height and massing of the proposed concrete wall would not be out of context with the visual character of the industrial and Airport buildings along North Access Road. Viewers would continue to experience the water and shoreline, and the industrial and aviation-related visual character of the area. As such, with implementation of the proposed project, the visual character of the area would largely remain the same.

Figure 3, p. 11, shows the existing and proposed views from SamTrans peninsula, looking east toward Reach 2. The existing visual character is dominated by natural vegetation, wetlands, and expansive long-range views of San Francisco Bay and the East Bay hills. This vantage point is also characterized by industrial structures, including large cylindrical wastewater storage drums, streetlights, a concrete wall, and a blast fence. The visual quality of this area is enhanced by the long-range views of San Francisco Bay and the East Bay hills, but the continuity and visual quality of the shoreline is disrupted by the industrial structures. As shown in the figure, the Reach 2 shoreline protection system would include a steel sheet pile wall that would extend up to 3.7 feet above the existing ground surface[3] along Sub-reach 2A, increasing to 10.9 feet above the existing ground surface along Sub-reach 2B. The proposed steel sheet pile wall would replace the existing concrete wall and would maintain the same linear form as the existing concrete wall in the same general location. The proposed steel sheet pile wall would not be out of context with the visual character of the industrial structures in the area and would not substantially alter or degrade the vegetation, wetlands, or shoreline that contribute to the scenic quality. Therefore, the visual character would remain largely unchanged with implementation of the proposed shoreline protection system.

As shown in Figure 4 and Figure 5, pp. 12 and 13, the existing visual character of Reaches 2–7 varies substantially along North Access Road. The vantage point shown in Figure 4 is characterized by industrial-appearing elements such as the blast fence, which is marked by horizontal metal ribs, support beams, and horizontal barbed-wire lines supported by metal brackets forming a "V" on top of the fence. The blast fence is adjacent to the west side of North Access Road, and a chain-link fence is adjacent to the east side of North

[3] The depth of the steel sheet pile wall for each reach is noted as below the existing ground surface, which would not change with the proposed project, or the newly graded ground surface for reaches constructed in the bay.

Access Road. The vantage point shown in Figure 5 is characterized by open water views across Seaplane Harbor, the U.S. Coast Guard Station, and Montara Mountain. However, these views are filtered through the chain-link fence and interrupted by overhead streetlights and construction materials. As such, the visual character of North Access Road does not have a high level of consistency or cohesion. As shown in Figure 4 and Figure 5, the proposed shoreline protection infrastructure along Reaches 3 and 4 would replace the existing concrete wall with a new steel sheet pile wall and armor rock revetment on the bay side. The visual character would change due to the increased height of the wall, which would introduce a new vertical, nonporous element on the east side of the road that would block mid- and long-range views across Seaplane Harbor toward San Francisco Bay and the East Bay hills. This change would adversely affect the feeling of openness that motorists experience while driving on North Access Road in this location. However, as discussed above under Impact AE-1, motorists do not have as high a degree of sensitivity to visual character as people walking, people bicycling, or recreational users.[4] Because motorists on North Access Road typically travel at speeds of up to 25 miles per hour, they would experience changes to the visual character and quality for a relatively short duration. Therefore, given that the existing visual character and quality does not have a high degree of cohesiveness due to the presence of varying types of structures, and that motorists do not have as high a degree of sensitivity to visual character and quality due the relative short duration of their views, the proposed project would not have a substantial adverse effect on the area's visual character or quality.

Figure 6, p. 15, shows existing and proposed views from Bayfront Park, a public park in the City of Millbrae. This view is characterized by long-range views of aircraft operations and close- to mid-range views of natural landscapes, such as wetlands, and wildlife foraging. This view would be considered to have high visual quality because of the opportunity to view aircraft operations, the shoreline, and wildlife at the same time. Implementation of the proposed project would replace the existing vinyl sheet pile wall with a steel sheet pile wall (and double steel sheet pile wall near the southern end of the reach) extending up to 7.3 feet above the existing ground surface, with an armor rock revetment on the bay side of the wall. The proposed wall would maintain the same linear form as the existing vinyl sheet pile wall in the same general location. The proposed steel sheet pile wall also would not be out of context with the existing visual character of the airfield. Views of aircraft operations would remain, and views of the natural vegetation and wetlands would be unobstructed in close- and mid-range views. Therefore, the proposed project would not have a substantial adverse effect on the area's visual character or quality.

Figure 7 shows the existing and proposed views from South McDonnell Road toward Reach 15. The existing visual character consists of linear features, notably the concrete channel embankment and wall, the blast fence, and chain-link fencing. A minor amount of vegetation growing through cracks in the concrete embankment is visible, but the prevalence of concrete and chain-link fencing reinforces the industrial character of the viewshed. Implementation of the proposed project would replace the existing concrete wall with a new, slightly taller 6.8-foot-tall concrete wall. The proposed project would be visible in this view, but the industrial visual character would be unchanged because the linear features—including the concrete channel embankment, blast fence, and chain-link fencing—would remain.

[4] North Access Road, although publicly accessible, is a private Airport road for use by Airport and airlines employees.

SOURCE: Prevision Design, 2021

FIGURE 7

VIEW 6: EXISTING AND PROPOSED VIEWS FROM THE MILLBRAE CHANNEL, LOOKING EAST TOWARD REACH 15

As noted above, Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae. However, should the landside protection system for Reach 16 be implemented, it would likely include a series of flood walls, deployable barriers, and raised roads located on Airport property that would be similar to the existing visual character and quality of the western perimeter of the Airport, comprised of buildings, structures, and fencing along the east sides of North McDonnell Road and South McDonnell Road. As such, it is not anticipated that implementation of Reach 16 would have a substantial adverse effect on the area's visual character or quality.

Overall, the proposed shoreline protection system would appear similar in scale and material to the existing shoreline protection features. The proposed project's concrete walls, steel sheet pile walls, and armor rock revetments would look similar to the existing concrete walls, vinyl sheet pile walls, armor rock, and embankments. Moreover, the proposed project would consist of elements commonly seen along the Airport's shoreline. The Airport shoreline would continue to be a distinct visual barrier between the bay and urban development to the west. In addition, due to its location along the western perimeter of the Airport and the presence of intervening buildings, structures, and fencing, it is not anticipated that landside flood protection along Reach 16 would have a substantial adverse effect on the area's visual character or quality. For these reasons, the proposed project would not substantially degrade the existing visual character or quality of public views of the site and its surroundings. Therefore, this impact would be ***less than significant***.

Impact AE-4: The proposed project would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. ***(Less than Significant)***

Existing light sources at the project site are primarily to support aircraft operations. Existing light sources include the approach lighting system on the runways and the lighting trestles in San Francisco Bay, high-intensity runway edge lights, standard centerline lights, and touchdown zone lights.

The proposed project would demolish the existing lighting trestle at the end of Runway 19L and replace it with a new lighting trestle that would be approximately 4.5 feet taller. Because the new lighting trestle would be in the same location and would contain light sources similar to the existing light sources, the proposed project would not result in any new light source. As such, this analysis focuses on light and glare during construction.

The proposed project would be constructed during daytime and nighttime hours. Construction of Reaches 1–6 would occur between 7 a.m. and 4 p.m., and nighttime work necessary to construct Reaches 7–15 would occur between 11 p.m. and 6 a.m. Should it be determined that Reach 16 is required to form a continuous, closed flood protection system, construction would likely occur during both daytime and nighttime hours. Construction lighting for nighttime construction activities would add to the existing ambient light levels in the project vicinity. Nighttime lighting sources during construction would consist of floodlights that would be focused on the work area to minimize light trespass. The proposed project would involve new sources of light and glare during construction, but these light sources would be temporary and limited to the construction site where there are no nearby light-sensitive (human) receptors. Moreover, the proposed project would not result in any permanent increases in light and glare. Temporary increases in nighttime lighting for construction would not be out of context with the existing conditions, given the high levels of nighttime activity that occur at the Airport (e.g., departing and arriving airplanes, runway and taxiway lighting, and the lighting trestles off the ends of the runways). Therefore, the proposed project's temporary increase in nighttime light and glare during construction would not adversely affect nighttime views in the area. As such, this impact would be ***less than significant***.

Impact C-AE-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact related to aesthetics. ***(Less than Significant)***

The geographic context for the analysis of potential cumulative impacts related to aesthetics includes the development and infrastructure projects located within 0.25 mile of the project site are listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Cumulative projects Airport utility infrastructure improvements, new on-Airport buildings and other above-ground structures, and development of a new six-story hotel building and a new seven-story residential building immediately south of the Airport. The hotel and residential cumulative projects located south of the Airport are not visually connected to the project site. Therefore, these cumulative projects would not combine with the proposed project to result in cumulative impacts to scenic vistas or substantially degrade the existing visual character or quality of the area, or create new sources of substantial light or glare that would affect views in the area.

Various projects under the Recommended Airport Development Plan[5] would be located in the vicinity of the proposed project. However, similar to the proposed project, these cumulative projects are not anticipated to substantially obstruct scenic views of San Francisco Bay, San Bruno Mountain, or the East Bay hills from publicly accessible areas as they would be limited in height due to airspace restrictions[6] and would be constructed further inland from the shoreline and closer to the western perimeter of the Airport. Given that projects under the Recommended Airport Development Plan would be developed and designed to support aircraft and airline operations, they would be compatible with the existing visual character and quality of the area, and would not create new sources of substantial light or glare. Therefore, the proposed project, would not combine with cumulative projects to result in a significant cumulative impact. As such, cumulative impacts related to aesthetics would be ***less than significant***.

---

[5] The Recommended Airport Development Plan (RADP) is a long-range plan to guide the Airport's landside development. The purpose of the RADP is to plan for forecast passenger and operations growth at SFO through the following measures: maximizing gate capacity, geometry, and flexibility; optimizing lobby and security flows and incorporating new technology for passenger screening; maximizing shared-use facilities and baggage claim flexibility; and maximizing transfer connectivity for passengers and baggage.

[6] Ricondo & Associates, Inc., *Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport*, November 2012, https://ccag.ca.gov/wp-content/uploads/2014/10/Consolidated_CCAG_ALUCP_November-20121.pdf, accessed April 22, 2021.

3. Population and Housing

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
3. POPULATION AND HOUSING. Would the project:					
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐	☐
b) Displace substantial numbers of existing people or housing units, necessitating the construction of replacement housing?	☐	☐	☐	☐	☒

The proposed project would not displace any residents or housing units because no residential uses or housing units currently exist on the project site. Therefore, topic E.3(b) related to housing and population displacement does ***not apply*** and is not discussed further in the Draft EIR, including this initial study.

Impact PH-1: The proposed project would not induce substantial unplanned population growth, either directly or indirectly. *(Less than Significant)*

In general, a project would be considered growth-inducing if its implementation were to result in substantial population increases and/or new development that might not occur if the project were not implemented. The proposed project would not include the construction of any new homes or businesses on the project site, nor would it result in new permanent employment. Following construction of the proposed project, the completed shoreline protection system would not require additional maintenance personnel beyond those required for the existing shoreline protection features. Therefore, the proposed project would not directly induce population growth, and the following analysis focuses on potential impacts related to population and housing during the construction of the proposed project.

The proposed project would result in a temporary increase in construction workers (an average of 40 construction workers onsite per day per reach, or a maximum of 180 construction workers onsite during the peak construction period when multiple reaches overlap) during the 7-year construction period.[7] According to the California Employment Development Department, from January 2020 to December 2020, the nine-county bay area region supported an average of 240,208 construction jobs.[8] The Association of Bay Area Governments estimates that the number of new construction jobs added in the nine-county bay area region will increase by approximately 100,000 by 2050, for a total of approximately 300,000 construction jobs in 2050.[9] Given the project site's proximity to regional population centers, and considering the size of the

[7] LCW Consulting, *SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 22, 2021.
[8] California Employment Development Department, *Current Industry Employment Statistics*, https://data.edd.ca.gov/Industry-Information/Current-Employment-Statistics-CES/r4zm-kdcg/data, accessed April 13, 2021.
[9] Association of Bay Area Governments and Metropolitan Transportation Commission, *Plan Bay Area 2050, Forecasting and Modeling Report, October 2021*, p. 22, https://www.planbayarea.org/sites/default/files/documents/Plan_Bay_Area_2050_Forecasting_Modeling_Report_October_2021.pdf, accessed May 3, 2022.

regional construction work force, the proposed project's workforce demand would be small relative to the regional labor supply. While some workers might relocate from other areas, the population increase would be negligible and temporary, limited to the construction period. Furthermore, given the varied skills represented in the bay area labor market, the demand for construction employment would likely be met within the existing and projected labor market in the bay area.

Construction industry jobs generally have no regular place of business, and many construction workers are highly specialized (e.g., crane operators, excavator operators, pile driver operators). Thus, construction workers' commutes to jobsites throughout the region may change several times a year, as dictated by demand for their specific skills. The work requirements of most construction projects are also highly specialized, and workers are employed on a jobsite only as long as their skills are needed to complete a particular construction task. It is anticipated that construction workers not already living in San Francisco, the East Bay, or San Mateo County would commute from their residences elsewhere in the bay area rather than permanently relocate to the project vicinity from more distant locations. Because this type of construction work is temporary, filling these jobs with existing bay area residents is typical for employers in various construction trades. Once construction is complete, construction workers typically seek employment at other job sites in the region that require their particular skills. Thus, construction of the proposed project would not generate a substantial permanent population increase in the project vicinity or region. Accordingly, the proposed project would not directly or indirectly induce substantial unplanned population growth or require the construction of housing to accommodate such growth. Therefore, this impact would be ***less than significant***.

Impact C-PH-1: The proposed project, in combination with cumulative projects, would not have a significant cumulative impact related to population or housing. ***(Less than Significant)***

The geographic context for potential cumulative population impacts encompasses the bay area. As discussed above, the proposed project would require an average of 40 construction workers onsite per day per reach, or a maximum of 180 construction workers onsite during overlapping phases of reach construction. It is possible that some of the cumulative projects listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8, could have similar numbers of construction workers on site as the proposed project given the scale and complexity of those projects. Conservatively assuming those projects would require the same average daily number of construction workers as the proposed project, the proposed project in combination with cumulative projects would create approximately 360 temporary construction jobs. This number of jobs is less than 1 percent of the anticipated growth in construction jobs projected for the area. Furthermore, given the anticipated growth in construction jobs, the construction labor force in bay area counties would be able to accommodate this temporary demand for construction labor. Therefore, construction of the proposed project, in combination with cumulative projects, would not directly or indirectly induce substantial unplanned population growth, and would have a ***less-than-significant*** cumulative impact related to population and housing.

---

4. Cultural Resources

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
4. CULTURAL RESOURCES. Would the project:					
a) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5, including those resources listed in article 10 or article 11 of the San Francisco Planning Code?	☒	☐	☐	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐	☐
c) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐	☐

HISTORIC RESOURCES

Impact CR-1: The proposed project could cause a substantial adverse change in the significance of a historical resource pursuant to CEQA Guidelines section 15064.5. ***(Potentially Significant)***

Implementation of the proposed project could cause a substantial adverse change in the significance of a historical architectural resource. This topic is addressed in Section 4.A, Historic Architectural Resources, of the Draft EIR.

Impact C-CR-1: The proposed project, in combination with cumulative projects, could result in a substantial adverse change in the significance of historical resource, as defined in CEQA Guidelines section 15064.5. ***(Potentially Significant)***

Implementation of the proposed project could cause a substantial adverse change in the significance of a historical architectural resource when combined with cumulative projects. This topic is addressed in Section 4.A, Historic Architectural Resources, of the Draft EIR.

ARCHEOLOGICAL RESOURCES

This section describes the archeological setting of the project site and evaluates potential effects to significant archeological resources and human remains. An archeological survey report and sensitivity analysis (archeological sensitivity analysis) was completed for the proposed project.[10] The report provides a detailed context, applicable regulatory framework, and a sensitivity analysis of the potential for prehistoric and historical archeological resources to be in the project site and to be affected by ground disturbance. The archeological sensitivity analysis is based in part on the results of a geoarcheological testing program.[11] Relevant information is summarized below.

[10] ESA, *San Francisco International Airport, Shoreline Protection Program, City and County of San Francisco, Archaeological Sensitivity Assessment Case No. 2020-004398ENV*, June 2021.
[11] Ibid.

The project site is the geographic area or areas within which the proposed project may directly or indirectly cause alterations in the character or use of historical resources, including prehistoric and historical archeological resources, if any such resources exist. The project site (see Figure 2-2, p. 2-8, in Chapter 2, Project Description) encompasses approximately 65 acres. The project site extends from the existing ground surface to the maximum depth of proposed ground disturbance at approximately 50 feet below ground surface (bgs).

ENVIRONMENTAL SETTING

The entirety of the project site is located on either imported fill over Young Bay Mud or Young Bay Mud for those reaches located in San Francisco Bay itself. Prior to land reclamation in the 20th century, the project site was within shallow tidal flats and marshlands inland of and along the former historic bay shoreline, and in the adjacent waters of the bay.

PREHISTORIC ARCHEOLOGICAL RESOURCES AND SENSITIVITY ASSESSMENT

Prehistoric archeological sites tend to be located in specific environmental settings, including relatively level areas near present or former water courses or other fresh water sources, such as perennial streams or seeps; or near large water bodies such as lakes, bays, estuaries, and oceans. The high diversity and concentration of plant and animal populations in those environmental settings makes these highly productive sources for food and other natural resources. On the northern San Francisco peninsula, the majority of known prehistoric archeological sites are located within about 0.5 mile (2,500 feet) of the historic bay or ocean margins. In San Mateo County, prehistoric archeological sites cluster near the bay shore and coast, but there are also numerous sites at greater distances from the shoreline, on the bay and coastal plains along perennial creeks (for instance, San Mateo and San Francisquito creeks), in oak groves in the hills, and along the ridgelines.

Far Western Anthropological Research Group, Inc. (Far Western) has developed a prehistoric archeological sensitivity model for the city of San Francisco and San Francisco's airport lands, to predict the locations of undiscovered prehistoric archeological sites.[12] The model addresses sensitivity for near surface, buried and submerged prehistoric archeological resources. Near-surface archeological resources are associated with the pre-development land surface (in the bay area, the ground surface that existed prior to about 1850), and therefore may be found near the modern ground surface, or buried under artificial fill or historic or modern development. Buried archeological resources are those that are present on land surfaces that were buried by naturally-deposited sediments, such as alluvium or wind-blown dune sand, prior to the historical period. Submerged archeological sites are resources that lie under sediments deposited by San Francisco Bay as it filled, starting about 10,000 years ago. The San Francisco Bay Area has undergone significant landscape changes since humans began to inhabit the region more than 13,000 years ago. Sea levels began rising about 15,000 years ago, at which time the coastline was located west of the Farallon Islands. The earliest occupation in the valley and along the shore of the growing bay were inundated by the rising bay and then buried in the bay sediments. This process continued over several thousand years until the water reached the present level of the bay approximately 4,000 years ago.

Far Western's sensitivity model considers the factors that, based on the locations of known prehistoric sites in Central California and elsewhere, appear to influence the locations at which prehistoric sites are likely to

[12] Meyer, Jack and Paul Brandy, *Geoarchaeological Assessment and Site Sensitivity Model for the City and County of San Francisco, California*, prepared by Far Western for the Environmental Planning Division of the San Francisco Planning Department, 2019.

be located. As discussed above, these factors include proximity to the bay shore or ocean coast, creeks, creek confluences, and other water sources; proximity to previously-identified prehistoric archeological sites, where these are known; degree of slope; landform history (e.g., whether an area was subject to alluvial burial, such as by bayshore marsh formation, or erosion such as might occur on steep slopes and in river channels), and; history of prior major grading or landfill (where this information is available). For submerged resources, the model also considers the topography of the pre-bay landform; that is, the landform that was inundated as rising sea levels created San Francisco Bay, and the timing of that inundation. More information on this topic is provided under the Submerged Resources Archeological Analysis, below.

The potential for prehistoric archeological resources to be present in the project area in each of these settings is discussed in the following sections.

NEAR SURFACE AND BURIED RESOURCES ARCHEOLOGICAL ANALYSIS

The project site was almost entirely within San Francisco Bay and its tidal salt marshes for some 2,000 years prior to the 20th century. The only dry land within the project site historically was the former location of Belair Island, in Reach 1. Historic maps indicate that this small island, which formerly reached as high as 60 feet above sea level, was leveled during the 1930s. Although because it was adjacent to a stream and provided access to bayshore resources it would have been a desirable location for prehistoric settlement, any archeological resources that might have been present on Belair Island would have been destroyed by the 1930s grading; therefore, there is a low sensitivity for near surface or buried prehistoric archeological resources to be present even in that location. An archeological records search identified three previously recorded prehistoric archeological sites within the 0.5-mile records search area surrounding the project site; all are located west of the project site in terrestrial settings near the historical bay shore. Thus, while the nearby historically terrestrial areas to the west of the project site are sensitive for near surface and buried prehistoric archeological resources, there is little or no potential for the project to affect such resources.

DEEPLY BURIED/ SUBMERGED RESOURCES ARCHEOLOGICAL ANALYSIS

A 2001 underwater cultural resources survey assessed portions of the bay floor immediately offshore of Reaches 2 and 5–14 for the presence of submerged and shallowly buried archeological resources, including both for features such as sunken ships and for mounded prehistoric deposits.[13] The survey consisted of an initial phase of remote-sensing data collection using side-scan sonar, magnetometer, and sub-bottom profiler instruments to identify data anomalies that might represent mounded prehistoric archeological deposits or historic features buried beneath the bay floor. A second phase utilized vibracore soil samplers operated by dive teams to assess these potential buried archeological features. Sub-bottom profile data showed potential buried features with internal stratigraphic structure similar to archeological *shell midden* deposits at 24 locations.[14] These features were assessed by extracting and analyzing the stratigraphy and shell makeup of core samples, to establish whether each as natural or cultural in origin. In each case, the buried landform (“mound”) was determined to be a naturally occurring sedimentary structure. No archeological materials were identified during the underwater survey.

As explained above, submerged archeological resources may be present under sediments deposits by San Francisco Bay as it formed starting about 10,000 years ago. Prior to that time, the area now occupied by San

[13] EcoSystems Management Associates, *Underwater Cultural Resources Survey for the Proposed SFO Runway Reconfiguration Project*, prepared for URS Corporation, 2001.
[14] A *shell midden* is the accumulation of refuse materials, including oyster, clam, and mussel shell fragments, resulting in a culturally formed deposit often indicating an area of human use or occupation.

Francisco Bay was an inland river valley. The ocean coastline lay some 30 miles to the west, near the Farallon Islands. At the end of the most recent glacial epoch, about 12,000 years ago, melting glaciers caused a rapid rise in sea levels world wide. Around 10,000 years ago, rising waters flowed in through the Golden Gate, and flooded the former inland valley to form the bay. Rising waters continued to expand the size of the bay until at least 4,000 years ago. After that time, as the rate of sea-level rise slowed, extensive marshes formed around the bay margins as the result of sediment deposition by creeks and other runoff entering the bay.

Humans are known to have been present in the bay region for at least the past 10,000 years. People who occupied the pre-bay San Francisco river valley, over many generations, witnessed the expansion of the bay. As the bay expanded over time, the rising waters inundated settlement sites on earlier shorelines and deposited sediments that buried these early sites beneath the floor of the bay. The process continued throughout the period during which the bay rose, and shoreline occupation sites gradually retreated. As the result of this process, archeological sites around the bayshore that are within the historic boundaries of the bay and that date to the period during which San Francisco Bay and its marshes were forming (approximately 10,000 to about 2,000 years ago) lie beneath the bottom of the Young Bay Mud stratum that was deposited by the bay as it filled.

Far Western's prehistoric archeological sensitivity model includes a Holocene sea-level rise curve, which estimates the location of the shore of the expanding bay at 2,000-year intervals—that is, the approximate times at which areas now within the bay were inundated.[15] Based on this curve, the areas within the project footprint were inundated primarily between 4,000 and 8,000 years ago. During the earliest period of inundation, human populations around the bay are believed to have been very small and, likely, sparsely distributed, so the earliest sites would be expected to be very rare. Over time, populations increased, such that it is likely that a larger number of living sites were established along bay shore lines as they existing later in time. Older shorelines typically lie further bayward of the modern shore than younger sites: However, this varies considerable from place to place, depending on the topography of the underlying pre-bay landform.

Far Western's model predicts moderate sensitivity for submerged prehistoric archeological resources around the margins of the Airport, primarily based on the dates of modeled shoreline inundation—which range between more than 8,000 years ago and less than 4,000 in the project area. These prehistoric resources would be expected to be located at the interface between the Young Bay Mud that was deposited by the rising bay and the underlying pre-bay land surface, which in the project area is known as Upper Layered Sediments. However, there is a potential for archeological resources to have survived on this pre-bay ground surface only if that surface was not eroded away as the bay filled. One prior geotechnical analysis (based on coring conducted to inform engineering for airport development)[16] presents evidence that the pre-bay land surface that underlies the project area is highly irregular in contour, which was interpreted by geotechnical engineers as evidence of widespread erosion of the Upper Layered Sediments as the Young Bay Mud was deposited. However, the geotechnical study did not address the potential for surviving, uneroded pre-bay surfaces, and thus did not provide an adequate basis for submerged archeological sensitivity predictions.

---

[15] This sea-level curve was developed from established rates of sea-level rise based on worldwide data, radiocarbon dates recovered from numerous samples of estuarine and marsh deposits collected throughout the bay and delta, and pre-bay bottom bathymetry extrapolated by subtracting the depth of the Young Bay Mud stratum from modern bathymetric data to estimate pre-bay topographic elevations.

[16] Airfield Development Engineering Consultant (ADEC), San Francisco International Airport, Airfield Development Program, Preliminary Report No. 3C (Task C), Preliminary (Phase 1) Geotechnical Analyses, Volume 1, Main Text and Figures, 2000.

As part of project planning, a geoarcheological testing plan[17] therefore was developed to assess sensitivity for deeply buried (submerged) prehistoric archeological resources within the project site and the potential for the proposed project to result in impacts in any archeologically sensitive areas that might be identified.[18] The testing plan included an analysis of the elevations and contours of the interface between the base of the Young Bay Mud and the surface of the underlying Upper Layered Sediments, and reconstructed the surface topography of formations that underlie Young Bay Mud at the project site. The reconstruction revealed that a system of incised channels ("paleochannels") that are interpreted as representing former stream drainages cut into and across the pre-bay land surface.[19] The deeper portions of these paleochannels, being at lower elevations than the Upper Layered Sediments surface, would have been the first areas to have been inundated and infilled with Young Bay Mud as sea levels rose. The potential for prehistoric archeological sites to have survived within these channels is slight, as the pre-bay land surfaces on which these resources would have been established were removed through prehistoric erosion. However, additional archeological data were needed to determine whether intact pre-bay surfaces and surface soils (paleosols) that might harbor prehistoric archeological resources survive between these channels.

Utilizing Far Western's Holocene sea-level rise curve, the testing plan estimated an approximate average timeframe of inundation for each specific reach within the project site. Based on these data, Reaches 6, 7, and 8, which include locations of the deepest paleochannels were inundated between approximately 8,200 and 9,300 years before present. Reaches 5, 9, 10, 11, 12, 13, and 14 were inundated between approximately 7,350 and 7,850 years before present; Reaches 2, 3, and 4 were inundated between 5,600 to 7,000 years before present; and Reaches 1 and 15 were inundated most recently, between approximately 3,500 and 4,150 years before present.

The testing plan proposed geoarcheological coring to examine subsurface stratigraphy in certain key project reaches, to determine whether intact paleosols—prehistoric soil surfaces that could preserve prehistoric resources-- have survived bay erosion and inundation, and to assess any paleosols encountered for evidence of submerged prehistoric archeological resources. Based on discussions with the planning department archeologist, the testing plan specified a total of 23 archeological cores spaced approximately 200 meters apart along Reaches 2, 4, 10, 11, 13, 14 (the southern end), and 15, to assess each reach for the presence of intact pre-bay surfaces that could harbor submerged prehistoric resources. Reaches 3, 5–9, a portion of 13, and a portion of 14 are collocated with prehistoric stream channels and were assessed as having little or no sensitivity for the presence of prehistoric archeological resources; accordingly, no cores were proposed for those reaches. The proposed cores were separated into 15 initial core locations and 8 supplemental core locations, the latter to be completed if evidence of an intact surface or potentially archeologically sensitive soils was observed in the initial cores, or if results from the initial cores were ambiguous or unclear as to whether or not intact paleosols are present on the surface of the Upper Layered Sediments.

GEOARCHEOLOGICAL TESTING RESULTS

Geoarcheological testing for submerged prehistoric archeological sensitivity was conducted in the project site. It consisted of recovery, by a professional drilling subcontractor, of continuous cores to the base of the

[17] Geoarcheological testing consists of mechanical extraction of continuous sediment cores, drilled to sample the potentially archeologically sensitive strata underlying a project site. Cores are examined and analyzed by an archeologist to assess for the presence of prehistoric archeological materials, or intact pre-bay soils that have the potential to harbor pre-bay archeological materials.
[18] ESA, *Archeological Testing Plan for the SFO Shoreline Protection Program, San Francisco, California* (San Francisco Planning Department Case No. 2020-004398ENV), 2020.
[19] ADEC, San Francisco International Airport, Airfield Development Program, Preliminary Report No. 3C (Task C), Preliminary (Phase 1) Geotechnical Analyses, Volume 1, Main Text and Figures, 2000.

Young Bay Mud sediments and three feet into the Upper Layered Sediments, where they proved to be present under the Young Bay Mud. The depth of cores varied from 27 to 61 feet bgs, based on the stratigraphy encountered. An archeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology, and with a demonstrated expertise in geoarcheology, examined all recovered core samples as they were recovered.

Geoarcheological coring observations confirmed that artificial fill directly overlies Bay Mud within the project site; there was no terrestrial surface present at the project site before the area was filled in the 20th century. This observation confirms the low sensitivity for near-surface and buried prehistoric archeological resources within the project site.

The primary goal of the geoarcheological coring program was to directly examine the upper 3 feet of the Upper Layered Sediments to look for signs of an intact paleosol that may represent formerly stable and livable ground surfaces, or other evidence that archeologically sensitive soils were present. If present, such paleosols can often be identified on the basis of color, structure, horizon development, bioturbation, lateral continuity, and the nature of the upper boundary (contact) with the overlying deposit.[20]The geoarcheological coring results[21] indicate that an intact, or partially-intact, paleosol likely exists on the surface of the Upper Layered Sediments in Reaches 2, 4, 10, 14 (the southern portion), and 15. These reaches therefore are considered to be highly sensitive for the presence of submerged prehistoric archeological resources. The results from Reaches 11–13 are consistent with a surface that either never formed a stable landform in the past, or from which the uppermost soil horizons were eroded away by rising sea levels in the Holocene: these reaches therefore do not appear to be archeologically sensitive. A partially intact paleosol was identified in Reach 13, in an area estimated to have been inundated over 8,000 years before present. On the basis of early age of inundation, the potential for a resource to be present at this particular location is relatively low, since populations around the bay are believed to have been very sparse at this time. However, if a submerged cultural resource were present at this location, it would be highly significant as representative of a prehistoric period that is virtually unknown in this area. This area therefore is also considered to be highly sensitive for submerged resources.

In summary, there is low sensitivity for, and a low potential to impact, near-surface and buried prehistoric archeological resources within the project site. In addition, the geoarcheological testing results indicate a low sensitivity for deeply buried submerged paleosols that could harbor prehistoric archeological materials in Reaches 1, 3, 5–9, 11–12, and the northern portion of Reach 14; accordingly, there is a low potential to impact submerged prehistoric archeological resources in those reaches. There is a moderate to high sensitivity for deeply buried submerged paleosols that could harbor prehistoric archeological materials in Reaches 2, 4, 10, the western end of 13, the southern portion of 14, and 15. Where the proposed steel sheet pile walls would extend into the Upper Layered Sediments in those reaches, there is a high potential to encounter deeply buried submerged paleosols that could harbor prehistoric archeological materials. As both the depth to the top of the Upper Layered Sediments and the depth of proposed piles vary, the potential for impacts in each of the sensitive reaches would need to be assessed as in more detail as design is finalized.

[20] Byrd, Brian F., Philip Kaijankoski, Jack Meyer, Adrian Whitaker, Rebecca Allen, Meta Bunse, and Bryan Larson, *Archaeological Research Design and Treatment Plan for the Transit Center District Plan Area, San Francisco, California*. Prepared by Far Western Anthropological Research Group, Past Forward, Inc., and JRP Historical, Prepared for the City and County of San Francisco Planning Department, San Francisco, CA, 2010.
[21] ESA, *Archeological Testing Plan for the SFO Shoreline Protection Program, San Francisco, California* (San Francisco Planning Department Case No. 2020-004398ENV), 2020.

HISTORICAL ARCHEOLOGICAL RESOURCES AND SENSITIVITY ASSESSMENT

As discussed above, the project site lay almost entirely within San Francisco Bay and adjacent tidal salt marsh until the 1920s, when land reclamation for the original Airport began. As a result, the only sensitivity for historical archeological resources within the project site would be possible buried maritime-related features that would have been present within the tidal marsh or on the bay floor, such as wooden pilings that were constructed around the oyster beds for oyster farming, piers or walkways used to access the bay, or ships beached in the shallow offshore waters, and subsequently covered by fill during land reclamation. The only portion of the project site that was not formerly within the bay or marsh was Belair Island in Reach 1. As discussed above, historic maps and aerial photographs indicate that the small island was entirely cut down during the 1930s and used to fill the surrounding area. The highest point on the island, which formerly reached 60 feet above sea level, was located in the west end of Reach 1, which currently lies less than 12 feet above sea level. The former hill footprint was further impacted by the construction of a canal and jetties immediately to the north of the Reach 1. As a result of the extensive disturbance associated with Belair Island, there is a little or no potential for historical (or any other) archeological resources to be present in that location.

The proposed project has the potential to impact submerged historical archeological resources, including shipwrecks or abandoned hulks, or features related to the historic oyster farming, if they were present within the project footprint prior to artificial filling. In addition, such resources could be present on the bay floor in Reach 7, where the proposed project would encompass a small portion of the current bay floor offshore of the current airport margin. Efforts to identify submerged historical archeological resources included background research and review of multibeam bathymetric data collected to the bay floor in the project vicinity, as discussed above under Deeply Buried/Submerged Resources Archeological Analysis. While the geoarcheological cores extracted for archeological assessment were also examined for any evidence of historical period materials, the potential to identify historical features through coring is slight because cores are unlikely to recover identifiable samples, and the testing plan did not focus on such features.

Background research to identify shipwrecks and other submerged historical archeological resources included reviewing the California State Lands Commission (CSLC) Shipwreck Database; San Francisco Planning Department, Environmental Planning Division Geographic Information System maritime resources layer, and the National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey's Automated Wreck and Obstruction Information System (AWOIS).

The CSLC Shipwreck Database lists a total of 58 ships inside San Francisco Bay (i.e., east of the Golden Gate Bridge). This database and historical background research did not reveal any known shipwrecks or other submerged historical archeological resources within the project site or the 0.5-mile records search buffer around the project site.

Navigational charts, such as those produced by the U.S. Coast Survey and its descendent agencies (the U.S. Coast Guard Service and NOAA) are another source of information about submerged historical archeological sites. Shipwrecks, abandoned hulks, and other objects are recorded and depicted on navigational charts if they may pose a hazard to navigation. Navigational charts dating from 1862 (oldest) to 2013 (most recent) were reviewed, and no shipwrecks, abandoned hulks, or other objects are recorded or depicted within the 0.5-mile records search area around the project site.

The NOAA Office of Coast Survey's AWOIS database also was consulted for information about potential shipwrecks located in the vicinity of the project site. The AWOIS database maintains a list of shipwrecks and other submerged objects that could pose a hazard to navigation. The AWOIS database does not include any entries for vessels within the 0.5-mile records search area.

In 2020, a multibeam bathymetric survey of the project site and vicinity was conducted to map the bay floor. This study augments the results of the 2001 study of the bay shore adjacent to the airport, discussed above. Multibeam bathymetry uses acoustical data to create an image of the bay floor, which records objects that protrude from the bay floor. Multibeam bathymetry is one of the primary tools used by maritime archeologists to determine the presence of submerged historical archeological resources, primarily historical shipwrecks. The multibeam survey did not record any objects visible on the bay floor in the project vicinity, with the exception of modern navigational aids and warning signs. Review of the multibeam bathymetry data by an ESA maritime archeologist concluded that no targets of interest—that is, potential shipwrecks or other submerged historic-period resources—are present in the project site.

The earliest U.S. Coast Survey maps (1862 and 1869) show the project site within the waters of San Francisco Bay and tidal salt marsh, just south of Point San Bruno. The 1862 map indicates the site of the future airport included shallow (1–2 feet deep) "shell banks," surrounded by San Francisco Bay waters that ranged from 1 to 4 feet deep. The northern and southern ends of the project site (Reaches 1 and 14–15) extended into the tidal marshes, while the rest of the project site was entirely within shallow portions of the bay. Due to the shallow water that encompassed much of the project site, any vessels such as ships or boats would have had to be small with a very shallow draft to enter the project vicinity. No piers, wharves, or other maritime features are depicted in the project vicinity on any historic maps. On this basis, overall, there is a low sensitivity for, ships, boats, or other maritime features to be present within the project site.

Remnant features related to oyster cultivation could include closely-connected wooden pilings that were constructed around the oyster beds to protect them from predators. Small structures were constructed on the pilings to house guards to watch the oyster beds. Evidence of oyster farming could be present in the Young Bay Mud and the base of the fill underlying the project site. As the proposed project would not include excavations that would expose such features for observation, and as archeological trenching would not be feasible given the setting (in particular the shallow depth to groundwater), geoarcheological testing would be the only means of determining whether such features are present. However, the potential to identify such features during geoarcheological testing is very low because only a small core is extracted, which would be insufficient to characterize the feature. If present, oyster farm-related features likely would be damaged or destroyed by pile driving. While such features would be of interest in documenting the physical characteristics of oyster farms, the potential for posts, piles, and connecting members to provide new information about historic oyster farming not already documented in the historic record generally would be limited, and it is assumed that the potential for significant features to be present is low.

APPROACH TO ANALYSIS

An archeological resource can be considered both a historical resource according to CEQA Guidelines section 15064.5 as well a unique archeological resource as defined in CEQA section 21083.2(g). Both prehistoric and historical archeological resources, including maritime archeological resources, are addressed in this impact discussion. There are no identified archeological resources within the project site. This analysis identifies the potential for archeological resources listed in or eligible for listing in the California

Register of Historical Resources and the National Register of Historic Places to be present within the project site and assesses the potential impact of the proposed project on those resources.

IMPACTS AND MITIGATION MEASURES

Impact CR-2: The proposed project could cause a substantial adverse change in the significance of an archeological resource pursuant to CEQA Guidelines section 15064.5. ***(Less than Significant with Mitigation)***

Project construction that has the potential to impact archeological resources in the project site would include demolition of existing shoring walls, earthwork, pile removal, installation of new piles and associated walls, and placement of fill. The archeological analysis indicates that there is the potential for submerged prehistoric resources to be present in the project site. SFO would implement **Mitigation Measures M-CR-2a, Accidental Discovery**, and **M-CR-2b, Archeological Testing**, to reduce and mitigate the potential for significant archeological impacts to less than significant. Under Mitigation Measure M-CR-2b, SFO would provide for the development of a supplemental geoarcheological testing program to more closely examine those locations determined to have archeological sensitivity based on the results of the previous geoarcheological testing discussed above. Archeological testing would not be necessary for Reach 16 because ground-disturbing activities would be confined to artificial fill, within the uppermost 4 feet bgs. As outlined in M-CR-2b below, if a significant resource were identified during testing, an archeological data recovery program would be scoped in consultation with the Planning Department Environmental Review Officer, and carried out, to recover the important information represented by the resource. Archeological interpretation also would be carried out for resources with significant interpretive value of interest to the public. For resources of Native American origin, consultation with tribal representatives regarding treatment, and interpretation of the resource with respect to the tribal cultural values it represents also would be implemented, as discussed under Section E.5, Tribal Cultural Resources. In addition, if suspected archeological resources were uncovered in any reach during implementation of the proposed project, ground-disturbing work at the discovery location would be required to halt, pending documentation of the find and evaluation of whether the resource encountered constitutes a historical resource under CEQA.

Mitigation Measure M-CR-2a also would be implemented, including for Reach 16, to address the potential for archeological discoveries in the absence of an archeologist. This measure provides that work must halt if a suspected archeological resource is discovered during project implementation and specifies procedures to be followed to protect the resource, ensure that it is assessed by an archeologist, and provide appropriate treatment of significant archeological resources. Implementation of Mitigation Measures M-CR-2a and M-CR-2b would minimize the potential for significant impacts on archeological resources. Therefore, with implementation of these mitigation measures, impacts to archeological resources would be ***less than significant with mitigation***.

> **Mitigation Measure M-CR-2a: Accidental Discovery.** The following mitigation measure is required to avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines section 15064.5(a) and (c).
>
> *ALERT Sheet.* SFO shall distribute the Planning Department archeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including demolition, excavation, grading, foundation, pile driving, etc. firms); or utilities firm involved in soils-disturbing activities within the project site. Prior to any soils-disturbing activities being undertaken, each contractor is

responsible for ensuring that the “ALERT” sheet is circulated to all field personnel, including machine operators, field crew, pile drivers, supervisory personnel, etc. SFO shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) confirming that all field personnel have received copies of the Alert Sheet.

Discovery, Stop Work, and Notification. Should any indication of an archeological resource be encountered during any soils-disturbing activity of the project, SFO shall immediately notify the ERO and shall immediately suspend any soils-disturbing activities in the vicinity of the discovery until the ERO has determined what additional measures should be undertaken.

Archeological Consultant Identification and Evaluation. If the ERO determines that an archeological resource may be present within the project site, SFO shall retain the services of an archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource as well as if it retains sufficient integrity and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify, document, and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by SFO.

Discovery Treatment Determination. Measures might include preservation *in situ* of the archeological resource; an archeological monitoring program; an archeological testing program; and/or an archeological interpretation program. If an archeological interpretive, monitoring, and/or testing program is required, it shall be consistent with the Environmental Planning Division guidelines for such programs and shall be implemented immediately. The ERO may also require that SFO immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.

Consultation with Descendant Communities. On discovery of an archeological site associated with descendant Native Americans, the Overseas Chinese, or other potentially interested descendant group an appropriate representative of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site.

Archeological Data Recovery Plan. An archeological data recovery program shall be conducted in accordance with an Archeological Data Recovery Plan (ADRP) if all three of the following apply: (1) a resource has potential to be significant, (2) preservation in place is not feasible, and (3) the ERO determines that an archeological data recovery program is warranted. The project archeological consultant, SFO, and ERO shall meet and consult on the scope of the ADRP. The archeological consultant shall prepare a draft ADRP that shall be submitted to the ERO for review and approval.

The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- *Field Methods and Procedures.* Descriptions of proposed field strategies, procedures, and operations.
- *Cataloging and Laboratory Analysis.* Description of selected cataloging system and artifact analysis procedures.
- *Discard and Deaccession Policy.* Description of and rationale for field and post-field discard and deaccession policies.
- *Security Measures.* Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- *Final Report.* Description of proposed report format and distribution of results.
- *Curation.* Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Funerary Objects. The treatment of human remains and of funerary objects discovered during any soils disturbing activity shall comply with applicable State and federal laws. This shall include immediate notification of the San Mateo County Coroner and, in the event of the Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission (NAHC), which will appoint a Most Likely Descendant (MLD). The MLD will complete his or her inspection of the remains and make recommendations or preferences for treatment within 48 hours of being granted access to the site (Public Resources Code section 5097.98). The ERO also shall be notified immediately upon the discovery of human remains.

SFO and ERO shall make all reasonable efforts to develop a Burial Agreement (Agreement) with the MLD, as expeditiously as possible, for the treatment and disposition, with appropriate dignity, of human remains and associated or unassociated funerary objects (as detailed in CEQA Guidelines section 15064.5(d)). The Agreement shall take into consideration the appropriate excavation, removal, recordation, scientific analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. If the MLD agrees to scientific analyses of the remains and/or associated or unassociated funerary objects, the archeological consultant shall retain possession of the remains and associated or unassociated funerary objects until completion of any such analyses, after which the remains and associated or unassociated funerary objects shall be reinterred or curated as specified in the Agreement.

Both parties are expected to make a concerted and good faith effort to arrive at a Burial Agreement. However, if SFO and the MLD are unable to reach an Agreement on scientific treatment of the remains and/or funerary objects, the ERO, with cooperation of SFO, shall ensure that the remains and/or funerary objects are stored securely and respectfully until they can be reinterred on the project site, with appropriate dignity, in a location not subject to further or future subsurface disturbance, in accordance with the provisions of state law.

Treatment of historic-period human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity, additionally, shall follow protocols laid out in the project archeological treatment document, and other relevant agreement established between SFO, the San Mateo County Coroner, and the ERO.

Public Interpretation Plan. The project archeological consultant shall submit a Public Interpretation Plan (PIP) if a significant archeological resource is discovered during a project. The PIP shall describe the interpretive product(s); locations or distribution of interpretive materials or displays; the proposed content and materials; persons or groups to be consulted for input on culturally appropriate interpretation, as applicable; the producers or artists of the displays or installation; and a long-term maintenance program. The PIP shall be sent to the ERO for review and approval. The PIP shall be implemented prior to occupancy of the project.

Archeological Resources Report. The project archeological consultant shall submit a confidential draft Archeological Resources Report (ARR) to the ERO that evaluates the historical significance of any discovered archeological resource, describes the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and discusses curation arrangements.

Once approved by the ERO, copies of the approved ARR shall be distributed as follows: California Archeological Site Survey Northwest Information Center (NWIC) shall receive one copy, and the ERO shall receive a copy of the transmittal of the ARR to the NWIC. The environmental planning division of the planning department shall receive one bound hardcopy of the ARR. Digital files that shall be submitted to the environmental division include an unlocked, searchable PDF version of the ARR, GIS shapefiles of the site and feature locations, any formal site recordation forms (CA DPR 523 series), and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The PDF ARR, GIS files, recordation forms, and/or nomination documentation should be submitted via USB or other stable storage device. If a descendant group was consulted during archeological treatment or will be consulted in the development of interpretive materials, a PDF of the ARR shall be provided to the representative of the descendant group.

Curation. If archeological data recovery is undertaken, materials and samples of future research value from significant archeological resources shall be permanently curated at a facility approved by the ERO.

Mitigation Measure M-CR-2b: Archeological Testing. Based on a reasonable presumption that buried or submerged archeological resources that qualify as historical resources under CEQA may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effects from the proposed project on such archeological resources.

In consultation with the ERO, SFO shall retain the services of an archeological consultant with demonstrated geoarcheological expertise. The archeological consultant shall undertake an archeological testing program as specified herein. In addition, the consultant shall be available to conduct an archeological monitoring and/or data recovery program if required pursuant to this measure. The archeological consultant's work shall be conducted in accordance with this measure at the direction of the Environmental Review Officer (ERO). All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the ERO for review and comment and shall be considered draft reports subject to revision until final approval by the ERO. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the ERO, the suspension of construction can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less-than-significant-level potential effects on a significant archeological resource as defined in CEQA Guidelines section 15064.5(a)(c).

Archeological Testing Program. The purpose of the archeological testing program will be to determine to the extent possible the presence or absence of archeological resources and to identify and to evaluate whether any archeological resource encountered on the site constitutes an historical resource under CEQA.

The archeological testing program shall be conducted in accordance with an approved Archeological Testing Plan (ATP). The archeological consultant and the ERO shall consult on the scope of the ATP, which shall be approved by the ERO prior to any project-related soils disturbing activities commencing. The ATP shall be submitted first and directly to the ERO for review and comment and shall be considered a draft subject to revision until final approval by the ERO. The archeologist shall implement the approved testing as specified in the approved ATP prior to and/or during construction.

The ATP shall identify the property types of the expected archeological resource(s) that potentially could be adversely affected by the proposed project, lay out what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. The ATP shall also identify the testing method to be used, the depth or horizontal extent of testing, and the locations recommended for testing and shall identify archeological monitoring requirements for construction soil disturbance as warranted.

Discovery Treatment Determination. At the completion of the archeological testing program, the archeological consultant shall submit a written summary of the findings to the ERO. The findings memo shall describe and identify each resource and provide an initial assessment of the integrity and significance of encountered archeological deposits.

If the ERO in consultation with the archeological consultant determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, the ERO, in consultation with SFO, shall determine whether preservation of the resource in place is feasible. If so, the proposed project shall be re-designed so as to avoid any adverse effect on the information potential or other characteristics that were the basis for determining the archeological resource to be significant, and the archeological consultant shall prepare a cultural resource preservation plan (CRPP), which shall be implemented by SFO during construction. The consultant shall submit a draft CRPP to the planning department for review and approval.

If preservation in place is not feasible, a data recovery program shall be implemented, unless the ERO determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible. The ERO in consultation with the archeological consultant shall also determine if additional treatment is warranted, which may include additional testing and/or construction monitoring.

Consultation with Descendant Communities. On discovery of an archeological site associated with descendant Native Americans, the Overseas Chinese, or other potentially interested descendant group an appropriate representative of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Archeological Resources Report (ARR) shall be provided to the representative of the descendant group.

Archeological Data Recovery Plan. An archeological data recovery program shall be conducted in accordance with an Archeological Data Recovery Plan (ADRP) if all three of the following apply: (1) a resource has potential to be significant, (2) preservation in place is not feasible, and (3) the ERO determines that an archeological data recovery program is warranted. The archeological consultant, SFO, and ERO shall meet and consult on the scope of the ADRP prior to preparation of a draft ADRP. The archeological consultant shall submit a draft ADRP to the ERO. The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- Field Methods and Procedures. Descriptions of proposed field strategies, procedures, and operations.
- Cataloging and Laboratory Analysis. Description of selected cataloging system and artifact analysis procedures.
- Discard and Deaccession Policy. Description of and rationale for field and post-field discard and deaccession policies.
- Security Measures. Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- Final Report. Description of proposed report format and distribution of results.
- Curation. Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Funerary Objects. The treatment of human remains and funerary objects discovered during any soils disturbing activity shall comply with applicable State and federal laws. This shall include immediate notification of the San Mateo County Coroner and, in the event of the Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission, which will appoint a Most Likely Descendant (MLD). The MLD will complete his or her inspection of the remains and make recommendations or preferences for treatment within 48 hours of being granted access to the site (Public Resources Code section 5097.98). The ERO also shall be notified immediately upon the discovery of human remains.

SFO and ERO shall make all reasonable efforts to develop a Burial Agreement (Agreement) with the MLD, as expeditiously as possible, for the treatment and disposition, with appropriate dignity, of human remains and associated or unassociated funerary objects (as detailed in CEQA Guidelines section 15064.5(d)). The Agreement shall take into consideration the appropriate excavation, removal, recordation, scientific analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. If the MLD agrees to scientific analyses of the remains and/or associated or unassociated funerary objects, the archeological consultant shall retain possession of the remains and associated or unassociated funerary objects until completion of any such analyses, after which the remains and associated or unassociated funerary objects shall be reinterred or curated as specified in the Agreement.

Nothing in existing state regulations or in this mitigation measure compels SFO and the ERO to accept treatment recommendations of the MLD. However, if the ERO, SFO, and MLD are unable to reach an agreement on scientific treatment of the remains and associated or unassociated funerary objects, the ERO, with cooperation of SFO, shall ensure that the remains associated or unassociated funerary objects are stored securely and respectfully until they can be reinterred on the property, with appropriate dignity, in a location not subject to further or future subsurface disturbance.

Treatment of historic-period human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity, additionally, shall follow protocols laid out in the project's archeological treatment documents, and in any related agreement established between SFO, the San Mateo County Coroner, and the ERO.

Archeological Public Interpretation Plan. The project archeological consultant shall submit an Archeological Public Interpretation Plan (APIP) if a significant archeological resource is discovered during a project. The APIP shall describe the interpretive product(s); locations or distribution of interpretive materials or displays; persons or groups consulted in the development of interpretive content; the proposed content and materials; the producers or artists of the displays or installation; and a long-term maintenance program. The APIP shall be sent to the ERO for review and approval. The APIP shall be implemented prior to occupancy of the project.

Impact CR-3: The proposed project could disturb human remains, including those interred outside of formal cemeteries. *(Less than Significant with Mitigation)*

There are no known human remains, including those interred outside of dedicated cemeteries, located in the immediate vicinity of the project site. While unlikely, ground disturbance associated with project activities could uncover or impact previously undiscovered human remains, either in the context of an archeological site or in isolation. In the event that construction activities within the project site were to disturb human remains, any inadvertent damage to the remains would be considered a significant impact. The proposed project is subject to the provisions of the California Health and Safety Code section 7050.5 with respect to the discovery of human remains. Public Resources Code section 5097.98 regulates the treatment and disposition of Native American human remains encountered during construction. Furthermore, Mitigation Measure M-CR-2a outlines work stoppage and agency notification protocols in the event human remains or funerary objects are encountered during construction and requires development of a treatment plan. For Native American burials, a plan for treatment and disposition is to be developed in consultation with the tribal most likely descendant appointed by the Native American Heritage Commission. Compliance with state regulatory requirements and implementation of Mitigation Measures M-CR-2a and M-CR-2b would ensure that any human remains uncovered during construction would be promptly identified and appropriately protected and treated, and therefore would minimize the potential for significant impacts to human remains or other funerary objects. Through compliance with statutory requirements and with implementation of Mitigation Measures M-CR-2a and M-CR-2b, impacts from the proposed project on previously unknown human remains would be ***less than significant with mitigation***.

Impact C-CR-2: The proposed project, in combination with cumulative projects, could result in a significant cumulative impact to archeological resources or human remains. *(Less than Significant with Mitigation)*

The geographic scope for cumulative effects on archeological resources and human remains consists of the project site. Federal and state laws protect cultural resources in most cases, by requiring either project redesign to ensure the preservation of the resource, or archeological recovery of a sample of the significant data represented by the archeological resource.

As discussed under Impact CR-2 and Impact CR-3, there are no known archeological resources in the project site, but the proposed project has the potential to result in impacts to submerged prehistoric archeological resources, should any be present within the project footprint. There are cumulative projects, such as the Recommended Airport Development Plan, that could similarly include piles or other deep foundations, and therefore impact the same archeological resources as the proposed project, if any such resource is identified. Therefore, the proposed project could combine with cumulative projects to result in a significant cumulative impact. However, the proposed project would include implementation of Mitigation Measures M-CR-2a and M-CR-2b, which would reduce the potential for impacts on as yet undiscovered resources to a less-than-significant level. Therefore, the proposed project, in combination with cumulative projects, would not result in a cumulatively considerable contribution to a significant cumulative impact and the cumulative impact would be ***less than significant with mitigation***.

5. Tribal Cultural Resources

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
5. **TRIBAL CULTURAL RESOURCES.** Would the project:					
a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, or cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:	☐	☒	☐	☐	☐
i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or					
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.					

Assembly Bill 52, Native Americans: California Environmental Quality Act, enacted in 2015, defines tribal cultural resources, as detailed above, and requires that CEQA lead agencies provide California Native American tribal representatives the opportunity to provide input on the presence of tribal cultural resources within a project area, and on the potential for projects to result in impacts to tribal cultural resources. This is accomplished through a requirement to provide notice of such projects, early in the planning process, to tribes who have indicated that they wish to be notified; to consult with tribes who request consultation; and, if potential impacts to tribal cultural resources are identified through consultation, to further consult on appropriate mitigation of those impacts; and to incorporate feasible mitigation in projects for which impacts were identified.

In 2015, the planning department notified Ohlone Native American tribes and individuals then listed by the Native American Heritage Commission of these requirements, invited consultation on tribal cultural resources on lands for which San Francisco is the lead CEQA agency, and consulted with Ohlone groups and individuals who responded to that outreach. Based on the results of that consultation, it was agreed that all archeological resources of Native American origin would be presumed to be tribal cultural resources. It also was agreed that the preferred mitigation of impacts to Native American archeological resources is preservation in place of the resource. If preservation is not feasible, it was determined that mitigation would include archeological data recovery and public interpretation, in consultation with and participation of tribal representatives, of the tribal values represented by the resource. The planning department includes these measures in all projects for which analysis identifies the potential for impacts to Native American archeological resources, irrespective of whether tribes request project-specific consultation, and they are implemented upon discovery of a Native American archeological resource.

More recently, in tribal consultation on two large programmatic projects in San Francisco, tribes have indicated that they place particular traditional cultural value on the San Francisco Bay shoreline and creek network, both as focuses of many traditional tribal subsistence and other activities and as representing the tribal relationship with the land and the water as both beneficiaries and as resource stewards. Tribes indicated that access to the shoreline and creeks, and maintenance and enhancement of native vegetation are culturally valued. The cultural values represented by Native American archeological deposits may differ from or include more than their archaeological information potential.

Pursuant to CEQA section 21080.3.1(d), within 14 days of a determination that an application for a project is complete or a decision is made by a public agency to undertake a project, the CEQA lead agency is required to contact the Native American tribes that are culturally or traditionally affiliated with the geographic area in which the project is located. Notified tribes have 30 days to request consultation with the lead agency to discuss potential impacts on tribal cultural resources. On April 6, 2021, the planning department contacted Native American tribal representatives and Ohlone interested parties for the San Francisco area, providing a description of the proposed project and requesting comments on the identification, presence, and significance of tribal cultural resources in the project vicinity. During the 30-day comment period, no Native American tribal representatives or Ohlone interested parties contacted the planning department to request consultation for the current project. Nonetheless, as agreed to in prior planning department consultation, the department presumes all Native American archeological resources on projects for which the City and County of San Francisco is the CEQA lead agency to be tribal cultural resources. The results of this prior consultation are applicable to the current project, as discussed below.

Impact TCR-1: The proposed project could result in a substantial adverse change in the significance of a tribal cultural resource, as defined in Public Resources Code section 21074. *(Less than Significant with Mitigation)*

CEQA section 21074 requires the lead agency to consider the effects of a project on tribal cultural resources. As defined in section 21074, tribal cultural resources are sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are listed, or determined to be eligible for listing, on the national, state, or local register of historical resources.

As discussed above, based on prior tribal consultation for San Francisco lands undertaken by the planning department in 2015, all Native American archeological resources are presumed to be potential tribal cultural resources. As discussed above under Section E.4, Cultural Resources, geoarchaeological testing and assessment indicates that buried and submerged prehistoric soils are present in the project footprint that represent surfaces that were exposed prior to the formation of San Francisco Bay, between 8,000 and 4,000 years ago, and therefore have the potential to contain and preserve Native American archeological resources that are tribal cultural resources. Such resources would represent the earliest Native American occupation of this area, and therefore, if present, would be highly significant. As analyzed under Section E.4, Cultural Resources, if such resources are present within the project footprint, project construction of piles or other deep foundations would damage these deposits, resulting in a loss of significant information, and affect the tribal cultural values represented by the resource. A tribal cultural resource is adversely affected when a project causes a substantial adverse change in the resource’s significance. For archeological sites that are tribal cultural resources, destruction or physical damage to a resource through pile or other deep foundation construction would constitute a substantial adverse change. This would be a significant impact to tribal cultural resources.

As discussed above, in tribal consultation on recent San Francisco projects, tribal representatives have also identified that locations where the land meets the water have symbolic cultural value; thus, the bay shoreline may be sensitive for non-archeological tribal cultural resources. However, based on tribal consultation, inherent in this value is the ability to access the bayshore. As the project site is not accessible to the public and, as the edge of an active airport, cannot be made safely accessible. This condition would not change under the current project, and this particular part of the shoreline has not been identified as a non-archeological tribal cultural resource. Therefore, the proposed project is not anticipated to result in significant impacts to non-archeological tribal cultural resources.

As discussed under Impact CR-2, construction of the proposed project has the potential to result in the discovery of and impacts to Native American archeological resources which, as discussed above, would be presumed to be tribal cultural resources. Therefore, the proposed project has the potential to result in substantial adverse changes to tribal cultural resources to the same extent that it would affect unidentified Native American archeological resources. As discussed under Impact CR-2, Mitigation Measures M-CR-2a and M-CR-2b set forth procedures for identification, protection, and treatment of archeological resources, including Native American archeological resources. These measures would mitigate the archeological impacts of the project to a less-than-significant level. In addition, **Mitigation Measure M-TCR-1, Tribal Cultural Resources Program**, would be implemented to ensure, through consultation with associated Native American tribal representatives, culturally appropriate treatment of Native American archeological resources that are tribal cultural resources and, if applicable, culturally appropriate public interpretation that captures and conveys the cultural values represented by the tribal cultural resource. With implementation of these mitigation measures, impacts to tribal cultural resources would be ***less than significant with mitigation***.

Mitigation Measure M-TCR-1: Tribal Cultural Resources Program.

Preservation in Place. In the event of the discovery of an archeological resource of Native American origin, the Environmental Review Officer (ERO), SFO, and the tribal representative, shall consult to determine whether preservation in place would be feasible and effective in preserving the cultural values represented by the resource. If it is determined that preservation-in-place of the tribal cultural resource (TCR) would be both feasible and effective, then the archeological consultant shall consult with tribal representative to incorporate measures (e.g., placement of an on-site marker of the location of the resource, land acknowledgement in public materials, or registration of the resource in NAHC Sacred Lands Files) for the preservation of tribal cultural values represented by the resource, in the cultural resource preservation plan (CRPP). The consultant shall submit a draft CRPP to Planning for review and approval. The CRPP, including identified tribal cultural resource preservation measures, shall be implemented by SFO prior to and during construction.

Interpretive Program. If the ERO, in consultation with the affiliated Native American tribal representatives and SFO, determines that preservation-in-place of the tribal cultural resources is not a sufficient or feasible option, then archeological data recovery shall be implemented as required by the ERO and in consultation with affiliated Native American tribal representatives. In addition, SFO shall develop and implement an interpretive program, in consultation with affiliated tribal representatives, that includes interpretation of the tribal cultural values represented by the resource. A Public Interpretation Plan (PIP) prepared in consultation with the ERO and affiliated tribal representatives, at a minimum, and approved by the ERO, would be required to guide the interpretive program. This interpretive plan may be combined with the archeological PIP (described under Section E.4, Cultural Resources, under Mitigation Measure M-CR-2a). The plan shall identify, as appropriate, proposed locations for installations or displays, the proposed content and materials of those displays or installation, the producers or artists of the displays or installation, and a long-term maintenance program. The interpretive program may include artist installations (by local Native American artists if requested during consultation), oral histories with local Native Americans, cultural displays and interpretation, and educational panels or other informational displays. Native Americans who participate substantially in interpretive efforts shall be offered compensation for their involvement. Upon approval by the ERO and affiliated Native American tribal representatives, and prior to completion of the project, the interpretive program shall be implemented by SFO.

Impact C-TCR-1: The proposed project, in combination with cumulative projects, could result in a significant cumulative impact to tribal cultural resources. ***(Less than Significant with Mitigation)***

The geographic scope for cumulative effects on tribal cultural resources consists of the project site. State laws protect tribal cultural resources in most cases, either through project redesign to ensure that the resource is preserved in place, or through mitigation efforts designed through consultation with the culturally-affiliated Native American tribe(s).

As discussed under Impact TCR-1, there are no known tribal cultural resources in the project site, although there is the potential for the presence of undiscovered prehistoric archeological resources that may also be determined to be tribal cultural resources. There are cumulative projects, such as the Recommended Airport Development Plan, that could impact the same tribal cultural resources as the proposed project, if any are identified. Therefore, the proposed project could combine with cumulative projects to result in a significant cumulative impact. However, the proposed project would include implementation of Mitigation Measures M-CR-2a, M-CR-2b, and M-TCR-1, which would ensure that significant impacts to as yet undiscovered tribal cultural resources would be reduced to a less-than-significant level. Therefore, the proposed project, in combination with cumulative projects, would not result in a cumulatively considerable contribution to a significant cumulative impact and the cumulative impact would be ***less than significant with mitigation***.

6. Transportation and Circulation

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
6. TRANSPORTATION AND CIRCULATION. Would the project:					
a) Involve construction that would require a substantially extended duration or intensive activity, the effects of which would create potentially hazardous conditions for people walking, bicycling, or driving, or public transit operations; or interfere with emergency access or accessibility for people walking or bicycling; or substantially delay public transit?	☐	☐	☒	☐	☐
b) Create potentially hazardous conditions for people walking, bicycling, or driving or public transit operations?	☐	☐	☒	☐	☐
c) Interfere with accessibility of people walking or bicycling to and from the project site, and adjoining areas, or result in inadequate emergency access?	☐	☐	☒	☐	☐
d) Substantially delay public transit?	☐	☐	☒	☐	☐
e) Cause substantial additional vehicle miles travelled or substantially induce additional automobile travel by increasing physical roadway capacity in congested areas (i.e., by adding new mixed-flow travel lanes) or by adding new roadways to the network?	☐	☐	☒	☐	☐
f) Result in a loading deficit, the secondary effects of which would create potentially hazardous conditions for people walking, bicycling, or driving; or substantially delay public transit?	☐	☐	☒	☐	☐
g) Result in a substantial vehicular parking deficit, the secondary effects of which would create potentially hazardous conditions for people walking, bicycling, or driving; or interfere with accessibility for people walking or bicycling or inadequate access for emergency vehicles; or substantially delay public transit?	☐	☐	☒	☐	☐

This section evaluates the potential impacts of the proposed project on transportation and circulation. The analysis was conducted in accordance with the planning department's *Transportation Impact Analysis Guidelines for Environmental Review* (also known as the SF Guidelines),[22] which were updated in October

[22] San Francisco Planning Department, *Transportation Impact Guidelines for Environmental Review*, October 2019, https://sfplanning.org/project/transportation-impact-analysis-guidelines-environmental-review-update#impact-analysis-guidelines, accessed April 9, 2021.

2019. Supporting information for this analysis is provided in the travel demand memorandum prepared for the proposed project (see Draft EIR, Appendix I).[23]

ENVIRONMENTAL SETTING

Eight staging areas for construction materials (e.g., steel sheet piles, riprap, base rock, forms, templates, sand) and sorting of demolition debris were identified for construction of the proposed project. Six of the eight construction staging areas are located on Airport property adjacent to the project site and range between 0.26 to 5.28 acres. The Aviador Lot is a 2.5-acre construction staging area located on Airport property west of U.S. 101 in the City of Millbrae. Plot 16D is a 4-acre construction staging area located on Airport property north of the U.S. 101/I-380 Interchange in the City of South San Francisco. For purposes of this analysis, the Plot 16D construction staging area was determined to be the primary staging area for construction materials and demolition debris generated during construction of Reaches 1–8, while the Aviador Lot construction staging area was determined to be the primary staging area for construction materials and demolition debris generated during construction of Reaches 9–15.

The 15 shoreline reaches and six of the eight construction staging areas are located on Airport property east of U.S. 101. Vehicle access to Reaches 1–8 and six construction staging areas (including Plot 16D) is available via North Access Road and the ramps connecting U.S. 101 and I-380 with North Access Road, as well as local streets via South Airport Boulevard (see Figure 2-50, p. 2-74, in Draft EIR Chapter 2, Project Description).

Vehicle access to Reaches 9–15 and the St. Francis Lot construction staging area is available via South McDonnell Road and the ramps connecting U.S. 101 with Millbrae Avenue. Vehicle access to Reach 16, which runs along the western edge of the Airport property east of U.S. 101, is available via South Airport Boulevard and North McDonnell and South McDonnell roads, connecting to the U.S. 101 ramps at South Airport Boulevard, San Bruno Avenue, and Millbrae Avenue.

Vehicle access to the Aviador Lot construction staging area, located on Airport property west of U.S. 101, is available via the U.S. 101 ramps at Millbrae Avenue and Rollins Road. The Gateway at Millbrae Station (Gateway) project is currently under construction adjacent to the west of the Aviador Lot construction staging area and is anticipated to be completed in 2022. As part of the Gateway project, the roadway connecting Aviador Avenue with Rollins Road (i.e., Camino Millennia) will be reconstructed as Garden Lane, and one travel lane each way will be provided, similar to the existing roadway configuration. In addition, Rollins Road north of Millbrae Avenue will be reconfigured, and a northbound right-turn-only lane will be provided at the approach to Garden Lane. The northern terminus of the reconfigured Rollins Road will also connect with the northern parking lot access route. The northern parking lot access route will be two-way and will connect Rollins Road with Aviador Avenue.[24]

In the vicinity of the project site, U.S. 101 is a north-south, 8- to 10-lane freeway[25] that connects the Airport with San Francisco and the North Bay to the north and the Peninsula and the South Bay to the south. U.S. 101 connects to I-280 north of Millbrae via I-380 and to I-80 in San Francisco. Local access to U.S. 101 is

[23] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021.
[24] City of Millbrae, *Gateway at Millbrae Station Design Review Application, March 4, 2019*, https://www.ci.millbrae.ca.us/home/showpublisheddocument?id=22279, accessed April 9, 2021.
[25] Roadway designations typically include *freeways*, *major arterials*, *secondary arterials*, *collector streets*, and *local streets*. Each of these roadways has a different potential capacity for mixed-flow traffic. U.S. 101 and I-380 are classified as freeways; North Access Road, South Airport Boulevard, North McDonnell Road, and South McDonnell Road are secondary arterials; and Millbrae and San Bruno avenues are major arterials.

provided at North Access Road, San Bruno Avenue, and Millbrae Avenue, while access to I-380 is provided at North Access Road and South Airport Boulevard.

North Access Road is an east-west roadway with two lanes in each travel direction for about 0.5 mile east of the U.S. 101/I-380 ramps, and one lane in each travel direction as it continues around the Airport shoreline to its terminus at Gate 118 (see Figure 2-19, p. 2-33, in Draft EIR Chapter 2, Project Description). South Airport Boulevard, North McDonnell Road, and Millbrae and San Bruno avenues generally have two travel lanes in each direction with dedicated turn lanes at major intersections. South McDonnell Road generally has one travel lane and bicycle lane each way with a wider shoulder on the east side of the roadway, and widens to two travel lanes and a bicycle lane each way approximately 0.25 mile north of the intersection of South McDonnell Road/Millbrae Avenue.

Table 1 summarizes the existing daily and a.m. peak-hour traffic volumes for the roadway segments that would be most affected by construction of the proposed project. The a.m. peak hour is presented because travel by construction vehicles and other traffic would overlap to a greater degree during the a.m. peak period than during the p.m. peak period. The sources of the traffic volumes are counts conducted in 2018 and 2019 before the COVID-19 pandemic caused changes in travel patterns (i.e., before air travel, public transit service, and peak-period travel by all modes declined).[26]

Table 1 Existing Daily and A.M. Peak-Hour Traffic Volumes at Study Locations

Roadway Segment	Daily		A.M. Peak Hour	
	NB/EB	SB/WB	NB/EB	SB/WB
U.S. 101[a]	142,000	142,000	8,500	8,500
North Access Road east of U.S. 101/I-380 ramps	4,676	4,977	359	327
North Access Road west of North Field Road	3,253	3,008	282	148
San Bruno Avenue east of U.S. 101 ramps	14,725	12,800	839	320
Millbrae Avenue east of U.S. 101 ramps	17,388	19,335	1,143	546
Millbrae Avenue west of U.S. 101 ramps	32,469	34,572	1,766	1,724
South McDonnell Road north of Millbrae Avenue	7,112	7,740	266	189

SOURCES: IDAX traffic volume counts conducted in 2018 and 2019, Caltrans published traffic volume date 2018/2019, as cited in LCW Consulting 2021, attachment 6 (see Appendix I).

NOTES:

NB/EB = northbound/eastbound; SB/WB = southbound/westbound.

[a] Caltrans' published Annual Average Daily Traffic (AADT) volumes counts for freeway segments are presented for both directions of travel. A 50/50 split between the northbound and southbound directions was assumed for the transportation analysis.

During the a.m. peak hour, traffic volumes on local access roadways are highest on Millbrae Avenue east and west of the U.S. 101 ramps, ranging from approximately 550 to 1,770 vehicles per hour per direction. The a.m. peak-hour traffic volumes on North Access Road and South McDonnell Road range from 190 to 360 vehicles

[26] The long-term effects of the ongoing COVID-19 pandemic on the transportation system are unknown at this time. It would be unreasonable to speculate how the transportation system and travel behavior could change in the future. For these reasons, to establish the existing setting, the analysis relies on transportation data and conditions before COVID-19.

per hour per direction, while traffic volumes on San Bruno Avenue are higher, ranging from 320 to 840 vehicles per hour per direction.

During the overnight hours, between 11 p.m. and 6 a.m., hourly traffic volumes on roadways in the project vicinity are generally lower than during the a.m. peak hour, but reflect different peaks of travel associated with Airport operations (e.g., employee shift changes and late night/early morning passenger arrivals or departures by auto when public transit options are very limited). For example, on North Access Road east of U.S. 101, traffic volumes during the overnight hours are about 14 to 37 percent of the a.m. peak-hour volumes, but with higher hourly volumes between 5 a.m. and 7 a.m.; on South McDonnell Road, overnight traffic volumes are about 21 to 60 percent of the a.m. peak-hour volumes, but with higher hourly volumes between 11 p.m. and 2 a.m.[27]

During field surveys conducted in April 2021, no unusual or potentially hazardous conditions were observed for people driving on North Access Road, on North McDonnell and South McDonnell roads, or on the U.S. 101/I-280 interchanges at North Access Road, San Bruno Avenue, and Millbrae Avenue.

WALKING CONDITIONS

Most roadways serving the project site provide vehicular access between the various Airport facilities and are not intended for people walking; for this reason, pedestrian facilities such as sidewalks and/or crosswalks are generally not provided. On the portion of North Access Road adjacent to Reaches 1–6, sidewalks are not provided. The portion of North Access Road north of the San Bruno Channel (the segment not adjacent to the project site) has a sidewalk on the north side of the street between South Airport Boulevard and the Park SFO garage, a distance of about 800 feet.

South McDonnell Road does not have sidewalks on either side of the street, except for the sidewalk on the east side of the roadway south of the Millbrae Gate driveway. North McDonnell Road has discontinuous sidewalks on the east side of the street, and on South Airport Boulevard sidewalks are generally provided on the west side of the street. In the vicinity of the Aviador Lot construction staging area, sidewalks are provided on the east side of Aviador Avenue adjacent to the site. Sidewalks and crosswalks will be provided on Garden Lane and Rollins Road as part of the Gateway project that is currently under construction adjacent to and west of the Aviador Lot construction staging area.

During field surveys conducted in April 2021, no substantial safety or right-of-way conflicts between pedestrians, bicyclists, and vehicles were observed on South Airport Boulevard, North McDonnell Road, or South McDonnell Road where sidewalks are provided.

[27] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021 (see Appendix I, Attachment 6).

BICYCLING CONDITIONS

Bicycle facilities are typically classified as class I, class II, class III, or class IV facilities.[28] **Figure 8** shows the bicycle facilities in the vicinity of the project site. As shown in Figure 8, class IV bicycle lanes are provided on North Access Road north of the San Bruno Channel between South Airport Boulevard and the Park SFO garage (not adjacent to the project site). Class II bicycle lanes are provided on both sides of North McDonnell and South McDonnell roads and on South Airport Boulevard. South of Millbrae Avenue, a class III signed route is provided on Old Bayshore Highway. During field surveys conducted in April 2021, no substantial safety or right-of-way conflicts between bicyclists and vehicles were observed on North McDonnell and South McDonnell roads or on South Airport Boulevard.

The Bay Trail runs along the coastline north and south of the Airport and provides regional bicycle access. In the project vicinity, south of the Airport property, a paved multi-use trail is located east of Old Bayshore Highway and ends in Bayfront Park at Millbrae Avenue.[29] North of San Bruno Avenue on the east side of U.S. 101, the Bay Trail continues north along the western edge of the Airport and under the U.S. 101/I-380 ramps to the intersection of South Airport Boulevard and North Access Road. The Bay Trail continues east within the class IV bicycle lane on North Access Road and east of the Park SFO garage along the shoreline to SamTrans peninsula where the SamTrans North Base Facility and the Safe Harbor Shelter are located.

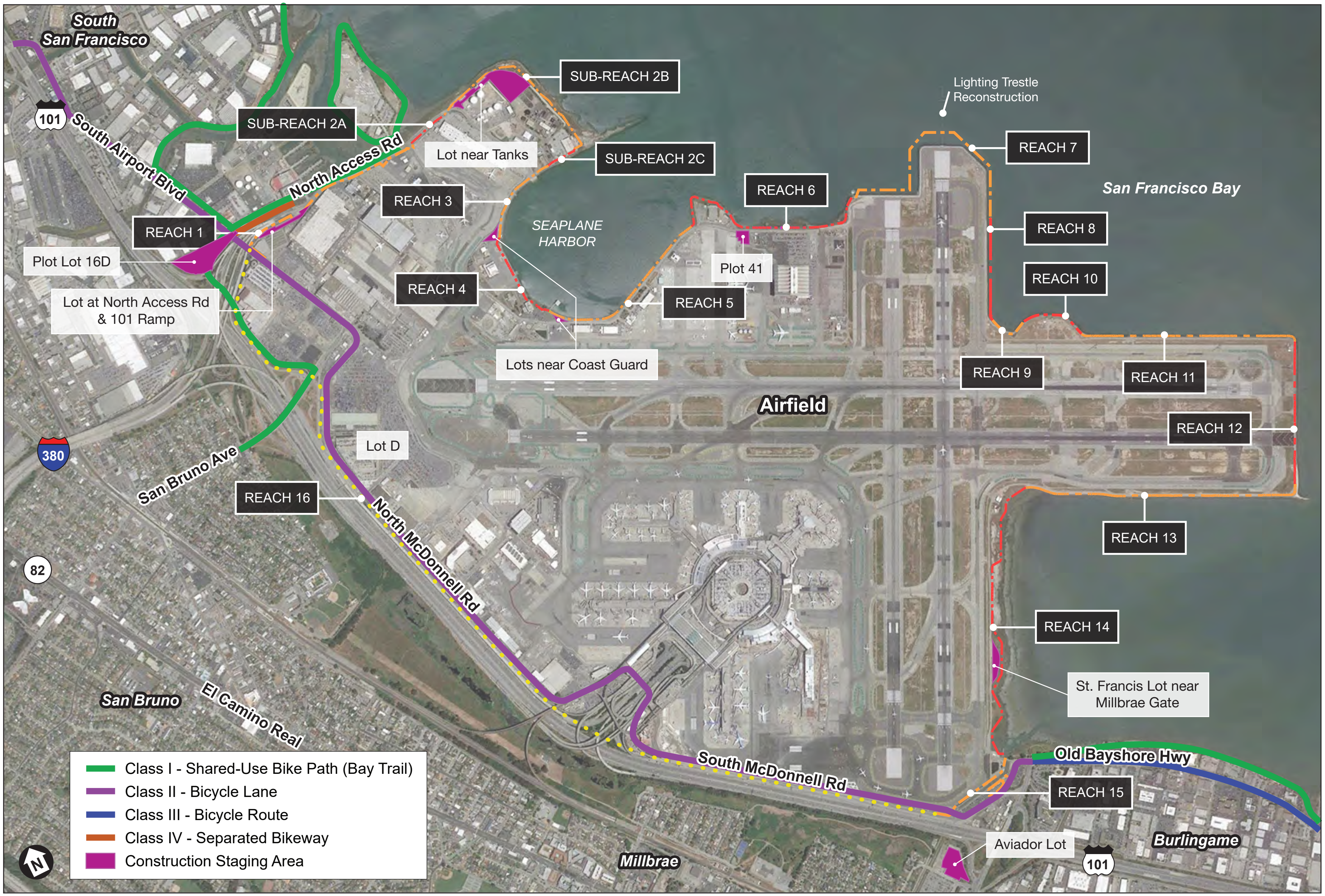
PUBLIC TRANSIT CONDITIONS

SamTrans is the primary public transportation provider in the project vicinity. SamTrans manages local and regional bus service, paratransit service, and Caltrain commuter rail. There are four SamTrans bus routes in the project vicinity, as shown on **Figure 9**. Routes 292 and 397 travel on South Airport Boulevard and on South McDonnell and North McDonnell roads. SamTrans route 397, which provides express overnight regional service, also serves the Millbrae Transit Center via Millbrae Avenue and Rollins Road. SamTrans route 140 runs between Daly City and the SFO AirTrain station, and travels on San Bruno Avenue and North McDonnell Road. The Millbrae Transit Center, located west of the existing Aviador Lot construction staging area, is the only location that provides an intermodal connection between Caltrain and Bay Area Rapid Transit (BART), and is the southern terminus of BART's Richmond-Millbrae and SFO Airport-Millbrae-Antioch lines. BART travels to the Airport on an elevated structure; the BART San Francisco International Airport Station is located west of the International Terminal and near North McDonnell Road.

The SamTrans North Base Facility, located at 301 North Access Road, is one of two SamTrans maintenance and operations facilities. It stores and serves SamTrans's bus and Redi-Wheels paratransit fleets. SamTrans route 38 travels on North Access Road between South Airport Boulevard and the SamTrans North Base Facility.

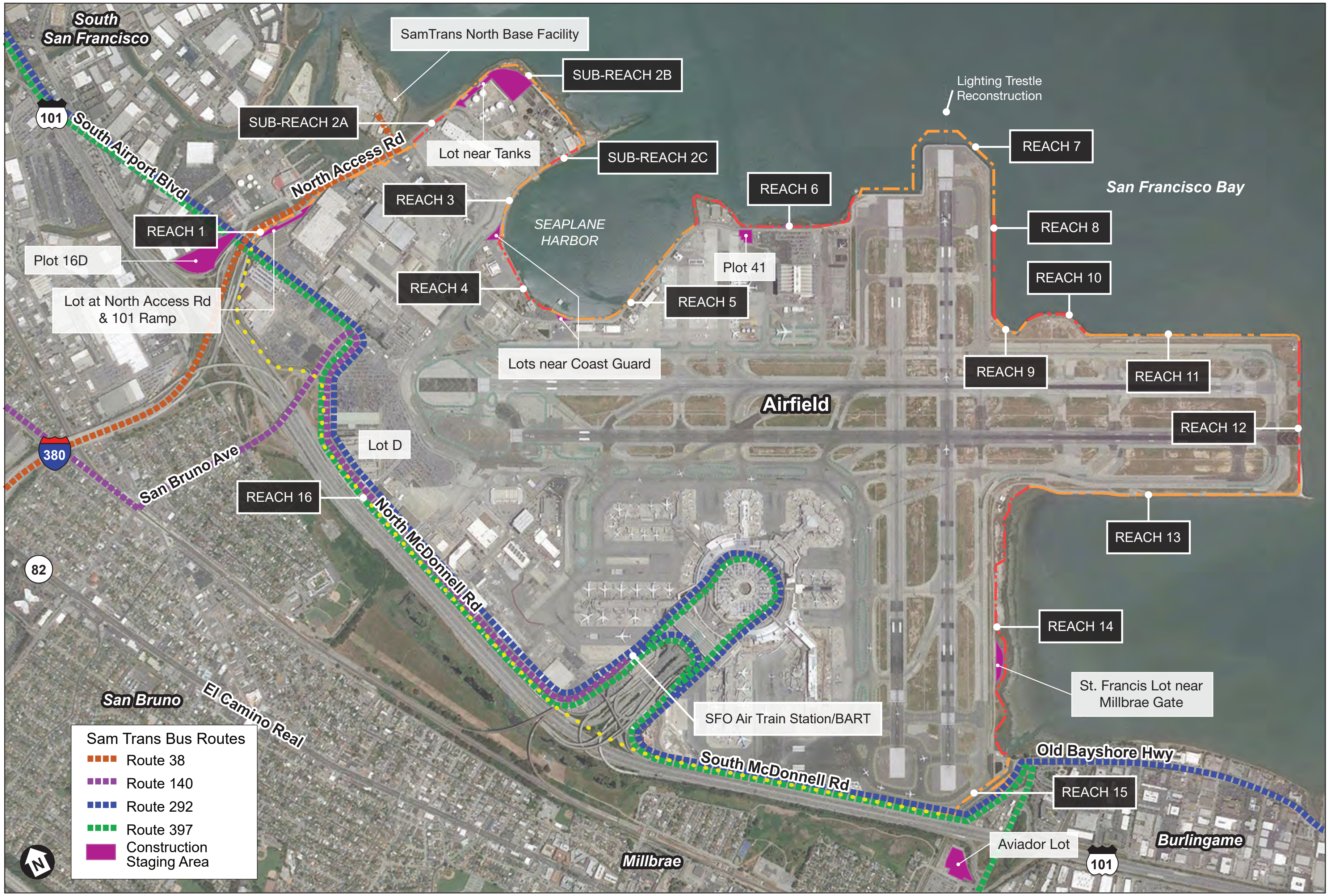
---

[28] *Class I bikeways* are bike paths with exclusive rights-of-way for use by people bicycling or people walking. *Class II bikeways* are striped within the paved areas of roadways and established for the preferential use of people bicycling in separated bicycle lanes. Separated bicycle lanes provide a striped, marked, and signed lane that is buffered from vehicular traffic. These facilities, which are located on roadways, reserve 4 to 5 feet of space for bicycle traffic exclusively. *Class III bikeways* are signed bicycle routes that allow people bicycling to share travel lanes with vehicles and may include shared-lane markings such as "sharrows" that allow bicyclists to share the roadway with vehicles. *Class IV bikeways* are dedicated bicycle facilities that are separated from vehicular traffic by a buffer zone (also referred to as a "cycle track"). The separation from vehicular traffic could be by grade separations, flexible posts, inflexible physical barriers, or on-street vehicular parking.
[29] The San Francisco Bay Trail Project, *San Francisco Bay Trail Brisbane Lagoon to Bayside Park*, https://baytrail.org/get-on-the-trail/map-by-number/brisbane-lagoon-to-bayside-park/, accessed April 9, 2021.



SOURCE: LCW Consulting, 2021

FIGURE 8
EXISTING BICYCLE ROUTE NETWORK



SOURCE: SamTrans; LCW Consulting, 2021

SFO Shoreline Protection Program

FIGURE 9
EXISTING TRANSIT NETWORK

SFO also provides AirTrain, a fully automated people mover on an elevated structure that connects the terminals with their garages, the BART station, and other locations in the Airport. Two AirTrain lines are provided: the Red Line connects all terminals, terminal garages and the BART station; and Blue Line connects the Rental Car Center with all terminals, terminal and long-term garages, and the BART station. The Blue Line has stations at the intersection of North McDonnell and West Field roads, the Rental Car Center, and the long-term parking garages.

APPROACH TO ANALYSIS

CONSTRUCTION TRAVEL DEMAND ASSOCIATED WITH THE PROPOSED PROJECT

Project travel demand refers to the number, type, and common destinations of new trips that people would take to and from the project area. Travel demand for construction of the proposed project was based on preliminary construction information provided by the project sponsor, including average daily and total trucks and workers by work phase for Reaches 1–15, which are being analyzed at a project level.[30] Information for Reach 16, which is being analyzed at a program level, has not been developed; therefore, travel demand for Reach 16 is not presented below. Should Reach 16 be implemented in the future, this analysis assumes it would be subject to additional environmental review, including estimating the travel demand associated with construction of the reach, at such time it is proposed.

SFO would construct the proposed project over a period of approximately seven years, with an anticipated construction period for the 15 reaches extending from June 2025 through June 2032. A shorter construction schedule extending from June 2025 through November 2031 was used for estimating construction-related vehicle trips. This shorter schedule, which includes a greater overlap in construction of individual reaches, results in a more conservative estimate of vehicles generated by project construction activities. Construction would occur during the daytime work shift (7 a.m. to 4 p.m.) for Reaches 1–6 and 15, and during the nighttime work shift (11 p.m. to 6 a.m.) for Reaches 7–14.

Each construction activity would generate various types of vehicle trips: haul trucks for the transfer and disposal of demolition materials, haul trucks importing fill and riprap, trucks delivering materials and equipment, and construction workers traveling to and from the worker parking lots. It is anticipated that construction workers would park in Airport facilities (likely Lot D and Lot DD with access from South Airport Boulevard; see Figure 2-2, p. 2-7 in Draft EIR Chapter 2, Project Description), and a construction worker shuttle would transport workers between the parking lots and the reaches before and after the work shifts.

Table 2 summarizes the average daily trucks, construction workers, and construction worker shuttles required for the phase of construction for each reach that would generate the highest number of trucks. As shown, during the seven-year construction period, the maximum number of daily construction trucks traveling to and from the work area would vary by reach. The largest numbers of daily construction trucks (export, import, and vendor haul trucks) would be present along Reaches 7 and 8 (154 to 163 trucks per day), while Reaches 1 and 15 would generate the smallest numbers of trucks during their respective peak phases of construction (58 to 76 trucks per day).

[30] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021 (see Appendix I).

Table 2 Maximum Average Daily Construction Vehicles by Reach

Reach (construction working days)	Average Daily Trucks, Workers, and Worker Shuttles for Reach Phase with the Greatest Number of Trucks[a]			
	Trucks	Workers	Worker Shuttles	Total
Reach 1 (102 days)[b]	76	34	6	116
Reach 2 (159 days)[b]	124	46	6	176
Reach 3 (71 days)[b]	176	54	6	236
Reach 4 (67 days)[b]	114	43	6	163
Reach 5 (111 days)[b]	176	54	6	236
Reach 6 (97 days)[b]	118	44	6	168
Reach 7 (800 days)[c]	154	68	6	228
Reach 8 (401 days)[c]	163	61	6	230
Reach 9 (22 days)[c]	125	54	6	185
Reach 10 (30 days)[c]	150	45	6	201
Reach 11 (339 days)[c]	131	35	6	172
Reach 12 (72 days)[c]	88	28	6	122
Reach 13 (375 days)[c]	131	35	6	172
Reach 14 (112 days)[c]	134	49	6	189
Reach 15 (69 days)[b]	58	39	6	103

SOURCES: SFO, 2021, LCW Consulting, 2021 (see Draft EIR, Appendix I)

NOTES:

[a] Due to rounding, numbers in columns may not add to totals.
[b] Construction would occur during the daytime shift.
[c] Construction would occur during the nighttime shift.

Although construction of the 15 reaches would be sequenced, construction of some reaches would partially or completely overlap (see Draft EIR Section 2.G, Project Construction and Maintenance, p. 2-#). Construction would begin at Reach 2 and move east toward Reach 6. Construction would then begin at Reach 1, followed by Reach 15, and then followed by Reaches 14–9 (in reverse numerical order). Construction of Reaches 7 and 8 is anticipated to overlap with construction of other reaches, with work at Reach 7 starting at the same time as Reach 2 work, and work at Reach 8 starting after completion of work at Reaches 1–6, 14, and 15. The preliminary schedule and overlap information was used to determine the maximum average daily construction vehicle activity that would result from the overlapping construction of the reaches.[31] This represents the greatest number of vehicles generated by construction on a daily basis.

A representative day was developed based on the maximum average daily construction worker and truck data presented above in Table 2 for two scenarios during which construction in multiple reaches could

[31] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021 (see Appendix I, Attachment 4).

overlap to analyze the most conservative scenario for construction truck trips. The two scenarios represent overlaps of daytime and/or nighttime construction.

Based on an analysis of the maximum average daily construction trucks, workers, and worker shuttles, and the duration of construction for each of the 15 reaches, the peak of construction activities would occur between December 2025 and June 2028, when either daytime or nighttime construction of other reaches could overlap with Reach 7 construction.[32] **Table 3** presents information on the maximum average daily numbers of construction trucks, workers, and worker shuttles for the construction overlap periods when the combined number of daily construction trucks would exceed 400 trucks per day.

Table 3 **Maximum Average Daily Construction Trucks, Workers, and Worker Shuttles during Peak Overlap Periods**

Reaches	Overlap Period	Average Daily Trucks, Workers, and Worker Shuttles for Reach Phase with the Greatest Number of Trucks[a]			
		Trucks	Workers	Worker Shuttles	Total
Reaches 2, 3, and 7 (overlap scenario 1)	December 2025	454	168	9	631
Reaches 3, 4, and 7	February–March 2026	444	165	9	618
Reaches 4, 5, and 7	April–May 2026	444	165	9	618
Reaches 5, 6, and 7	August–September 2026	448	166	9	623
Reaches 7, 8, and 14 (overlap scenario 2)	December 2027–January 2028	450	178	12	640
Reaches 10, 11, and 13	November-December 2030	411	115	6	532

SOURCES: SFO, 2021, LCW Consulting, 2021 (see Appendix I)
NOTE:
a Due to rounding, numbers in columns may not add to totals.

For the remainder of the construction period, the average daily number of construction trucks and workers would be less, generally ranging from 130 to 300 trucks per day. The overlap of Reaches 2, 3, and 7 (two daytime construction reaches and one nighttime construction reach, referred to as *overlap scenario 1*) and Reaches 7, 8, and 14 (three nighttime construction reaches, referred to as *overlap scenario 2*) shown in Table 3 were selected as the representative maximum number of construction vehicles generated during the peak phases of construction.

In general, the phase with the highest number of construction trucks would typically occur toward the middle of the construction period for the reach, and not in the first or last phases of work. The first phases of work typically include site preparation and equipment mobilization, while the last phases of work typically include cleanup and resurfacing of roadways; these phases are typically less intense than active construction of the shoreline protection system. The overlap of reaches presented in Table 3 include overlaps at the beginning and end of the construction period, and therefore represents a conservative estimate of the

[32] Ibid, Attachment 3.

maximum number of vehicles that would travel to and from the work areas. This assumption allows for shifts in the start or end time of reach construction, or changes to the sequencing of reach construction.

Based on a review of the expected travel characteristics of import and export trucks, construction workers, and construction worker shuttles, the number of construction vehicles that would be added to the roadway network was determined for two analysis hours: the a.m. peak hour (between 6 a.m. and 7 a.m.) and an average hour during the overnight construction period (between 11 p.m. and 6 a.m.). The distribution of the construction vehicles by analysis hour assumes the following:

- Material import or export between offsite locations and the Aviador Lot and Plot 16D construction staging areas for both the daytime and nighttime construction reaches would occur 24 hours a day, but 70 percent of truck trips would likely occur between 6 a.m. and 11 a.m. (i.e., including travel during the a.m. peak hour).
- Materials transfer between the Aviador Lot and Plot 16D construction staging areas and the daytime construction reaches would occur over a ten-and-a-half-hour period between 6 a.m. and 4:30 p.m. (i.e., including travel during the a.m. peak hour).
- Materials transfer between the Aviador Lot and Plot 16D construction staging areas and the nighttime construction reaches would occur over a seven-hour period between 11 p.m. and 6 a.m. (i.e., including travel during the average overnight hour).
- Construction workers would arrive one hour before the shift starts and leave one hour after the shift ends (i.e., daytime construction workers would arrive and nighttime construction workers would depart during the a.m. peak hour). The analysis conservatively assumes that construction workers would all drive to the Airport parking lots in single-occupant vehicles (i.e., no carpools, no transit).
- Construction worker shuttles would travel between the construction worker parking lot(s) and the reaches one hour before the worker shifts start and one hour after the worker shifts end. The start of the daytime shift and the end of the nighttime shift would overlap (i.e., including travel during the a.m. peak hour).

Before determining the number of vehicle trips during the analysis hours and assigning the construction vehicle trips to the roadway network, the numbers of daily construction trucks, workers, and worker shuttles presented in Table 3 were multiplied by two to reflect one inbound and one outbound trip for each vehicle. With the exception of concrete deliveries, which would be made directly to the reach, all materials deliveries would be made to the Plot 16D (for Reaches 1–8) or Aviador Lot (for Reaches 9–15) construction staging areas, and then would be subsequently transported to the reaches as needed. Similarly, exported demolition materials would be transported from the reach to either the Plot 16D (for Reaches 1–8) or Aviador Lot (for Reaches 9–15) construction staging areas, and then would be subsequently transported to offsite locations. Construction workers would park their vehicles in designated parking lots and would be transported to the reaches by construction worker shuttles.

Table 4 presents the daily, a.m. peak-hour, and overnight average-hour vehicle trips for the two overlap scenarios, disaggregated by construction vehicle trip type:

- Under overlap scenario 1, which includes daytime construction of Reaches 2 and 3 and nighttime construction of Reach 7, the majority of the vehicle trips during the a.m. peak hour would be associated with construction workers traveling to (for Reaches 2 and 3) or from (for Reach 7) the construction worker parking lots (i.e., 168 of the 286 vehicle trips during the a.m. peak hour). During the overnight hours, there would be an average of 16 truck trips per hour between the Plot 16D construction staging area and Reach 7.

- Under overlap scenario 2, which includes nighttime construction of Reaches 7, 8, and 14, the majority of the a.m. peak-hour vehicle trips would be associated with construction workers leaving at the end of the shift (i.e., 178 of 264 vehicle trips during the a.m. peak hour), and the remaining vehicle trips would be associated with import and export of materials at the Plot 16D construction staging area for Reaches 7 and 8 and the Aviador Lot construction staging area for Reach 14. During the overnight hours, there would be an average of 35 trips per hour between the Plot 16D construction staging area and Reaches 7 and 8, and 19 trips between the Aviador Lot construction staging area and Reach 14, and two trips between offsite sources in San Francisco and Reach 14 related to deliveries of concrete.

Table 4 Construction Vehicle Trips during Reach Overlap Scenarios

	Daily	A.M. Peak Hour[a]	Overnight Average Hour[b]
OVERLAP SCENARIO 1: REACHES 2, 3, AND 7			
Trucks between offsite locations and reaches	0	0	0
Trucks between offsite locations and Plot 16D staging area[c]	563	79	0
Trucks between Plot 16D staging areas and reaches	344	33	16
Construction workers	336	168	0
Construction worker shuttles	18	6	0
Total	***1,261***	***286***	***16***
OVERLAP SCENARIO 2: REACHES 7, 8, AND 14			
Trucks between offsite locations and reaches	2	0	2
Trucks between offsite locations and Plot 16D staging area	389	54	0
Trucks between offsite locations and Aviador Lot staging area	136	20	0
Trucks between Plot 16D staging area and reaches	244	0	35
Trucks between Aviador Lot and reaches	130	0	19
Construction workers	356	178	0
Construction worker shuttles	24	12	0
Total	***1,281***	***264***	***55***

SOURCES: SFO, 2021, LCW Consulting, 2021 (see Appendix I)

NOTES:

Includes inbound and outbound trips by construction trucks, workers, and worker shuttles (i.e., one-way trips). Due to rounding, numbers in columns may not add to totals.

a The a.m. peak hour is defined as 6 a.m. to 7 a.m.
b The overnight average hour is defined as the hours between 11 p.m. and 6 a.m.
c Plot 16D construction staging area used for Reaches 1–8, and Aviador Lot construction staging area used for Reaches 9–15.

The daily and hourly construction trucks, workers, and worker shuttles were assigned to the roadway network based on information provided by the project sponsor on the origin or destination of the type of export or import materials, vendor location, and anticipated residences of construction workers. In general, the North Bay and East Bay would be the primary destinations of export trucks (e.g., Dutra Materials in Richmond, Dutra Quarry in San Rafael, and Altamont Landfill in Livermore); San Francisco would be the primary origin of import trucks for concrete and backfill soil; the North Bay and East Bay would be the origins of riprap, rock, and asphalt (e.g., Dutra Quarry in San Rafael and Dutra Materials in Richmond); and various sources in the South Bay and East Bay would be the origins of other vendor trucks. Construction workers would be drawn primarily from the East Bay and the South Bay, with somewhat fewer workers from San Francisco and the North Bay.[33]

Construction truck trips to and from the Plot 16D construction staging area were assigned to U.S. 101, I-380, the North Access Road ramps, North Access Road, and South Airport Boulevard. Construction truck trips between the Plot 16D construction staging area and Reaches 1–8 were assigned to South Airport Boulevard and North Access Road. Construction truck trips to and from the Aviador Lot construction staging area were assigned to U.S. 101 and the U.S. 101 northbound and southbound ramps at Millbrae Avenue. Construction truck trips between the Aviador Lot construction staging area and Reaches 9–15 were assigned to Millbrae Avenue and South McDonnell Road. Concrete deliveries from San Francisco would be made directly to the reach, and trucks were assigned to U.S. 101 and the North Access Road ramps for Reaches 1–8, and the U.S. 101 northbound and southbound ramps at Millbrae Avenue and South McDonnell Road for Reaches 9–15.

Construction workers traveling to and from the construction worker parking lots located off South Airport Boulevard were assigned to U.S. 101 and the northbound and southbound ramps at San Bruno Avenue. In addition, construction workers traveling from the north via I-280/I-380 were assigned to the I-380 North Access Road ramps and South Airport Boulevard to access the parking lots. Construction worker shuttles traveling between the parking lots and the reaches were assigned to South Airport Boulevard, North Access Road, North McDonnell Road, and South McDonnell Road.

Table 5 presents the daily, a.m. peak-hour, and average overnight-hour construction vehicle trips by type of trip for seven study locations for the two overlap scenarios. Under both overlap scenarios, the majority of trucks traveling between offsite locations and the construction staging areas would use U.S. 101 south of the Airport. The local roadway segment with the largest number of construction vehicles would be North Access Road west of North Field Road; all construction truck trips between the Plot 16D construction staging area and Reaches 1-8 would travel on this roadway segment. The maximum number of trucks on North Access Road would be 181 trucks per day each way during the overlap of Reaches 2, 3, and 7 (overlap scenario 1) and 134 trucks per day each way during the overlap of Reaches 7, 8, and 14 (overlap scenario 2). As noted above, this estimate of construction vehicles conservatively assumes that for each reach, the work phase with the largest number of trucks would overlap at the same time. For the majority of the construction period, the number of project-generated vehicle trips on the roadway network would be less than the number presented in Table 5.

[33] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021 (see Appendix I, Attachment 1).

Table 5 Construction Vehicle Trips for Maximum Construction Period during Overlap Scenarios

Roadway Segment	Overlap of Reaches 2, 3, and 7 (Overlap Scenario 1)						Overlap of Reaches 7, 8, and 14 (Overlap Scenario 2)					
	Daily		A.M. Peak Hour[a]		Overnight Average Hour[b]		Daily		A.M. Peak Hour		Overnight Average Hour	
Construction Vehicle Type	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
U.S. 101 NORTH OF NORTH ACCESS ROAD												
Trucks between offsite and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between offsite and staging areas[c]	37	37	5	5	0	0	40	40	6	6	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	0	0	0	0	0	0
Construction workers	34	34	14	20	0	0	36	36	36	0	0	0
Total	***71***	***71***	***19***	***25***	***0***	***0***	***77***	***77***	***41***	***6***	***1***	***1***
U.S. 101 BETWEEN NORTH ACCESS ROAD AND MILLBRAE AVENUE												
Trucks between offsite and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between offsite and staging areas	217	217	30	30	0	0	158	158	22	22	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	0	0	0	0	0	0
Construction workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	***309***	***309***	***85***	***68***	***0***	***0***	***257***	***257***	***22***	***120***	***1***	***1***
U.S. 101 SOUTH OF MILLBRAE AVENUE												
Trucks between offsite and staging areas	217	217	30	30	0	0	181	181	25	25	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	0	0	0	0	0	0
Construction workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	***309***	***309***	***85***	***68***	***0***	***0***	***278***	***278***	***25***	***123***	***0***	***0***

Roadway Segment Construction Vehicle Type	Overlap of Reaches 2, 3, and 7 (Overlap Scenario 1)						Overlap of Reaches 7, 8, and 14 (Overlap Scenario 2)					
	Daily		A.M. Peak Hour[a]		Overnight Average Hour[b]		Daily		A.M. Peak Hour		Overnight Average Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
NORTH ACCESS ROAD WEST OF NORTH FIELD ROAD												
Trucks between staging areas and reaches	172	172	16	16	8	8	122	122	0	0	17	17
Construction worker shuttles[d]	9	9	3	3	0	0	12	12	6	6	0	0
Total	***181***	***181***	***19***	***19***	***8***	***8***	***134***	***134***	***6***	***6***	***17***	***17***
MILLBRAE AVENUE EAST OF U.S. 101												
Trucks between offsite and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between staging areas and reaches	0	0	0	0	0	0	65	65	0	0	9	9
Total	***0***	***0***	***0***	***0***	***0***	***0***	***66***	***66***	***0***	***0***	***10***	***10***
MILLBRAE AVENUE WEST OF U.S. 101												
Trucks between offsite and staging areas	0	0	0	0	0	0	68	68	10	10	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	65	65	0	0	9	9
Total	***0***	***0***	***0***	***0***	***0***	***0***	***133***	***133***	***10***	***37***	***9***	***9***
SAN BRUNO AVENUE EAST OF U.S. 101												
Construction workers	126	126	75	51	0	0	134	134	0	134	0	0

SOURCES: SFO, 2021; LCW Consulting, 2021

NOTES:

Includes inbound and outbound trips by construction trucks, workers, and worker shuttles (i.e., one-way trips). Due to rounding, numbers in columns may not add to totals.

NB/EB = northbound/eastbound; SB/WB = southbound/westbound.

[a] The a.m. peak hour is defined as 6 a.m. to 7 a.m.
[b] The overnight average hour is defined as the hours between 11 p.m. and 6 a.m.
[c] Plot 16D construction staging area used for Reaches 1–8, and Aviador Lot construction staging area used for Reaches 9–15.
[d] Construction worker shuttles would travel on South Airport Boulevard, North McDonnell Road, South McDonnell Road, and North Access Road to access the reaches.

SUMMARY OF CONSTRUCTION ACTIVITIES AND THE AIRPORT'S STANDARD CONSTRUCTION MEASURES CONSIDERED IN THE ANALYSIS

In compliance with Airport Standard Construction Measures Division 01 35 43.01, Demolition, and Division 01 55 26, Traffic Regulation,[34] SFO or its contractors would prepare and implement a traffic control plan that conforms to the California Manual of Uniform Traffic Control Devices and is consistent with SFO traffic regulations and the policies of the police department's Airport Bureau.[35] The elements of the traffic control plan would include, as appropriate, circulation and detour routes; advance warning signage; construction truck routes; maintenance of pedestrian and bicycle access and circulation; vehicle, pedestrian, or bicycle detour routes; designation of sufficient staging areas; scheduling and monitoring of construction vehicle movement; and coordination with public service providers such as transit, fire, police, schools, and hospitals. The traffic control plan would serve to inform city, state, and federal agencies of construction of the proposed project and minimize temporary transportation effects in the vicinity of the construction area. In addition, as appropriate, California Department of Transportation (Caltrans) encroachment permits would be obtained where construction activities occur within the Caltrans right-of-way.

Impact TR-1: The proposed project would require a substantially extended construction duration; however, the effects would not create potentially hazardous conditions for people walking, bicycling, driving, or public transit operations; would not interfere with emergency access or accessibility for people walking or bicycling; and would not substantially delay public transit. *(Less than Significant)*

The following impact analysis presents an overview of the types of transportation impacts that could result from construction of the proposed project and describes the type of traffic control plan that would be developed and implemented to manage construction activities. This is followed by an analysis of construction activities relative to each component of the significance criteria, including construction duration and intensity, and then by an evaluation of impacts related to potentially hazardous conditions, accessibility, and delays to public transit.

CONSTRUCTION DURATION AND INTENSITY

In general, construction-related activities are temporary and generally do not result in permanent changes to the transportation network. Construction-related vehicles traveling to and from the project site and associated staging areas would share the surrounding roadways with other vehicles and with people walking and bicycling. In general, increased construction traffic from any project could result in conflicts between construction trucks (which have slower speeds and wider turning radii than automobiles) and automobiles, people bicycling, and people walking. In addition, construction activities from any project could result in physical obstructions or temporary or permanent changes to the public right-of-way that could interfere with emergency access or accessibility for people walking, bicycling, driving, or public transit operations; could create hazardous conditions; or could result in transit delays.

Construction of the proposed project would occur over a seven-year period between 2025 and 2032, which is considered an extended duration. Construction activities associated with the proposed project would not be considered intense as it relates to the transportation network. The majority of the construction activities would occur within restricted areas of the Airport, and interaction between construction activities and the adjacent

[34] San Francisco International Airport, *SFO Memorandum: Airport Standard Construction Measures Implementation in Construction*, March 2020.
[35] California Department of Transportation, *2014 California Manual of Uniform Traffic Control Devices,* Revision 6, March 2021, Chapter 6C, Temporary Traffic Control Elements, https://dot.ca.gov/programs/safety-programs/camutcd, accessed April 9, 2021.

publicly accessible transportation network would be primarily limited to trucks accessing the reach work and construction staging areas via either North Access Road or South McDonnell Road. For Reaches 1–3, 5, and 6, temporary travel lane closures on North Access Road may be required to facilitate construction; however, as part of the traffic control plan, two-way traffic operations of the remaining travel lanes would be maintained.

During the peak periods of construction that overlap for approximately six months of the seven-year construction period, up to 455 trucks per day would be traveling to and from the reaches and construction staging areas (454 inbound trips and 454 outbound trips), and approximately 180 construction workers per day would be traveling to and from the construction worker parking areas (180 inbound trips and 180 outbound trips). For the remainder of the construction period, the number of average daily construction-related vehicles would be less. These construction-related vehicles would be distributed among multiple access routes to the northern and southern ends of the Airport, to Airport parking facilities, to the Plot 16D construction staging area, and to the Aviador Lot construction staging area, depending on which reaches are under construction. This would not be considered a substantial increase in daily vehicles on area roadways, given the roadway's vehicle capacity (i.e., number of travel lanes) and the existing daily volume of vehicles on regional facilities and local access roadways.

IMPACTS RELATED TO POTENTIALLY HAZARDOUS CONDITIONS DURING CONSTRUCTION

The following impact analysis related to potentially hazardous conditions and accessibility is grouped by reaches based on the primary access route to the reaches' work and primary construction staging areas, as follows: Reaches 1–8 would be accessed via North Access Road; Reaches 8–15 would be accessed via the Millbrae Gate and South McDonnell Road; and Reach 16 would be accessed primarily via North McDonnell and South McDonnell roads. In addition, an impact analysis is presented for the offsite Aviador Lot construction staging area that would serve Reaches 9–15.

REACHES 1–8

Truck access into and out of the construction work areas for Reaches 1–6 would be available via North Access Road, and for Reaches 7 and 8, access would be available via North Access Road and the restricted vehicle service road east of Gate 118. Reaches 1, 2, 3, 5, and 6 would be partially or completely aligned adjacent to North Access Road, and construction may require one or more travel lane closures on North Access Road to provide an adequate work area for equipment and materials. Because the portion of North Access Road adjacent to the reaches is not intended to accommodate people walking and pedestrian facilities are not provided, construction activities would not create potentially hazardous conditions for people walking.

As shown in Table 5, during the construction overlap of Reaches 2, 3, and 7 (overlap scenario 1), a maximum of 32 truck trips per hour would travel during the a.m. peak hour (including inbound and outbound trips) on North Access Road, and 16 truck trips per hour would travel during the overnight hours. During the construction overlap of Reaches 7, 8, and 14 (overlap scenario 2), a maximum of 34 truck trips per hour would travel on North Access Road during the overnight hours traveling to and from Reaches 7 and 8. As noted above, SFO would implement a traffic control plan as part of the proposed project that would be consistent with the California Manual of Uniform Traffic Control Devices regulations effective at the time of construction of the proposed project. Along the segment of North Access Road where two lanes are provided in each travel direction (Reaches 1 and 2), one or two travel lanes may be temporarily closed, and two-way traffic flow would be maintained in the remaining lanes. Along the two-lane segment of North Access Road (generally between Reaches 2 and 6), alternating one-way operations on the open travel lanes would be required. Alternating one-way operations would involve placing traffic cones or other temporary road safety barriers and a flagger at each end of the affected section to stop and direct two-way traffic in one travel lane. Alternately, for longer sections of temporary travel lane closures for 24-hour traffic control operations, temporary traffic signals may be installed at either end of the affected roadway segment.

Along the section of North Access Road where two travel lanes are provided in each direction (i.e., between the U.S. 101/I-380 ramps and North Field Road in the eastbound direction, and between the U.S. 101/I-380 ramps and 700 feet east of North Field Road in the westbound direction), existing weekday hourly traffic volumes are highest between 5 a.m. and 8 a.m. and between 1 p.m. and 3 p.m., and range from 110 to 590 vehicles per hour per direction. At North Field Road, the existing peak hourly traffic volumes on North Access Road decrease to 50 to 280 vehicles per hour per direction between 5 a.m. and 8 a.m., and between 50 and 290 vehicles per hour per direction between 1 p.m. and 5 p.m.[36] If the eastbound and/or westbound vehicle travel lanes were to be temporarily reduced from two lanes in each direction to one lane in each direction, the peak hourly traffic volumes and the construction vehicles (up to 16 vehicles per hour during the a.m. peak hour and 17 vehicles per hour during the overnight hours) would be accommodated within the remaining travel lanes without creating potentially hazardous conditions.[37]

A Caltrans encroachment permit would be required if temporary travel lane closures, transition areas, or construction activities encroach into the Caltrans right-of-way at the merge of the I-380/U.S. 101 ramps with North Access Road (i.e., generally west of where North Access Road crosses the San Bruno Channel and connects with the freeway ramps). The Caltrans encroachment permit would be prepared as part of the traffic control plan.

In the section of North Access Road where one vehicle travel lane is provided in each direction, existing peak hourly volumes range between 15 and 26 vehicles per hour. These volumes could be accommodated with alternate one-way operation without resulting in substantial queues or creating potentially hazardous conditions. Construction activities at Reaches 7 and 8, located within the restricted Airport area, would not affect the transportation-related public right-of-way.

The new concrete wall along the eastern portion of Reach 1 would be installed immediately adjacent to the Bay Trail, which runs for about 1,000 feet on the north side of North Access Road. Although construction activities would not occur on the Bay Trail, the trail may need to be temporarily closed for a portion of the 4.5-month construction duration at Reach 1 for the safety of trail users. People bicycling on the Bay Trail to access the SamTrans North Base Facility and the Safe Harbor Shelter would be detoured adjacent to the construction site; this temporary, protected detour (e.g., providing a 5-foot-wide bicycle lane using temporary portable barriers or traffic cones) would maintain access to the Bay Trail throughout construction. Bicycle detour signage would be posted. By implementing the required traffic control plan, the protected detour would accommodate bicyclists without creating potentially hazardous conditions for bicyclists.

At some locations along Reaches 1 and 2, temporary travel lane and/or roadway closures may be required to install the concrete wall for Reach 1 and sheet pile walls for Reach 2. The travel lane(s) connecting North Access Road with SamTrans peninsula may also be temporarily closed to install passive flood gates on the north side of North Access Road approximately 800 feet east of South Airport Boulevard. These temporary closures would typically occur during the day outside of the peak hours, and construction activity would

[36] LCW Consulting, *Technical Memorandum – SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities*, November 2021 (see Appendix I, Attachment 6).
[37] Per the *2000 Highway Capacity Manual*, travel lane capacity (i.e., traffic volume throughput) ranges between 670 and 840 vehicles per hour per lane for the segment of North Access Road that has two travel lanes each way (i.e., suburban principal or minor arterial) and 480 to 780 vehicles per hour per lane for the segment of North Access Road that has one lane in each travel direction (intermediate minor arterial).

occur across one travel lane at a time as construction is conducted across the roadway. The construction contractor would use steel plates to restore vehicle access on the affected roadways at the end of each workday. Because of the limited length and duration of the temporary travel lane closures, construction of the deployable flood gates would not result in potentially hazardous conditions for people driving or bicycling.

There are no bus stops on North Access Road, although SamTrans buses use the roadway to travel to and from the SamTrans North Base Facility on SamTrans peninsula. In addition, bus stops served by SamTrans route 38 are located along the driveway to the North Base Facility and the Safe Harbor Shelter, just north of North Access Road. Bus access to the SamTrans North Base Facility and the bus stops on the driveway would be maintained during construction of Reach 1, except during a temporary closure for construction of the passive flood gate, as noted above. Advance notification would be provided to SamTrans regarding any temporary travel lane or roadway closures during construction. The number of construction trucks traveling to and from Reaches 1–8 would be fewer than 20 trucks each way per hour. Vehicle access to Reaches 2–8 would be east of the roadway that connects North Access Road with SamTrans peninsula, and therefore would not result in any design features that could create potentially hazardous conditions for SamTrans bus operations. Therefore, construction of Reaches 1–8 would not substantially affect public transit operations.

For these reasons, construction truck access to Reaches 1–8 would not create potentially hazardous conditions for people driving, bicycling, or walking, or for public transit operations.

REACHES 9–15

Reaches 9–15 are located within the restricted area of the Airport; therefore, construction activities would not affect any transportation-related public right-of-way. Truck access into and out of the construction work areas for Reaches 9–15 would be available via the existing Millbrae Gate on South McDonnell Road, located about 180 feet north of the intersection of South McDonnell Road and Old Bayshore Boulevard/Millbrae Avenue.

On an hourly basis, the maximum number of construction trucks entering and exiting the Millbrae Gate would be between 13 and 26 truck trips per hour during nighttime construction of Reaches 8–14, and 12 truck trips per hour during daytime construction of Reach 15. As shown on Table 4, during the construction overlap of Reaches 7, 8, and 14 (overlap scenario 2), a maximum of 21 truck trips per hour to and from Reach 14 would occur during the overnight hours. South McDonnell Road has one travel lane and one bicycle lane in each direction, and truck access into and out of the Millbrae Gate would be right-turn-in and left-turn-out. As appropriate, the traffic control plan would include measures for deploying flaggers at the driveway to facilitate truck movements onto South McDonnell Road across the class II bicycle lanes and vehicle travel lanes, which would reduce conflicts between vehicles and people bicycling. Therefore, construction of the proposed project would not create potentially hazardous conditions for people bicycling.

On South McDonnell Road, there are no dedicated pedestrian facilities on either side of the roadway north of the Millbrae Gate driveway. There is a sidewalk on the east side of the roadway south of the driveway and adjacent to Bayfront Park, but people walking on this sidewalk would not be affected by construction vehicles entering and exiting the Millbrae Gate. Therefore, construction of the proposed project would not create potentially hazardous conditions for people walking.

Construction of Reaches 9–14 would be conducted during the overnight shift (between 11 p.m. and 6 a.m.). Construction trucks accessing the Millbrae Gate to deliver supplies and remove demolition materials would be present during the overnight hours (a maximum of 10 vehicles per hour each way). Construction of Reach 15 would occur over a four-month period during the daytime shift, and trucks would travel to and from the reach between 7 a.m. and 3 p.m. (a maximum of seven vehicles per hour each way).

SamTrans routes 292 and 397 travel on South McDonnell Road but do not stop near the Millbrae Gate driveway. Thus, providing access for construction vehicles via the Millbrae Gate would not substantially affect public transit operations.

For these reasons, construction truck access to Reaches 9–15 via the Millbrae Gate would not create potentially hazardous conditions for people driving, bicycling, or walking, or for public transit operations.

REACH 16

Reach 16, which is being analyzed at a program level, runs for about 3.5 miles along the western edge of the Airport east of U.S. 101, generally following the alignment of North McDonnell and South McDonnell roads. Should Reach 16 be required to form a continuous, closed flood protection system, the shoreline protection system for Reach 16 would consist of a low concrete wall with a maximum height of 2 feet, and a series of deployable barriers at multiple locations where roadways intersect with the protection system. It is anticipated that construction of Reach 16 would require temporary travel lane closures on the east side of North McDonnell and South McDonnell roads. (Both roadways have one to two vehicle travel lanes, a bicycle lane in each direction, and turn lanes at intersections.) Closures of vehicle travel lanes also would necessitate temporary bicycle lane closures, and people bicycling would share the remaining northbound travel lane with vehicles. On North McDonnell Road where sidewalks are provided intermittently on the east side of the street, the sidewalk may also be included as part of the work area and pedestrian detours would be provided as part of the required traffic control plan.

Bus stops for SamTrans bus routes in the northbound direction at West Area Drive, West Field Road, and opposite the United Airlines Maintenance and Operations Center may need to be temporarily relocated during construction of Reach 16. The Bay Trail runs east of North McDonnell Road between North Access Road and San Bruno Avenue and may need to be temporarily closed or rerouted during construction. By implementing a required traffic control plan for Reach 16, construction would not create potentially hazardous conditions for people walking, bicycling, driving, or public transit operations.

AVIADOR LOT CONSTRUCTION STAGING AREA

Truck access into and out of the existing Aviador Lot construction staging area via Aviador Avenue (which has one travel lane in each direction) is right-turn-in and left-turn-out for trucks accessing the construction staging area via Garden Lane and left-turn-in and right-turn-out for trucks accessing the construction staging area via the northern parking lot access route. SFO or its contractors would implement a traffic control plan as part of the proposed project and would deploy flaggers at the Aviador Lot construction staging area driveway as appropriate to facilitate truck access into and/or out of the driveway. For oversize or extralegal trucks[38] that have a larger turning radius than standard trucks, additional traffic control may be required at either end of Garden Lane, which is currently being constructed as a two-lane, 24-foot curb-to-curb roadway and/or at either end of the northern parking lot access route.

[38] An *extralegal truck* is a vehicle whose overall dimensions and/or weight exceed those set forth in division 15 of the California Vehicle Code. This division defines a *legal vehicle* as a vehicle under 8.5 feet in width, 65 feet in length, and 14 feet in height, and up to 34,000 pounds in weight on any one axle, California Vehicle Code division 15, https://codes.findlaw.com/ca/vehicle-code/, accessed April 28, 2021.

Construction activities would result in a maximum of up to 266 trucks per day traveling to and from the Aviador Lot construction staging area when construction on multiple reaches overlap (i.e., overlap scenario 2 for overlap of Reaches 7, 8, and 14), with substantially fewer trucks during the majority of the construction period. As shown on Table 5, during reach overlap scenario 2, the maximum number of construction trucks traveling to and from the Aviador Lot construction staging area (see roadway segment of Millbrae Avenue west of U.S. 101) would be about 20 truck trips during the a.m. peak hour and 16 truck trips per hour during the overnight hours. This increase in vehicles would be accommodated within the travel lanes on Aviador Avenue, Garden Lane, and Rollins Road and within the northern parking lot access route that would also be used for access to/from the Aviador Lot construction staging area, without creating potentially hazardous conditions for people driving and buses traveling to and from the Millbrae Transit Center via Rollins Road. These roadways have low traffic volumes and travel speeds, and currently accommodate construction vehicle travel to and from the Aviador Lot construction staging area for ongoing Airport construction projects. Thus, by implementing the traffic control plan for the proposed project, truck access to and from the Aviador Lot construction staging area would not create potentially hazardous conditions for people driving, walking, or bicycling, or for public transit operations.

IMPACTS RELATED TO ACCESSIBILITY DURING CONSTRUCTION

During construction, emergency vehicle access routes to the project site and the Aviador Lot construction staging area would remain unchanged compared to existing conditions. As noted above, construction of some reaches close to North Access Road (i.e., Reaches 1, 2, 3, 5, and 6) may require one or two travel lane closures, depending on whether North Access Road has two or four travel lanes on the affected roadway segment, and construction of Reach 16 along North McDonnell and South McDonnell roads may require temporary closures of the northbound travel lane(s).

On roadways where travel lane closures would be required, one or more travel lanes would be available at all times for emergency vehicle access. Temporary roadway closures needed to install passive flood gates would be limited in duration and the affected roadway could be covered with steel plates in the event that emergency access is required. The required traffic control plan for the reaches would include provisions to maintain emergency vehicle access on publicly accessible roadways and within the Airport's restricted areas. Therefore, construction of the proposed project would not interfere with emergency vehicle access.

REACHES 1–8

There are no public sidewalks or bicycle lanes on North Access Road, with the exception of the sidewalk on the north side of North Access Road between South Airport Boulevard and the Park SFO Garage. Construction activities along Reach 1 would not affect this segment of North Access Road north of the San Bruno Channel, and therefore would not affect people walking or bicycling. The section of the Bay Trail that runs along the north side of North Access Road would be temporarily closed during construction of Reach 1; however, a protected detour would be provided in one travel lane adjacent to the construction site. Because this detour would only be necessary for a short duration (less than 4.5 months), and because access to the Bay Trail would be maintained throughout construction, construction of Reaches 1–8 would not substantially affect accessibility for people walking or bicycling on the Bay Trail.

As noted above, construction of Reaches 1, 2, 3 and 5 may require one or two temporary travel lane closures on North Access Road; however, one or more travel lanes would be always available for emergency vehicle access. Therefore, construction of Reaches 1–8 would not interfere with emergency vehicle access.

REACHES 9–15

Construction vehicles accessing Reaches 9–15 via the Millbrae Gate would cross the northbound bicycle lanes at the Millbrae Gate driveway, similar to existing operations at the driveway. Otherwise, these construction vehicles would not affect bicycle travel on South McDonnell Road, or the sidewalk on the east side of South McDonnell Road south of the Millbrae Gate driveway; therefore, they would not interfere with accessibility for people walking or bicycling.

Construction of Reaches 8–15 would not require any temporary travel lane closures on South McDonnell Road at the Millbrae Gate driveway, and therefore, construction of Reaches 8–15 would not interfere with emergency vehicle access.

REACH 16

As described above, construction of Reach 16 may require temporary closures of bicycle lanes on North McDonnell and South McDonnell roads, temporary sidewalk closures on North McDonnell Road, and a temporary closure of the Bay Trail between San Bruno Avenue and North Access Road. These closures would be phased and limited in duration, and the traffic control plan for Reach 16 would include pedestrian and bicycle detours to maintain access where it is safe to do so. The traffic control plan would include the placement of appropriate signage, including but not limited to “Sidewalk Closed” and “Trail Closed” to minimize effects on accessibility for people walking or bicycling. Access to the AirTrain West Field Road and Rental Car Center stations on North McDonnell Road would be maintained. Thus, by implementing the traffic control plan, construction of Reach 16 would not substantially interfere with accessibility for people walking or bicycling.

Construction of Reach 16 would require temporary travel lane closures on the east side of North McDonnell and South McDonnell roads; however, one or more travel lanes would be always available on these roadways for emergency vehicle access. Therefore, construction of Reach 16 would not interfere with emergency vehicle access.

AVIADOR LOT CONSTRUCTION STAGING AREA

No construction activities would occur on the sidewalks or roadways in the vicinity of the Aviador Lot construction staging area, and access to the site would be available via an existing driveway that currently accommodates construction vehicles for ongoing Airport projects. Construction vehicles traveling to and from the Aviador Lot construction staging area via Rollins Road, Garden Lane, the northern parking lot access route, and Aviador Avenue would be required to obey traffic laws, including traffic signals and stop signs. These vehicles would not substantially affect the nearby sidewalks, crosswalks, or bicycle facilities, or interfere with emergency access. Thus, construction vehicles traveling to and from the Aviador Lot construction staging area would not substantially interfere with accessibility for people walking or bicycling, or interfere with emergency access.

IMPACTS RELATED TO POTENTIAL TRANSIT DELAYS DURING CONSTRUCTION

REACHES 1–8

Within the project study area, SamTrans route 38 operates on North Access Road between South Airport Boulevard and the SamTrans North Base Facility, which is accessed via North Access Road. The last revenue stop is at the Safe Harbor Shelter adjacent to the SamTrans North Base Facility. The SamTrans North Base

Facility provides an overnight storage and maintenance area for SamTrans buses and paratransit vehicles. Bus travel to and from the facility is considered non-revenue bus travel time. Non-revenue buses are not in service dropping off or picking up passengers; rather, they are traveling to and from the facility and a terminus point where revenue service begins or ends. The methodology for analyzing transit delay impacts considers if construction of a project would result in a substantial transit delay and whether that delay resulted in a substantial number of people riding transit switching to riding in private or for-hire vehicles. As non-revenue buses do not carry passengers, the analysis herein analyzes potential transit delay impacts to revenue routes. However, the effects of the project's construction on non-revenue buses are included for informational purposes. Construction of Reach 1 would include measures in the traffic control plan to inform SamTrans of upcoming travel lane closures to maintain two-way traffic operations in the remaining lanes and to maintain access to the SamTrans North Base Facility for SamTrans route 38 and non-revenue travel throughout the proposed project's construction period.

During the construction overlap of Reaches 2, 3, and 7 (overlap scenario 1), a maximum of 32 truck trips per hour would travel during the a.m. peak hour (including inbound and outbound trips) on North Access Road, and 16 truck trips per hour would travel during the overnight hours. During the construction overlap of Reaches 7, 8, and 14 (overlap scenario 2), a maximum of 34 truck trips per hour would travel on North Access Road during the overnight hours traveling to and from Reaches 7 and 8. The temporary closure of travel lanes on North Access Road during construction and the resulting detour of vehicles to the remaining travel lanes, combined with additional construction truck traffic associated with Reaches 1–8, would result in somewhat slower travel speeds for all vehicles, including transit, along Reach 1. However, truck trips to and from the reaches would not substantially overlap with the non-revenue bus travel, which would generally occur between 4 and 7 a.m. and between 7 and 9 p.m. In addition, the decrease in transit travel speeds would be for a limited distance and duration and would not represent a substantial increase in overall transit travel times for SamTrans route 38. Therefore, construction of the proposed project would not substantially affect transit vehicle travel to and from the SamTrans North Base Facility or substantially delay bus operations.

REACHES 9–15

Within the project study area, SamTrans bus routes 292 and 397 travel on South McDonnell Road adjacent to the Millbrae Gate. On an hourly basis, the maximum number of construction trucks entering and exiting the Millbrae Gate would be between 13 and 26 truck trips per hour during nighttime construction of Reaches 8–14, and 12 truck trips per hour during daytime construction of Reach 15. During the construction overlap of Reaches 7, 8, and 14 (overlap scenario 2), a maximum of 22 truck trips per hour to and from Reach 14 would occur during the overnight hours. These additional construction trucks on South McDonnell Road would not substantially change traffic operations or delay transit. Therefore, construction access to Reaches 9–15 via the Millbrae Gate at South McDonnell Road would not substantially delay bus operations.

REACH 16

Within the project study area, SamTrans bus routes 140, 292, and 397 travel on South Airport Boulevard, North McDonnell Road, and/or South McDonnell Road. The temporary closure of travel lanes on North McDonnell Road or South McDonnell Road during construction and the resulting detour of vehicles to the remaining travel lanes, combined with additional construction truck traffic associated with Reach 16, would result in somewhat slower travel speeds for all vehicles traveling adjacent to the work areas. However, construction of Reach 16 would be temporary and phased, and the traffic control plan would include measures to maintain two-way traffic operations on roadway segments where travel lane closures may be required. Therefore, construction of Reach 16, should it be deemed necessary to form a continuous, closed flood protection system, would not substantially delay bus operations.

AVIADOR LOT CONSTRUCTION STAGING AREA

SamTrans route 397 provides express overnight regional service, operating every hour between 1 a.m. and 6 a.m., and travels to and from the Millbrae Transit Station via Rollins Road and Millbrae Avenue (i.e., one bus per hour in each direction). The number of construction vehicles traveling to and from the Aviador Lot construction staging area during the overnight period when SamTrans route 397 is in service would be highest during overlap scenario 2. During the construction overlap of Reaches 7, 8, and 14 (overlap scenario 2), a maximum of 19 truck trips per hour would be traveling to and from the reaches during the overnight hours. These additional vehicles could be accommodated in the multiple travel lanes on Rollins Road, Millbrae Avenue, and South McDonnell Road during the overnight hours when traffic volumes are substantially lower than during the day. Because there is only one bus per hour per direction on these roadways, construction trucks would not substantially delay bus operations.

SUMMARY

Overall, construction-related activities for the proposed project would be temporary and phased; would not result in a substantial increase in activity to such an extent as to adversely affect the transportation-related right-of-way; and would be conducted in accordance with the Airport's Standard Construction Measures Division 01 35 43.01, Demolition, and Division 01 55 26, Traffic Regulation, which would require preparing and implementing a traffic control plan. By implementing these measures, construction of the proposed project would not create potentially hazardous conditions for people walking, bicycling, driving, or for public transit operations; would not interfere with emergency access; and would not interfere with accessibility for people walking or bicycling, or substantially delay transit. Therefore, the project's construction-related transportation impacts would be ***less than significant***.

Impact TR-2: Operation of the proposed project would not result in significant transportation impacts. *(Less than Significant)*

The proposed project is an infrastructure project that would address flood protection and future sea-level rise. The proposed project would install a new shoreline protection system and would not generate new travel demand or induce automobile travel once it is operational. Regular inspection and maintenance activities for the new shoreline protection system would be similar to the inspection and maintenance activities for the existing shoreline protection features. In addition, the proposed project would not increase physical roadway capacity in congested areas or add roadways to the transportation-related public right-of-way.

In the event of a flood, the flood gates across roadways at the cordon of the shoreline protection system, as described in Impact TR-1 (e.g., deployable flood gates across North Access Road and passive flood gates on intersecting roadways along Reaches 1 and 2, and deployable flood gates across roadways that intersect with North McDonnell and South McDonnell roadways along Reach 16), would be raised to protect against flooding.[39] In the absence of the deployable and passive flood gates, roadways serving the Airport and the North Base Facility and the Safe Harbor Shelter would be flooded, blocking vehicular access to these

[39] SFO Landside Operations would notify SamTrans at least 24 hours in advance of installing the deployable flood gate. The passive flood gate located at the entrance to SamTrans peninsula for Reach 1 would raise on its own as flood waters reach the flood gate (see Figure 2-4, p. 2-13, in Draft EIR Chapter 2, Project Description).

facilities. However, under normal operations, the flood gates would not interfere with vehicular travel or people walking or bicycling across these roadways. Therefore, for these reasons operational impacts related to transportation hazards, accessibility, public transit delay, vehicle miles traveled, loading, and parking (topics 6[b] through 6[g]) would be ***less than significant***.

Impact C-TR-1: Construction of the proposed project, in combination with cumulative projects, would not result in significant construction-related transportation impacts. *(Less than Significant)*

The geographic context for the analysis of potential cumulative impacts includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. These projects may result in increases in construction worker vehicles and construction trucks, may use the same construction access routes to regional facilities, and may result in temporary travel lane closures.

Of the nine identified cumulative projects, the timing of construction for the Moxy Hotel and Adrian Court development projects is not known; however, these projects are not located in the immediate vicinity of the project site. Construction vehicles would access the Moxy Hotel site via the existing site driveway on Millbrae Avenue between U.S. 101 and South McDonnell Road/Old Bayshore Highway, and construction of the Moxy Hotel would not include any changes to the access driveway or travel lanes on Millbrae Avenue. Construction trucks for the proposed project would use this segment of Millbrae Avenue to access Reaches 9–15, which could overlap with construction of the Moxy Hotel. However, travel on this segment by construction trucks would occur primarily during the overnight hours (except for daytime construction of Reach 15 over a three-month period), and therefore would not substantially overlap with daytime construction trucks for the Moxy Hotel project.

The remaining seven projects would be located on Airport property. These projects may partially or completely overlap with construction of the proposed project. However, most of these projects are not located near the project site and the majority would not use North Access Road or South McDonnell Road and the Millbrae Gate for truck access to the work sites. However, some Recommended Airport Development Plan projects would require the use of North Access Road to access the work sites. These projects could overlap with construction of Reaches 1–8, which would use North Access Road for construction vehicle access and/or require temporary travel lane closures. Recommended Airport Development Plan projects in the area of the Airport adjacent to North McDonnell Road between the Terminal area and West Area Drive also could overlap with construction of Reach 16.

As with the proposed project, these cumulative projects would be required to comply with the Airport's Standard Construction Measures. They also would be required to coordinate with Caltrans and local jurisdictions, as appropriate, to coordinate any temporary sidewalk, bicycle route, and travel lane closures, and to develop traffic control plans that would address construction-related vehicle routing, traffic control, and pedestrian and bicyclist movements adjacent to the construction area for the duration of the construction overlap. The Airport's Standard Construction Measures require contractors to coordinate with SFO's Airport Operations division. Thus, the traffic control plans for the SFO projects would be coordinated, similar to the ongoing coordination activities for the multiple concurrent construction projects occurring at the Airport. The traffic control plans would help maintain the safety of public streets for people walking, bicycling, or driving, or for public transit operations.

Given the limited number of cumulative projects in the immediate vicinity that could overlap with construction of the proposed project, as well as implementing traffic control plans required for all SFO projects, cumulative construction-related transportation impacts would be ***less than significant***.

Impact C-TR-2: Operation of the proposed project, in combination with cumulative projects, would not result in significant transportation impacts. ***(Less than Significant)***

None of the cumulative projects would combine with the proposed project's maintenance activities that would be performed by SFO. Regular inspection and maintenance activities for the new shoreline protection system would occur on SFO property, and any vehicle trips associated with this work would be minimal. Thus, no significant cumulative operational transportation impacts would occur, and cumulative transportation impacts would be ***less than significant***.

7. Noise

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
7. NOISE. Would the project result in:					
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☒	☐	☐	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☒	☐	☐	☐	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan area, or, where such a plan has not been adopted, in an area within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?	☒	☐	☐	☐	☐

The proposed project has the potential to result in significant impacts related to noise. All noise topics are addressed in Draft EIR Section 4.B, Noise.

8. Air Quality

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
8. AIR QUALITY. Would the project:					
a) Conflict with or obstruct implementation of the applicable air quality plan?	☒	☐	☐	☐	☐
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal, state, or regional ambient air quality standard?	☒	☐	☐	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☒	☐	☐	☐	☐

The proposed project has the potential to result in significant air quality impacts. All air quality topics are addressed in Draft EIR Section 4.C, Air Quality.

9. Greenhouse Gas Emissions

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
9. GREENHOUSE GAS EMISSIONS. Would the project:					
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐	☐
b) Conflict with any applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐	☐

ENVIRONMENTAL SETTING

Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) because they capture heat radiated from the sun as it is reflected back into the atmosphere. The accumulation of GHGs contributes to global climate change. The primary GHGs, or climate pollutants, are carbon dioxide (CO_2), black carbon, methane (CH_4), nitrous oxide (N_2O), ozone, and water vapor.

Individual projects contribute to the cumulative effects of climate change by emitting GHGs during demolition, construction, and operation. Although the presence of some of the primary GHGs in the atmosphere is naturally occurring, carbon dioxide, methane, and nitrous oxide are also emitted from human activities, accelerating the rate at which these compounds occur within Earth's atmosphere. Emissions of carbon dioxide are largely by-products of fossil fuel combustion, whereas methane results from off-gassing associated with agricultural practices and landfills. Black carbon has emerged as a major contributor to global climate change, possibly second only to carbon dioxide. Black carbon is produced naturally and by human activities as a result of the incomplete combustion of fossil fuels, biofuels, and biomass materials.[40] Nitrous oxide is a by-product of various industrial processes. Other GHGs, including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, are generated in certain industrial processes. GHGs are typically reported in "carbon-dioxide- equivalent" (CO_2e) measures.[41]

Human influence on the climate system is now an established fact; combined evidence from across the climate system strengthens this finding. It is unequivocal that the increase of CO_2, CH_4, and N_2O in the atmosphere over the industrial era is the result of human activities and that human influence is the principal driver of many changes observed across the atmosphere, ocean, cryosphere and biosphere.[42] Secondary effects of climate change very likely include impacts on agriculture, the state's electricity system, and the ecosystems of native freshwater fish; an increase in the vulnerability of levees, such as in the Sacramento-San Joaquin Delta; changes in disease vectors; and changes in habitats and biodiversity.[43,44]

EXISTING GREENHOUSE GAS EMISSION ESTIMATES

The California Air Resources Board (air board) estimated that, in 2019, California produced about 418 million gross metric tons of carbon dioxide equivalents (MMT CO_2e).[45] The air board found that transportation is the source of 40 percent of the state's GHG emissions, followed by industrial uses, at 21 percent, and electricity generation (both in-state and outside generation), at 14 percent. Commercial and residential fuel use (primarily for heating) accounted for 10 percent of GHG emissions.[46] In San Francisco, motorized transportation and buildings (i.e., natural gas and electricity use within the buildings) were the two largest sources of GHG emissions, accounting for 47 percent (approximately 2.2 MMT CO_2 e) and 41 percent (1.9 MMT CO_2e), respectively, of the approximately 4.6 MMT CO_2e emitted in San Francisco in 2019.[47] Other sources include landfilled organics (approximately 7 percent), municipal emissions (approximately 3 percent, including both municipal buildings and fleets), and agriculture (approximately 1.8 percent).[48]

Electricity in San Francisco is provided primarily by the San Francisco Public Utilities Commission (SFPUC) and Pacific Gas and Electric (PG&E). In 2019, electricity consumption in San Francisco totaled approximately

[40] Center for Climate and Energy Solutions, *What Is Black Carbon?* April 2010, https://www.c2es.org/document/what-is-black-carbon/, accessed September 30, 2021.
[41] Because of the differential heat absorption potential of various GHGs, GHG emissions are frequently measured in "carbon dioxide equivalents," which present a weighted average, based on each gas's heat absorption (or "global warming") potential.
[42] Intergovernmental Panel on Climate Change, *Technical Summary for AR6 Climate Change 2021: The Physical Science Basis, Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 2021, https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf, accessed September 30, 2021.
[43] Ibid.
[44] California Climate Change Center, *Our Changing Climate 2012: Vulnerability and Adaptation to the Increasing Risks from Climate Change in California*, 2012, https://ucanr.edu/sites/Jackson_Lab/files/155618.pdf, accessed September 30, 2021.
[45] California Air Resources Board, *California Greenhouse Gas Inventory for 2000–2019 by Category as Defined in the Scoping Plan*, n.d., https://ww2.arb.ca.gov/ghg-inventory-data, accessed September 30, 2021.
[46] Ibid.
[47] San Francisco Department of the Environment, *San Francisco's Carbon Footprint*, n.d., https://sfenvironment.org/carbonfootprint, accessed September 30, 2021.
[48] Ibid.

5.6 million megawatt-hours.[49] The City produces approximately 80 percent of this power through Hetch Hetchy Power and CleanPowerSF, with the remaining energy coming from PG&E. CleanPowerSF was launched by SFPUC in 2016 to provide renewable energy to residents and businesses. The organization was formed to achieve the city's ambitious targets regarding the delivery of completely emissions-free electricity by 2030.[50] PG&E's 2019 power mix was as follows: 2 percent natural gas and other, 45 percent nuclear, 25 percent eligible renewables (described below), and 28 percent large hydroelectric.[51]

SFPUC, which operates three hydroelectric power plants as part of San Francisco's Hetch Hetchy water supply system, as well as solar, biomass, and biowaste infrastructure, provides electrical power to the San Francisco Municipal Railway, City buildings, and a limited number of commercial accounts in San Francisco.[52] Hetch Hetchy Power provides 100 percent greenhouse gas-free energy to public facilities such as San Francisco International Airport.[53]

REGULATORY SETTING

STATE

Executive Orders S-3-05, B-30-15, and B-55-18. Executive Order S-3-05[54] sets forth a series of target dates by which time statewide emissions of GHGs will need to be progressively reduced, as follows: reduce emissions to 1990 levels by 2020 (approximately 427 MMT CO_2e) and 80 percent below 1990 levels by 2050 (approximately 85 MMT CO_2e). As discussed above, in 2019 California produced about 418 million gross metric tons of carbon dioxide equivalents.[55]

Executive Order B-30-15 sets an interim statewide GHG emissions reduction target of 40 percent below 1990 levels by 2030. The purpose of this interim target is to ensure that California meets its target of reducing GHG emissions to 80 percent below 1990 levels by 2050.[56] Executive Order B-30-15 also requires all state agencies with jurisdiction over sources of GHG emissions to implement measures within their statutory authority for achieving reductions in GHG emissions and meeting the 2030 and 2050 GHG emission reduction targets.

Executive Order B-55-18 establishes a statewide goal of achieving carbon neutrality as soon as possible, but no later than 2045, and achieving and maintaining net negative emissions thereafter. The air board was tasked with developing a framework for implementing and accounting for progress toward the goal.

---

[49] California Energy Commission, *Electricity Consumption by County*, 2019, https://ecdms.energy.ca.gov/elecbycounty.aspx, accessed September 30, 2021.
[50] Kevin Stark, *Power Switch: S.F. Builds Case for Pushing Out PG&E*, San Francisco Public Press, 2019, https://www.sfpublicpress.org/power-switch-s-f-builds-case-for-pushing-out-pge/, accessed September 30, 2021.
[51] Pacific Gas & Electric, *Exploring Clean Energy Solutions*, 2019, https://www.pge.com/en_US/about-pge/environment/what-we-are-doing/clean-energy-solutions/clean-energy-solutions.page?WT.mc_id=Vanity_cleanenergy, accessed September 30, 2021.
[52] San Francisco Public Utilities Commission, *Hetch Hetchy Power System*, https://sfpuc.org/about-us/our-systems/hetch-hetchy-power-system, accessed September 30, 2021.
[53] City of San Francisco Office of the Mayor, *News Release Mayor London Breed Announces New Climate Commitments and Environmental Successes*, April 22, 2021, https://sfmayor.org/article/mayor-london-breed-announces-new-climate-commitments-and-environmental-successes, accessed September 28, 2021.
[54] Office of the Governor, *Executive Order S-3-05*, June 1, 2005, http://static1.squarespace.com/static/549885d4e4b0ba0bff5dc695/t/54d7f1e0e4b0f0798cee3010/1423438304744/California+Executive+Order+S-3-05+(June+2005).pdf, accessed September 30, 2021. Executive Order S-3-05 sets forth a series of target dates by which statewide emissions of GHGs will need to be progressively reduced, as follows: by 2010, reduce GHG emissions to 2000 levels (approximately 457 million metric tons of carbon dioxide equivalents); by 2020, reduce GHG emissions to 1990 levels (approximately 427 million metric tons of carbon dioxide equivalents); and by 2050, reduce GHG emissions to 80 percent below 1990 levels (approximately 85 million metric tons of carbon dioxide equivalents).
[55] California Air Resources Board, *California Greenhouse Gas Inventory for 2000–2019 by Category as Defined in the Scoping Plan*, n.d., https://ww2.arb.ca.gov/ghg-inventory-data, accessed September 30, 2021.
[56] Office of the Governor, *Executive Order B-30-15*, April 29, 2015, https://www.ca.gov/archive/gov39/2015/04/29/news18938/index.html, accessed September 30, 2021.

Executive Order B-55-18 also requires all policies and programs undertaken to achieve carbon neutrality to be implemented in a manner that supports climate adaptation and biodiversity.[57]

Assembly Bill 32 and the Climate Change Scoping Plan. In 2006, the California Legislature passed Assembly Bill (AB) 32 (California Health and Safety Code division 25.5, section 38500 et seq.), also known as the California Global Warming Solutions Act. AB 32 requires the air board to design and implement emission limits, regulations, and other measures so that statewide GHG emissions are reduced to 1990 levels by 2020.

Pursuant to AB 32, the air board adopted the 2008 Climate Change Scoping Plan, which outlines measures to meet the 2020 GHG reduction limits. To meet the goals of AB 32, California needed to reduce its GHG emissions to 30 percent below projected 2020 business-as-usual emissions levels (approximately 15 percent below 2008 levels).[58] In 2018, the air board announced that inventory year 2016 emissions had dropped below 1990 levels, which is an achievement of the AB 32 goal as emissions have continued this current trajectory.[59]

The Climate Change Scoping Plan must be updated every five years to evaluate AB 32 policies and ensure that California is on track with respect to achieving long-term climate stabilization goals. The First Scoping Plan Update was approved in 2014, and an additional update was approved in 2017. The *2017 Climate Change Scoping Plan* identifies specific measures to reduce GHG emissions to 1990 levels by 2020, and requires the air board and other State agencies to develop and enforce regulations and other initiatives for reducing GHGs.[60] The plan identifies opportunities for leveraging and new funds that will drive GHG emissions reductions even farther through strategic planning and targeted low-carbon investments. The 2017 update defines the air board’s climate change priorities for the next five years and sets the groundwork for reaching the long-term goals set forth in Executive Order B-30-15 and Senate Bill (SB) 32. The plan also highlights California’s progress toward meeting the 2030 GHG emissions reduction goals of SB 32 and evaluates how to align the state's longer-term GHG reduction strategies with other state policy priorities for water, waste, natural resources, clean energy, transportation, and land use.[61]

Specifically, the *2017 Climate Change Scoping Plan* articulates a key role for local governments, recommending they establish GHG reduction goals for both their municipal operations and the community consistent with those of the State. The Climate Change Scoping Plan anticipates that actions by local governments will reduce GHG emissions because local governments have primary authority to plan, zone, approve, and permit development that will accommodate population growth and the changing needs of their jurisdictions.[62] The plan also relies on the requirements of SB 375 (discussed below) to align local land use and transportation planning and achieve GHG reductions.

---

[57] Office of the Governor, *Executive Order B-55-18*, September 10, 2018, https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf, accessed September 30, 2021.
[58] California Air Resources Board, *AB 32 Global Warming Solutions Act of 2006*, https://ww2.arb.ca.gov/resources/fact-sheets/ab-32-global-warming-solutions-act-2006, accessed September 30, 2021.
[59] California Air Resources Board, *Climate pollutants fall below 1990 levels for the first time*, 2018, https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time, September 30, 2021.
[60] California Air Resources Board, *California’s 2017 Climate Change Scoping Plan*, https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf?utm_medium=email&utm_source=govdelivery, accessed September 30, 2021.
[61] Ibid.
[62] Ibid.

The next update, the 2022 Scoping Plan Update, will assess progress towards achieving the SB 32 2030 target (discussed below) and lay out a path to achieve carbon neutrality by mid-century pursuant to Executive Order B-55-18.[63]

Senate Bill 32 and Assembly Bill 197. On August 24, 2016, the California Legislature passed SB 32 (California Health and Safety Code division 25.5, section 38566), thereby amending the California Global Warming Solutions Act of 2006. SB 32 directed the air board to adopt, to the extent technologically feasible and cost effective, the rules and regulations necessary to achieve a reduction in statewide GHG emissions (i.e., to 40 percent below 1990 levels by 2030). The passage of SB 32 codified the 2030 interim GHG emissions reduction target established by Executive Order B-30-15.

SB 32 was paired with AB 197 (California Government Code division 2 of title 2, article 7.6 of chapter 1.5, California Health and Safety Code sections 39510, 39607, 38506, 38531, and 38562.5). AB 197 provides additional guidance on how to achieve the reduction targets established in Executive Order B-30-15 and SB 32. SB 32 and AB 197 became effective January 1, 2017.

The *2017 Climate Change Scoping Plan* estimates 385 MMT CO_2e will be reduced from known commitments, leaving a gap of 236 MMT CO_2e that is needed to meet the 2030 target codified by SB 32. The air board concluded that the gap in emissions will need to be bridged by the Cap-and-Trade program's achievement of 236 MMT CO_2e. **Table 6** shows the reductions that the air board is expecting from the known commitments of the scoping plan and the amount needed from the Cap-and-Trade program to achieve the 2030 target.[64]

Table 6 GHG Reductions from the 2017 Scoping Plan Measures[65]

Scoping Plan Measure	GHG Reductions (million metric tons of carbon dioxide equivalents)
Short-Lived Climate Pollutants	217
Mobile Sources Clean Fuels and Technology and Freight	64
Landfill Methane Energy Efficiency	64
Biofuels	25
50% Renewable Portfolio Standards	16
Cap-and-Trade Program	236
Total Scoping Plan Reductions to meet SB 32 Target	**621**

SOURCE: California Air Resources Board, *California's 2017 Climate Change Scoping Plan*, November 2017, https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf, accessed September 3, 2021.

Senate Bills 375 and 743. The Climate Change Scoping Plan relies on the requirements of SB 375 (chapter 728, statutes of 2008), also known as the Sustainable Communities and Climate Protection Act of 2008, to

[63] California Air Resources Board, *Presentation 2022 Scoping Plan Update Scenario Concepts Technical Workshop*, August 17, 2021, https://ww2.arb.ca.gov/sites/default/files/2021-08/carb_presentation_sp_scenarioconcepts_august2021_0.pdf, accessed September 30, 2021.
[64] Ibid.
[65] California Air Resources Board, *California's 2017 Climate Change Scoping Plan*, https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf?utm_medium=email&utm_source=govdelivery, accessed September 30, 2021.

reduce carbon emissions from land use decisions. SB 375 requires regional transportation plans developed by each of the state's 18 metropolitan planning organizations to incorporate a *sustainable communities strategy* in each regional transportation plan, which will then achieve the GHG emissions reduction targets set by the air board. Plan Bay Area 2050, the Metropolitan Transportation Commission's regional transportation plan serves as a roadmap for the bay area's future through 2050. For the San Francisco Bay Area, the per capita GHG emissions reduction targets applicable to Plan Bay Area 2050 are 19 percent by 2035 (i.e., emissions from vehicles and light-duty trucks compared with 2005 levels).[66]

The Governor's Office of Planning and Research (OPR) implemented changes to the CEQA Guidelines, in accordance with SB 743, including the addition of section 15064.3, which requires CEQA transportation analyses to move away from a focus on vehicle delay and level of service. In support of these changes, OPR published its *Technical Advisory on Evaluating Transportation Impacts in CEQA*, which states that the determination of a project's transportation impact should be based on whether project-related vehicle miles traveled (VMT) per capita (or VMT per employee) would be 15 percent lower than that of existing development in the region.[67] OPR's technical advisory explains that this criterion is consistent with section 21099 of the Public Resources Code, which states that the criteria for determining significance must "promote a reduction in greenhouse gas emissions." In addition, the 15 percent reduction is consistent with the VMT reduction that the air board has determined to be necessary to meet the state's 2030 and 2050 GHG goals.[68] This metric is intended to replace the use of vehicle delay and level of service for measuring transportation-related impacts.

Senate Bills 1078, 107, X1-2,350, and 100 and Executive Orders S-14-08 and S-21-09. California established aggressive renewable portfolio standards under SB 1078 (chapter 516, statutes of 2002) and SB 107 (chapter 464, statutes of 2006), which required retail sellers of electricity to provide at least 20 percent of their electricity from renewable sources by 2010. Executive Order S-14-08 (November 2008) expanded the state's renewable portfolio standards, which call for 20 to 33 percent of electricity to come from renewable sources by 2020. In 2009, Governor Schwarzenegger continued California's commitment to renewable portfolio standards by signing Executive Order S-21-09, which directed the air board to enact regulations to help California meet the renewable portfolio standards (i.e., 33 percent of electricity from renewable energy by 2020).[69]

In April 2011, Governor Brown signed SB X1-2 (chapter 1, statutes of 2011), codifying the GHG emissions reduction goal for energy suppliers (i.e., 33 percent of electricity from renewable energy by 2020). This renewable portfolio standard preempts the air board's standard that calls for 33 percent of electricity to come from renewable sources; it applies to all electricity suppliers (not only retail sellers) in the state, including publicly owned utilities, investor-owned utilities, electricity service providers, and community choice aggregators. Under SB X1-2, all electricity-supplying entities must adopt the goals of the new renewable portfolio standard (i.e., 20 percent of retail sales from renewable sources by the end of 2013, 25 percent by the end of 2016, and 33 percent by the end of 2020).[70] Eligible renewable sources include geothermal, ocean wave, solar photovoltaic, and wind sources but exclude large hydroelectric facilities

---

[66] These targets became applicable October 1, 2018. California Air Resources Board, *SB 375 Regional Plan Climate Targets*, https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/regional-plan-targets, accessed November 30, 2021.
[67] Governor's Office of Planning and Research, *Technical Advisory on Evaluating Transportation Impacts in CEQA,* December 2018, http://opr.ca.gov/docs/20190122-743_Technical_Advisory.pdf, accessed September 30, 2021.
[68] Ibid.
[69] California Public Utilities Commission, *RPS Program Overview*, n.d., https://www.cpuc.ca.gov/rps/#:~:text=California%27s%20RPS%20program%20was%20established,a%2050%25%20RPS%20by%202030, accessed September 30, 2021.
[70] Ibid.

(30 megawatts or more). Therefore, because SFPUC receives more than 67 percent of its electricity from large hydroelectric facilities, the remaining electricity provided by SFPUC is required to be 100 percent renewable.[71] SB 350 (chapter 547, statutes of 2015), signed by Governor Brown in October 2015, dramatically increased the stringency of the renewable portfolio standard. SB 350 establishes a renewable portfolio standard that calls for 50 percent of electricity to come from renewable sources by 2030, along with interim targets of 40 percent by 2024 and 45 percent by 2027.

SB 100 further accelerates the renewable energy targets that were set by earlier legislation. The goal of the renewable portfolio standard was revised to achieve a 50 percent renewable resource target by the end of 2026 and 60 percent by the end of 2030. The bill states that it is the policy of the state for eligible renewable energy resources and zero-carbon resources to supply 100 percent of all retail sales of electricity to California end-uses, as well as 100 percent of the electricity procured for state agencies, by the end of 2045.[72]

Green Building Code and Title 24 Updates. The California Green Building Standards Code (CALGreen) (proposed Part 11, Title 24) was adopted as part of the California Building Standards Code (24 California Code of Regulations). Part 11 established voluntary standards that became mandatory under the 2010 edition of the code. These involved sustainable site development, energy efficiency (in excess of California Energy Code requirements), water conservation, material conservation, and internal air contaminants. The current energy efficiency standards were adopted in 2019 and took effect on January 1, 2020.

Executive Order S-01-07. With EO S-01-07, Governor Schwarzenegger set forth the low carbon fuel standard (LCFS) for California in 2007. Under this order, the carbon intensity of California's transportation fuels is to be reduced by at least 10 percent by 2020.

Assembly Bill 1493. With the passage of AB 1493, also known as Pavley I, in 2002, California launched an innovative and proactive approach to dealing with GHG emissions and climate change at the state level. AB 1493 requires the air board to develop and implement regulations to reduce automobile and light-duty truck GHG emissions. These stricter emissions standards were designed to apply to automobiles and light-duty trucks beginning with the model year 2009. Although litigation challenged these regulations and the EPA initially denied California's related request for a waiver, the waiver request was granted.[73] Additional strengthening of the Pavley standards (referred to previously as *Pavley II* and now referred to as the *Advanced Clean Cars* measure) was adopted for vehicle model years 2017–2025 in 2012. Together, the two standards are expected to increase average fuel economy to roughly 54.5 miles per gallon in 2025. The estimated standards for model year 2020 are 43.7 miles per gallon (mpg) for passenger cars and 31.3 mpg for light trucks.

---

[71] San Francisco Public Utilities Commission, Approval of the Enforcement Program for the California Renewable Energy Resources Act, December 13, 2011, https://www.gsweventcenter.com/Draft_SEIR_References/2011_1213_SFPUC_Agenda_Item_20.pdf, accessed November 9, 2021.
[72] Senator Kevin De Leon, *Senate Bill No. 100: California Renewable Portfolio Standards Program: Emissions of Greenhouse Gases*, September 10, 2018, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB100, accessed September 30, 2021.
[73] California's waiver to set state-specific standards is currently uncertain as a result of the SAFE Vehicles Rule.

Innovative Clean Transit. Adopted in December 2018, the Innovative Clean Transit regulation requires public transit agencies to gradually transition to 100 percent zero-emissions bus fleets by 2040. According to the air board, this regulation will provide the following benefits to the state:[74]

- Reduce GHG emissions for all Californians, especially transit-dependent and disadvantaged communities. The majority of these benefits will be in the state's most populated and impacted areas where transit buses are most prevalent.
- Increase penetration of the first wave of zero-emissions heavy-duty technologies into applications that are well suited to their use to further achieve emissions reduction benefits.
- Save energy and reduce dependency on petroleum and other fossil fuels.
- Expand zero-emissions-vehicles industry to bring high-quality green jobs to local communities and trained workforce to California.
- Provide other societal benefits by encouraging improved mobility and connectivity with zero-emissions transportation modes and reduced growth in light-duty vehicle miles traveled.

Short-Lived Climate Pollutant Reduction Strategy. SB 605 directed the air board, in coordination with other State agencies and local air districts, to develop a comprehensive short-lived climate pollutant (SLCP) Reduction Strategy, while SB 1383 directed the air board to approve and implement the SLCP Reduction Strategy to achieve the following reductions in SLCPs:

- 40 percent reduction in CH_4 below 2013 levels by 2030
- 40 percent reduction in hydrofluorocarbon (HFC) gases below 2013 levels by 2030
- 50 percent reduction in anthropogenic black carbon below 2013 levels by 2030
- The bill also establishes the following targets for reducing organic waste in landfills and CH_4 emissions from dairy and livestock operations as follows:
  - 50 percent reduction in organic waste disposal from the 2014 level by 2020
  - 75 percent reduction in organic waste disposal from the 2014 level by 2025
  - 40 percent reduction in CH_4 emissions from livestock manure management operations and dairy manure management operations below the dairy sector's and livestock sector's 2013 levels by 2030

The air board and California's Department of Resources Recycling and Recovery (CalRecycle) are currently developing regulations to achieve the organic waste reduction goals under SB 1383. In January 2019 and June 2019, CalRecycle proposed new and amended regulations in California Code of Regulations titles 14 and 27. Among other things, the regulations set forth minimum standards for organic waste collection, hauling, and composting. The final regulations will take effect on or after January 1, 2022.

The air board adopted the SLCP Reduction Strategy in March 2017 as a framework for achieving the CH_4, HFC, and anthropogenic black carbon reduction targets set by SB 1383. The SLCP Reduction Strategy includes 10 measures to reduce SLCPs, which fit within a wide range of on-going planning efforts throughout the State, including the air board's and CalRecycle's proposed rulemaking on organic waste diversion.

[74] California Air Resources Board, *Innovative Clean Transit*, https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit/about, September 3, 2021.

REGIONAL

The Bay Area Air Quality Management District (air district) is responsible for attaining and maintaining federal and state air quality standards in the San Francisco Bay Area Air Basin, as established by the federal Clean Air Act and the California Clean Air Act. The acts require plans to be developed for areas that do not meet air quality standards. The most recent air quality plan, the Bay Area 2017 Clean Air Plan, includes a goal that calls for reducing GHG emissions to 1990 levels by 2020, 40 percent below 1990 levels by 2035, and 80 percent below 1990 levels by 2050.[75] In addition, the air district established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the air basin. The program includes GHG emissions reduction measures that promote energy efficiency, reduce VMT, and help with the development of alternative energy sources.[76]

The air district's CEQA Air Quality Guidelines help lead agencies comply with the requirements of CEQA with respect to potentially adverse impacts on air quality. The air district advises lead agencies to consider adopting a GHG emissions reduction strategy that meets climate stabilization goals and then review projects for compliance with the GHG emissions reduction strategy as a CEQA threshold of significance.[77,78] This is consistent with the approach to analyzing GHG emissions described in CEQA Guidelines section 15183.5.

LOCAL

San Francisco Greenhouse Gas Reduction Ordinance. In May 2008, the city adopted ordinance 81-08, amending the San Francisco Environment Code to establish GHG emissions targets and require departmental action plans. Ordinance 81-08 authorized the San Francisco Department of the Environment to coordinate efforts to meet the targets and established the following GHG emissions reduction limits and target dates:

- Determine 1990 citywide GHG emissions by 2008 (i.e., the baseline level, with reference to which target reductions have been set).
- Reduce GHG emissions to 25 percent below 1990 levels by 2017.
- Reduce GHG emissions to 40 percent below 1990 levels by 2025.
- Reduce GHG emissions to 80 percent below 1990 levels by 2050.[79]

In July 2021, the City adopted an updated GHG ordinance to demonstrate the city's commitment to the Paris Agreement by establishing GHG reduction targets for 2030, 2040, and 2050 and setting other critical sustainability goals. The updated ordinance sets goals for both sector-based emissions and consumption-based emissions. The GHG targets established under ordinance 81-08 applied solely to sector-based emissions, which are those emissions that are generated within the geographic boundaries of the city. The updated

---

[75] Bay Area Air Quality Management District, *2017 Clean Air Plan*, April 2017, https://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf, accessed September 30, 2021.
[76] Bay Area Air Quality Management District, *Climate Protection Program*, 2017, https://www.baaqmd.gov/plans-and-climate/climate-protection/climate-protection-program, accessed September 30, 2021.
[77] Bay Area Air Quality Management District, *California Environmental Quality Act Air Quality Guidelines*, May 2017, https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed September 30, 2021.
[78] The air district is proposing updated GHG thresholds, but these thresholds have not been adopted yet. The updated thresholds do not contain recommendations for construction GHG analysis, but do recommend land use projects meet certain performance measures or be evaluated for consistency with a GHG reduction strategy. Therefore, because the analysis is based on consistency with a GHG reduction strategy, the analysis would be consistent with updated GHG thresholds, as they are stated today.
[79] City and County of San Francisco, *Greenhouse Gas Emissions Targets and Departmental Action Plans*, May 13, 2008, https://sfenvironment.org/policy/chapter-9-greenhouse-gas-emissions-targets-and-departmental-action-plans, accessed September 30, 2021.

ordinance reflects a more comprehensive effort to reduce GHG emissions by setting consumption-based targets as well. Consumption-based emissions are those that are associated with producing, transporting, using, and disposing of products and services consumed by people within the city, even those emissions that are generated outside of the city boundaries. The City's updated GHG reduction targets are as follows:

- By 2030, reduce sector-based GHG emissions to 61 percent below 1990 levels.
- By 2030, reduce consumption-based GHG emissions to 30 metric tons of CO_2e per household or less, equivalent to a 40 percent reduction compared to 1990 levels.
- By 2040, reach net-zero sector-based emissions and sequester any residual emissions using nature-based solutions.[80]
- By 2050, reduce consumption-based GHG emissions to 10 metric tons of CO_2e per household or less, equivalent to an 80 percent reduction compared to 1990 levels.

These sector-based GHG reduction targets are more ambitious than those set forth in Governor Brown's Executive Order B-30-15 (e.g., a 61 percent reduction in sector-based GHG emissions by 2030 rather than a 40 percent reduction by 2030) and in B-55-18 (e.g., achieving carbon neutrality by 2040 rather than by 2045). The consumption-based targets are consistent with the 2030 goal of Executive Order B-30-15 and the 2050 goal of Executive Order S-3-05 (80 percent below 1990 levels, by 2050).

The updated GHG ordinance also serves to codify the city's "0-80-100-Roots" climate action framework, which comprises climate and sustainability goals in these key areas: waste, transportation, energy, and carbon sequestration. The framework also emphasizes the importance of housing in implementing meaningful climate solutions, which require an increased supply of high-quality housing that is both affordable and near transit service. The goals in the 0-80-100-Roots framework are defined as follows:

- Zero Waste (**0**-80-100-Roots)
  - By 2030, reduce the generation of solid waste to 15 percent below 2015 levels and reduce the amount of solid waste that is incinerated or sent to landfill to at least 50 percent below 2015 levels.
- Transportation (0-**80**-100-Roots)
  - By 2030, increase the percentage of low-carbon trips to at least 80 percent of measured trips and increase the number of electric vehicles to at least 25 percent of all registered private vehicles.
  - By 2045, increase the number of electric vehicles to 100 percent of all registered private vehicles.
- Energy (0-80-**100**-Roots)
  - By 2025, supply 100 percent renewable electricity.
  - By 2045, supply 100 percent renewable energy.
- Carbon Sequestration (0-80-100-**Roots**)
  - Sequester carbon through ecosystem restoration, including an increased urban tree canopy (i.e., tree roots), green infrastructure, and compost applications.

[80] Nature-based solutions are those that remove remaining emissions from the atmosphere by storing them in natural systems that support soil fertility or employing other carbon farming practices.

- Housing and Buildings
  - Build at least 5,000 new housing units per year, with at least 30 percent of these units provided as affordable units.
  - By 2021, require zero onsite fossil fuel emissions from all new buildings.
  - By 2035, require zero onsite fossil fuel emissions from all large existing commercial buildings.

To support the 2021 Housing and Buildings goal of zero onsite fossil fuel emissions from all new buildings, the Board of Supervisors passed an all-electric new construction ordinance in November 2020. Taking effect on June 1, 2021, the ordinance, which applies to all new buildings, prohibits the construction of natural gas or propane infrastructure.[81]

Strategies to Address Greenhouse Gas Emissions in San Francisco. San Francisco has developed many plans and programs for reducing the city's contribution to global climate change and meeting the goals of ordinance 81-08. Strategies to Address Greenhouse Gas Emissions in San Francisco[82] documents city actions related to pursuing cleaner energy, reducing energy consumption, supporting alternative transportation, and implementing solid waste policies. For instance, the city has implemented mandatory requirements and incentives that have measurably reduced GHG emissions, including but not limited to, requirements for increased energy efficiency in new and existing buildings, requirements for the installation of solar panels on roofs, implementing a green building strategy, implementing a transportation sustainability program, implementing a better roofs program, adoption of a zero-waste strategy, adoption of a construction and demolition debris recovery ordinance, creation of a solar energy generation subsidy, incorporation of alternative-fuel vehicles in the city's transportation fleet (including buses), and adoption of a mandatory recycling and composting ordinance. The strategy also includes specific regulations for new development, which would reduce GHG emissions generated by anticipated future development. These GHG emissions reduction actions resulted in a 41 percent reduction in GHG emissions in 2019 compared with 1990 levels[83] and exceeded the 2020 goals in the air district's 2017 Clean Air Plan, Executive Orders S-3-05 and B-30-15, AB 32, and the city's 2017 GHG emissions reduction goal.

The July 2021 GHG ordinance requires the San Francisco Department of the Environment to prepare and submit to the Mayor a Climate Action Plan (CAP) by December 31, 2021. The CAP, which is to be updated every five years, will carry forward the efforts of the city's previous climate action plans and align with the Paris Agreement (e.g., limit global warming to 1.5 degrees Celsius) as well as the reduction targets adopted within the GHG ordinance. The CAP will also incorporate an equity framework to address historic inequities; prioritize the social, economic, and environmental benefits from implementing the CAP; and ensure that those benefits are distributed equitably. Other goals of the CAP include identifying synergies with the city's Hazards and Climate Resilience Plan and incorporating frameworks for health and vulnerable populations. Areas of focus in the CAP will include the following: energy supply, transportation and land use, building operations, housing, responsible production and consumption, and carbon sequestration. Reduction targets, goals, and/or principles will be outlined for each of these elements.

[81] San Francisco Department of Building Inspection, *All-Electric New Construction Ordinance,* https://sfdbi.org/AllElectricNewConstructionOrdinance, accessed September 30, 2021.
[82] San Francisco Planning Department, *Strategies to Address Greenhouse Gas Emissions in San Francisco*, July 2017, https://sfplanning.org/project/greenhouse-gas-reduction-strategies, accessed September 30, 2021.
[83] San Francisco Department of the Environment, *San Francisco's Carbon Footprint,* 2017, https://sfenvironment.org/carbonfootprint, accessed September 30, 2021.

SFO Climate Action Planning and Initiatives. SFO first developed a climate action plan in 2008 as a blueprint for meeting the objectives of San Francisco's GHG Reduction Ordinance (Ordinance 81-08[84]). Consistent with the City's objectives, the Airport established actions that would help the City reduce its GHG emissions 25 percent below 1990 emissions by 2017, 40 percent below 1990 emissions by 2025, and 80 percent below 1990 emissions by 2050. In 2016, the Airport developed a 5-year strategic plan, which established the following five sustainability goals for the years 2017–2021: (1) achieve net-zero energy at the Airport, (2) achieve zero waste, (3) achieve carbon neutrality and reduce GHG emissions by 50 percent (from the 1990 baseline), (4) implement a healthy buildings strategy for new and existing infrastructure, and (5) maximize water conservation to achieve 15 percent reduction per passenger per year (from the 2013 baseline).[85]

SFO has implemented strategies that support the City's climate change initiatives.[86] In fiscal year 2019, SFO reduced the GHG emissions from Airport-controlled operations by 41 percent below the 1990 emissions levels, compared to the Airport's goal to reduce GHG emissions by 50 percent below the 1990 emissions level by 2021.[87] The Airport achieved these reductions by, among other things, switching to 100 percent carbon-free electricity, using renewable diesel and compressed natural gas, and preventing refrigerant leaks. Moreover, SFO is developing and implementing plans to achieve up to a 95 percent reduction in GHG emissions below 1990 levels.[88] Future strategies to achieve these targets could include:

- Implement a cost-effective central utility plant that runs on carbon-free electricity.
- Swap fossil fuel-based fleets with all-electric cars, shuttle buses, and an expanded AirTrain.
- Invest in carbon offsets to mitigate the approximately 5 percent of remaining emissions in excess of 1990 emissions levels.
- Support airlines in bringing sustainable aviation fuel to SFO.
- Provide robust load-managed charging infrastructure to facilitate the electrification of passenger and transportation network company vehicle travel.
- Envision, plan, and activate a transit-first intermodal airport to serve all users.
- Design highly energy-efficient, all-electric, and zero-waste terminal spaces.

The proposed project would result in temporary GHG emissions associated with construction activities over a period of approximately seven years. The proposed project would not include any new buildings, energy-using facilities, operational vehicle trips, or other operational activities that would contribute to annual long-term increases in GHG emissions.

APPROACH TO ANALYSIS

CEQA Guidelines section 15064.4 calls for a "good-faith effort" to "describe, calculate, or estimate" GHG emissions. CEQA Guidelines section 15064.4 also allows lead agencies to rely on a qualitative analysis to

[84] San Francisco Board of Supervisors, Ordinance No. 81-08, Climate Change Goals and Action Plan, https://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances08/o0081-08.pdf, accessed April 13, 2021.
[85] San Francisco Airport Commission, *San Francisco International Airport: Five-Year Strategic Plan 2017–2021*, https://www.flysfo.com/sites/default/files/assets/pdfs/reports/Strategic-Plan-2017-2021.pdf, accessed March 31, 2021.
[86] San Francisco Airport Commission, *Climate Action Plan: Fiscal Year 2019*, https://www.flysfo.com/sites/default/files/media/sfo/community-environment/SFO_Climate_Action_Plan_FY19_Final.pdf, accessed March 31, 2021.
[87] Ibid.
[88] Ibid.

describe GHG emissions resulting from a project. In accordance with section 15064.4, the significance of GHG impacts should consider the extent to which the proposed action would increase or reduce GHG emissions, exceed a locally applicable threshold of significance, or comply with "regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions." The CEQA Guidelines also state that a project may be found to have a less-than-significant impact if it complies with an adopted plan that includes specific measures to reduce GHG emissions (section 15064[h][3]). Similarly, the air district has prepared guidelines and methodologies for analyzing GHGs. These guidelines are consistent with CEQA Guidelines sections 15064.4 and 15183.5, which pertain to the analysis and determination of significant impacts from a proposed project's GHG emissions.

With respect to GHG emissions, determination of the impacts of the proposed action is based on compliance with local, regional, and state plans, policies, and regulations adopted for the purpose of reducing the cumulative impacts of climate change. GHG emissions are analyzed in the context of their contribution to the cumulative effects of climate change because individual projects could never generate enough GHG emissions to result in a noticeable change in the global average temperature.

As discussed above, the Climate Change Scoping Plan adopted pursuant to SB 32 is the state's overarching plan for addressing climate change. Its recommendations are intended to curb projected business-as-usual increases in GHG emissions and reduce them to 40 percent below 1990 levels. As noted in the Regulatory Setting, other bills and executive orders have established reduction goals for future years (i.e., 2045 and 2050). Meeting the emissions targets of SB 32 as well as longer-term goals would result in an overall annual net decrease in GHG emissions compared with current levels and account for the projected increases in emissions resulting from anticipated growth.

In summary, applicable GHG reduction plans and regulations; Executive Orders S-3-05, B-30-15, and B-55-18; the Climate Change Scoping Plan and related updates; 2017 Clean Air Plan; Strategies to Address Greenhouse Gas Emissions in San Francisco; and the updated San Francisco GHG ordinance are intended to reduce GHG emissions to below current levels. The city's GHG emissions reduction targets are more aggressive than the state's 2030 and 2045 GHG emissions reduction targets and the city GHG ordinance is consistent with the goals of statewide executive orders and bills (i.e., AB 32, SB 32, and Executive Orders S-3-05, B-30-15, B-55-18). Therefore, projects that are consistent with the Strategies to Address Greenhouse Gas Emissions in San Francisco would be consistent with the state's GHG goals and would not conflict with an applicable plan or generate GHG emissions that would make a considerable contribution to global climate change. The air district has reviewed the GHG reduction strategy and concluded that "aggressive GHG reduction targets and comprehensive strategies like San Francisco's help the bay area move toward reaching the state's AB 32 goals and also serve as a model from which other communities can learn." Although the AB 32 milestone year of 2020 has passed, San Francisco's updated San Francisco GHG ordinance includes a pathway to reach the 2030 goals of SB 32 to ensure that the city continues to serve as a model for other communities. As noted previously, GHG emissions reduction actions implemented by the City resulted in a 41 percent reduction in GHG emissions in 2019 compared with 1990 levels and exceeded the 2020 goals in the air district's 2017 Clean Air Plan, Executive Orders S-3-05 and B 30-15, AB 32, and the City's 2017 GHG emissions reduction goal. With this 41 percent reduction in GHG emissions, the City has met interim 2030 targets of 40 percent below 1990 levels, and has done so more than 10 years before the target date.

Impact C-GG-1: The proposed project would generate greenhouse gas emissions, but not at levels that would result in a significant impact on the environment or conflict with any policy, plan, or regulation adopted for the purpose of reducing greenhouse gas emissions. ***(Less than Significant)***

Individual projects contribute to the cumulative effects of climate change by directly or indirectly emitting GHGs during the construction and operational phases. Direct construction emissions include construction vehicle trips and off-road equipment usage. Indirect emissions include emissions from electricity providers (for electric equipment and vehicles); energy required to pump, treat, and convey water used during construction; and emissions associated with waste removal, disposal, and landfill operations. There would be no operational GHG emissions because the proposed project would not involve operational activities. Therefore, this analysis discusses whether the proposed project's construction GHG emissions would be consistent with the City and County of San Francisco's GHG Reduction Strategy.

As discussed above, SFO has implemented strategies that support the City's climate change initiatives, reduced the GHG emissions from Airport-controlled operations by 41 percent below the 1990 emissions levels, and identified future strategies to achieve further reduction targets.

The proposed project would result in temporary GHG emissions associated with construction activities over a period of approximately seven years. The proposed project would not include any new buildings, energy-using facilities, operational vehicle trips, or other operational activities that would contribute to annual long-term increases in GHG emissions.

The proposed project would be subject to regulations adopted to reduce GHG emissions as identified in the GHG reduction strategy. As discussed below, compliance with the applicable regulations would reduce the project's GHG emissions related to on-road vehicle travel, off-road equipment use, and waste disposal.

In addition, construction workers would be provided discounted Caltrain and BART transit passes to commute to and from the project site, and would be offered a shuttle from worker parking lots to the construction staging areas and reaches. These programs would reduce GHG emissions from single-occupancy vehicles used by construction workers by promoting the use of alternative transportation modes with zero or lower GHG emissions on a per capita basis.

Construction equipment would be required to meet several requirements, including idling restrictions and the conditions of an onsite maintenance program to reduce emissions from equipment that would be in frequent use.[89] The construction fleet, including both on-road vehicles and off-road equipment, may also use biodiesel or renewable diesel, provided that the use of such fuels is demonstrated to reduce criteria air pollutant emissions and GHG emissions compared to conventional fuel. Furthermore, the construction contractors would be required to use electric equipment where feasible in compliance with the Airport's Standard Construction Measure Division 01 57 00. Electric equipment could include concrete/industrial saws, sweepers/scrubbers, welding machines, air compressors, cranes, forklifts, pumps, cement and mortar mixers, generators, and portable equipment.

The proposed project's waste-related emissions would be reduced through compliance with the City's Recycling and Composting Ordinance, Construction and Demolition Debris Recovery Ordinance, and Construction and Demolition Debris Recycling Requirements. In addition, the Airport's Standard Construction Measure Division 01 35 43.07 requires the contractor to develop and implement a construction

[89] Airport Standard Construction Measures, Continued Division 01 – General Requirements: Temporary Controls (01 57 00).

and demolition debris management plan to comply with the debris and waste management requirements of the City and County of San Francisco, SFO, and construction and demolition diversion requirements of the California Green Building Standards Code.[90] This standard construction measure also requires source reduction and onsite reuse and recycling of materials. Together, these regulations reduce the amount of materials sent to a landfill, reducing GHGs emitted by landfill operations. These regulations also promote the reuse of materials, conserving their embodied energy[91] and reducing the energy required to produce new materials.

The project sponsor is required to comply with these regulations, which have proven effective, as San Francisco's GHG emissions have measurably decreased when compared to 1990 emissions levels, demonstrating that the City has met and exceeded Executive Order S-3-05, AB 32, and the 2017 Clean Air Plan GHG reduction goals for the year 2020. Furthermore, the combination of all the City's actions, described in the GHG reduction strategy, have resulted in the City meeting the longer-term 2030 goals in SB 32 more than 10 years before the target date. Other existing regulations, such as those implemented through AB 32, will continue to reduce the proposed project's contribution to climate change. In addition, San Francisco's local GHG reduction targets are consistent with the long-term GHG reduction goals of Executive Order S-3-05, Executive Order B-30-15, AB 32, SB 32, and the 2017 Clean Air Plan. Furthermore, consistent with planning department procedures for GHG analysis in the city, a *Compliance Checklist Table for Greenhouse Gas Analysis for Municipal Projects* was completed for the proposed project. Thus, the proposed project is determined to be consistent with San Francisco's GHG reduction strategy.[92]

Additionally, the proposed project's purpose is to address the effects of climate change on the Airport by adapting to changes associated with sea-level rise. Two of the proposed project's objectives include: (1) to protect travelers and workers, Airport operations, and City assets from future sea-level rise caused by climate change through 2085 and (2) to create a protection system adaptable to future projections of sea-level rise. Although construction activities for the proposed project would produce short-term GHG emissions, the long-term benefits of the proposed project on climate change adaptation at the Airport would serve to indirectly reduce future GHG emissions from maintenance and inundation cleanup activities (and other reactive, instead of preventive, actions) along the Airport's shoreline.

Because the proposed project is consistent with the City's GHG reduction strategy, it is also consistent with the GHG reduction goals of Executive Order S-3-05, Executive Order B-30-15, AB 32, SB 32, and the 2017 Clean Air Plan; would not conflict with these plans and, therefore, would not exceed San Francisco's applicable GHG threshold of significance. Therefore, the proposed project's contribution to cumulative GHG impacts would not be cumulatively considerable. The proposed project would result in a ***less-than-significant*** impact with respect to GHG emissions.

---

[90] Airport Standard Construction Measures, Division 01 – General Requirements: Recovery, Reuse, and Recycling Requirements (01 35 43.07).
[91] *Embodied energy* is the total energy required for the extraction, processing, manufacture, and delivery of building materials to the building site.
[92] San Francisco Planning Department, Compliance Checklist Table for Greenhouse Gas Analysis: Table 2. Municipal Projects, SFO Shoreline Protection Program, January 10, 2022.

10. Wind

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
10. WIND. Would the project:					
a) Create wind hazards in publicly accessible areas of substantial pedestrian use?	☐	☐	☒	☐	☐

Impact WI-1: The proposed project would not create wind hazards in publicly accessible areas of substantial pedestrian use. ***(Less than Significant)***

Winds at the Airport blow most frequently from the west and west-northwest. These are also the most frequent directions of strong winds. However, during winter storms, some of the strongest winds blow from the southeast, although these winds are substantially less frequent than the prevailing westerly and north-northwesterly winds.

The San Francisco Planning Code establishes wind comfort and wind hazard criteria used to evaluate new development in certain areas of the city. Because none of these areas include the Airport, the wind comfort and wind hazard criteria established in the planning code are not applicable to the proposed project.

Wind impacts are directly related to the height, orientation, design, location, and surrounding development context of a proposed project. In addition, tall buildings and exposed structures can strongly affect the wind environment for pedestrians. A building or structure that stands alone or is much taller than the surrounding structures can intercept and redirect winds that might otherwise flow overhead and move the winds down the vertical face of the building or structure to ground level, where they create ground-level wind and turbulence. These redirected winds can be relatively strong, turbulent, and incompatible with the intended uses of nearby ground-level spaces. A building or structure similar in height to surrounding buildings typically would cause little or no additional ground-level wind acceleration and turbulence. Thus, wind impacts are generally caused by large building masses that extend substantially above their surroundings, and by buildings or structures oriented such that a large wall catches a prevailing wind, particularly if such a wall includes little or no articulation.

Based on wind analyses conducted for other development projects in San Francisco, a building or structure that does not exceed a height of 85 feet generally has little potential to cause substantial changes to ground-level wind conditions. Such winds may occur under existing conditions, but shorter buildings or structures typically do not cause substantial changes in ground-level winds.

The proposed project would introduce steel sheet pile and concrete walls that would extend to a maximum height of 10.9 feet above existing ground surface. Although the proposed height for Reach 16 is not currently known, it is not anticipated that the landside protection system, if needed to form a continuous, closed flood protection system, would reach or exceed 85 feet in height. Therefore, the proposed project would not create wind hazards in publicly accessible areas of substantial pedestrian use. As such, this impact would be ***less than significant***.

Impact C-WI-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative wind impact. *(Less than Significant)*

The geographic context for the analysis of potential cumulative impacts related to wind includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Given that none of the cumulative projects are anticipated to exceed a maximum height of 85 feet, the proposed project, in combination with these cumulative projects, would not cause substantial changes to ground-level wind conditions. Therefore, cumulative wind impacts would be ***less than significant***.

---

11. Shadow

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
11. SHADOW. Would the project:					
a) Create new shadow that substantially and adversely affects the use and enjoyment of publicly accessible open spaces?	☐	☐	☒	☐	☐

Impact SH-1: The proposed project would not create new shadow that would substantially and adversely affect the use and enjoyment of publicly accessible open spaces. *(Less than Significant)*

In 1984, San Francisco voters approved an initiative known as Proposition K, The Sunlight Ordinance, which was codified as planning code section 295 in 1985. Section 295 generally prohibits new structures taller than 40 feet that would cast shadow on open space that is under the San Francisco Recreation and Park Commission's jurisdiction between one hour after sunrise and one hour before sunset, at any time of the year, unless that shadow would not result in a significant adverse effect on the use of the open space. Public open spaces that are not under the recreation and park commission's jurisdiction, as well as private open spaces, are not subject to planning code section 295.

The proposed project would not shade any publicly accessible parks. The proposed shoreline protection system along Reach 1 would run parallel to approximately 1,000 feet of the Bay Trail. The Reach 1 shoreline protection system would include a concrete wall extending a maximum height of 6.1 feet above the existing ground surface. Because of the low height of the wall, new shadow from the wall would be minimal and would not affect users of the Bay Trail. For these reasons, the proposed project would not create new shadow that substantially and adversely affects the use and enjoyment of publicly accessible open spaces. Therefore, this impact would be ***less than significant***.

Impact C-SH-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative shadow impact. *(Less than Significant)*

The geographic context for the analysis of potential cumulative impacts related to shadow includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Cumulative shadow impacts could occur if the proposed project, in combination with cumulative projects, would result in aboveground facilities that would create new shadows in a manner that would substantially affect the use and enjoyment of publicly accessible open spaces. However, given the distance between the cumulative projects and the proposed project, the proposed project would not combine with the cumulative projects to cast shadows that would adversely affect the use and enjoyment of publicly accessible open spaces. Therefore, cumulative shadow impacts would be ***less than significant***.

---

12. Recreation

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
12. RECREATION. Would the project:					
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated?	☐	☐	☒	☐	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒	☐

Impact RE-1: The proposed project would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated. *(Less than Significant)*

The project site is located entirely within the Airport's boundaries and does not contain any parks. The proposed project would remove the existing shoreline protection features and would construct a new shoreline protection system consisting of a combination of concrete walls and steel sheet pile walls, some with armor rock revetment and/or open water fill. The proposed project does not include residential or other land uses that would increase the use of existing recreational facilities in the project area.

During construction, approximately 1,000 feet of the Bay Trail adjacent to Reach 1 would be closed during construction. However, with implementation of the required traffic control plan discussed above under Section E.6, Transportation and Circulation, the project sponsor would provide a detour adjacent to the construction area to maintain public access to the Bay Trail. Although design details for Reach 16 are not currently known, construction of Reach 16, should it be needed to form a continuous, closed flood protection system, would likely occur adjacent to the Bay Trail from the west end of Reach 1 to San Bruno

Avenue. Similar to the construction of Reach 1, the project sponsor would provide a detour adjacent to the Reach 16 construction area to maintain public access to the Bay Trail as part of the required traffic control plan. Therefore, the proposed project would not require closure of any portion of the Bay Trail, nor would the proposed project displace trail users. Construction of the proposed project also would not result in the increased use or physical deterioration of other recreational facilities. Therefore, this impact would be ***less than significant***.

Impact RE-2: The proposed project would not include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. *(No Impact)*

The proposed project would involve construction of a new shoreline protection system consisting of new steel sheet pile and concrete walls. The proposed project would not include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. Therefore, the proposed project would have ***no impact*** related to the construction or expansion of recreational facilities.

Impact C-RE-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact on recreational resources. *(Less than Significant)*

The geographic context for the analysis of potential cumulative impacts related to recreation includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. The proposed project would remove the existing shoreline protection features and construct a new shoreline protection system. Neither the cumulative projects nor the proposed project includes residential or other land uses that would increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of those facilities would occur or be accelerated. The proposed project and the cumulative projects also do not include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. As such, the proposed project would not combine with cumulative projects to create a significant impact on recreational facilities. Therefore, this impact would be ***less than significant***.

13. Utilities and Service Systems

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
13. UTILITIES AND SERVICE SYSTEMS. Would the project:					
a) Require or result in the relocation or construction of new or expanded, water, wastewater treatment, or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?	☐	☐	☒	☐	☐
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐	☐
d) Generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐	☐
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☒	☐	☐

The Airport is served by existing public and investor-owned utility service systems, including facilities for the collection and treatment of stormwater and wastewater; provision of potable and fire-supply water; solid waste collection and recycling; and electrical power, natural gas, and telecommunications.[93]

Impact UT-1: The proposed project would not result in a determination by the wastewater treatment provider that serves the project site that it has inadequate capacity to serve the proposed project's projected demand in addition to the provider's existing commitments, or require construction of new stormwater drainage facilities; wastewater treatment facilities; or electric power, natural gas, or telecommunications facilities; or the expansion of existing facilities. *(Less than Significant)*

SANITARY SEWER

The Mel Leong Treatment Plant is a wastewater and stormwater treatment plant operated by SFO that serves all Airport systems and facilities and is located near Reach 2 in the northeast portion of the Airport (see Figure 2-2, p. 2-7, in Draft EIR Chapter 2, Project Description). The Mel Leong Treatment Plant includes two

[93] San Francisco International Airport, Utilities, https://www.flysfo.com/about-sfo/sfo-tomorrow/utilities, accessed February 5, 2021.

sub-plants: an industrial wastewater treatment plant and a sanitary waste treatment plant. The sanitary waste treatment plant treats wastewater from potable uses such as terminal restrooms, hangars, restaurants, and retail shops.[94]

As a result of the low, flat elevation of the Airport, the system requires lift and pump stations to convey wastewater and stormwater to the treatment facility. The Mel Leong Treatment Plant treats and discharges both the sanitary and industrial wastewater in accordance with state and federal permits.[95] The facility is able to treat up to 4.4 million gallons per day at peak flows. The solids are separated and the dried sludge is removed and hauled to a landfill. A portion of the treated effluent is used as *reclaimed water*[96] at the Airport. The remaining effluent is pumped to the plant's North Bayside System Unit, where the effluent is combined with effluent from surrounding municipalities for dechlorination and deepwater discharge into San Francisco Bay.[97]

The proposed project does not include residential or other land uses that would generate substantial volumes of sanitary wastewater during operation. During construction, new sources of wastewater discharges to the Airport's system would be mainly limited to the sanitary needs of construction workers. No dewatering effluent is anticipated to be conveyed to the Mel Leong Treatment Plant.

A maximum of 180 workers would be present in the project area during a peak workday when construction of multiple reaches overlaps. Sanitary facilities would be serviced by a vendor and sanitary drainage would be hauled offsite for disposal. The resulting effect on wastewater system capacity would be negligible. Therefore, no discharges to the Mel Leong Treatment Plant during construction of the proposed project are anticipated, and this impact would be ***less than significant***.

STORMWATER FACILITIES AND INDUSTRIAL WASTEWATER

The Airport's basin area includes approximately 2,100 acres of Airport property east of U.S. 101, divided into eight separate subbasins. The majority of the basin area is impervious. The limited pervious areas are located mainly in the airfield between the runways and taxiways. Stormwater from the Airport site is collected through a series of inlets and collection pipes. The majority of the conveyance for the system operates by gravity. However, 19 existing pump stations are used as part of the stormwater system. The elevation of the Airport is low and flat, averaging about 2.5 feet above the mean high tide[98] elevation of San Francisco Bay. For this reason, stormwater must be discharged to the outfall locations via a stormwater pump station. Four detention basins, each with its own detention facility, divert the "first flush"[99] of a rainfall event to the industrial wastewater treatment plant at the Mel Leong Treatment Plant. After the first flush, stormwater is conveyed to the bay via stormwater outfalls.

As part of construction of the proposed project, nine of the 10 stormwater outfalls located on Airport property would need to be raised over the height of the proposed wall to ensure that they would function in tandem with the proposed shoreline protection system. Raising the stormwater outfalls would require cutting the outfalls on the landside of the proposed wall and installing one or two additional concrete piles

[94] San Francisco International Airport, *Draft Final Airport Development Plan*, 2016, https://www.flysfo.com/about-sfo/sfo-tomorrow/draft-final-airport-development-plan, accessed February 5, 2021.
[95] U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System Permit (No. CA0038318); California Water Quality Control Board San Francisco Bay Region, Waste Discharge Requirements (Order No. R2-2018-0045).
[96] *Reclaimed water* is wastewater that has been treated and converted to water that can be reused for other purposes.
[97] Ibid.
[98] The average of the high tide of each tidal day observed over the National Tidal Datum Epoch.
[99] First flush is the initial surface runoff of a rainstorm.

in the bay, depending on the reach, to a maximum depth of approximately 80 feet. The outfalls would then extend over the proposed wall and slope down to reconnect with the outfalls on the bay side of the shoreline protection system. Any modifications of the stormwater outfalls would be required to not affect compliance with the existing regulations described in Draft EIR Section 4.F, Hydrology and Water Quality.

Because of the location and size of the area of ground disturbance, the proposed project would be subject to the construction site runoff requirements of the State Water Resources Control Board (state water board) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ. The proposed project also would be subject to the San Francisco Bay Regional Water Quality Control Board (regional board) Basin Plan and the SFO Storm Water Pollution Prevention Plan (SWPPP). Accordingly, the project sponsor would be required to submit a notice of intent to the state water board describing the proposed treatment discharge activities. For project-generated discharge activities to occur, the state water board must issue an Authorization to Discharge once it has been determined that the discharger is eligible to discharge under the permit.

In summary, construction of the proposed project would occur in accordance with applicable requirements and would not exceed the capacity of existing or planned stormwater drainage systems. Therefore, this impact would be ***less than significant***.

ELECTRICITY, NATURAL GAS, AND TELECOMMUNICATIONS

PG&E provides electricity and natural gas to the Airport.

As the proposed project consists of the construction of a new shoreline protection system, it does not include residential or other land uses that would generate substantial increases in demand for electricity, natural gas, and telecommunications service during operation. Construction of the proposed project would require electrical power to operate certain types of construction equipment and to light work areas. However, this demand would be temporary and nominal, and it would not require the construction of new utility facilities or infrastructure or exceed the Airport's resources as allocated through PG&E. Because the proposed project would not increase demand for electricity or natural gas during or after construction to such an extent as to require the construction of new or expansion of existing utility facilities, the proposed project would result in a ***less-than-significant*** impact on electricity, natural gas, and telecommunications infrastructure.

Impact UT-2: Sufficient water supplies would be available to serve construction of the proposed project during normal, dry, and multiple dry years. *(Less than Significant)*

Construction of the proposed project would require the intermittent use of water for dust control during construction, in accordance with the Airport's Standard Construction Measure Division 01 57 00: for construction workers' drinking and onsite sanitary needs, for washing, and for soil and cement mixing, among other activities. The proposed project's water demand, including for Reach 16, would be temporary, terminating with the completion of construction, and would be minor compared to the San Francisco Public Utilities Commission's water supply capacity and annual demand. The water supply system is managed to be able to accommodate short-term spikes in potable use for construction projects; therefore, there would be no need for new or expanded water supply or water treatment facilities as a result of construction of the proposed project. Because water supplies for the type of demand required for construction of the proposed project have been planned for and are projected to be sufficient, no additional water supply capacity is required. Therefore, this impact would be ***less than significant***.

Impact UT-3: The proposed project would be served by a landfill with adequate permitted capacity to accommodate the proposed project's solid waste disposal needs and comply with all applicable statutes and regulations related to solid waste. ***(Less than Significant)***

SFO currently recycles or diverts approximately 80 percent of its solid waste. Nearly all construction and demolition waste generated at the Airport is recycled, with a consistent recycling rate of more than 90 percent.[100] Solid waste generated at the Airport is collected and transported to a transfer station and material recovery facility in South San Francisco, where recyclable materials are removed. Once processed, the solid waste is transferred to the Altamont Landfill and Resource Recovery Facility in the City of Livermore. This landfill has a permitted peak maximum disposal capacity of 11,150 tons per day. The landfill's total permitted capacity is 124,400,000 cubic yards; the remaining capacity is approximately 65,400,000 cubic yards. The Altamont Landfill is expected to remain operational until at least 2070.[101]

For construction and demolition debris, SFO complies with chapter 7 of the San Francisco Environment Code by implementing the Airport's Standard Construction Measure Division 01 35 43.07, Recovery, Reuse, and Recycling Requirements. This standard construction measure requires contractors to develop and implement a construction and demolition debris management plan, separate source materials, and divert at least 75 percent of their construction and demolition waste material. The San Francisco Department of the Environment tracks compliance with this measure through contractor submittals for all SFO construction projects.[102]

The proposed project could significantly affect solid waste disposal facilities if it were to generate volumes of waste material exceeding the local waste diversion goals or daily limit of local landfills. The proposed project would construct a new shoreline protection system and would not include uses that would generate solid waste during operation. Waste materials associated with the proposed project would be generated during construction and would consist of excavated material and construction debris. Construction debris would include materials such as excavated soils, asphalt, concrete, decommissioned underground utility boxes, demolished trestles, excavated vinyl sheet pile walls, and trash. Construction of the proposed project would generate approximately 287,000 cubic yards of waste.[103] In accordance with the Airport's Standard Construction Measure Division 01 35 43.07, SFO's construction contractors would be required to prepare a construction and demolition debris management plan and divert at least 75 percent of their construction and demolition waste material. All waste materials would be stockpiled onsite and separated according to waste characterization criteria. The materials would then be either recycled or disposed of at an offsite permitted facility in compliance with applicable regulatory standards. SFO's construction contractors would recycle approximately 281,000 cubic yards (98 percent) of construction demolition materials and dispose of the remaining approximately 6,000 cubic yards (2 percent) at the Altamont Landfill over approximately seven years. Although the construction duration and design for Reach 16 is not currently known, should it be determined that Reach 16 is required to form a continuous, closed flood protection system, SFO's construction contractors would be required to comply with the Airport's Standard Construction Measure Division 01 35 43.07.

---

[100] San Francisco International Airport, 2014, *San Francisco International Airport 2014 Sustainability Report*, https://www.flysfo.com/sites/default/files/media/sfo/community-environment/sfo-2014-sustainability-report.pdf, accessed February 5, 2021.
[101] California Department of Resources Recycling and Recovery, SWIS Facility/Site Activity Details, Altamont Landfill & Resource Recovery (01-AA-0009), 2019, https://www2.calrecycle.ca.gov/SolidWaste/SiteActivity/Details/7?siteID=7, accessed February 12, 2021.
[102] San Francisco International Airport, *Zero Waste Plan*, https://www.flysfo.com/sites/default/files/media/sfo/community-environment/13259_Zero_Waste_Roadmap.pdf, accessed April 1, 2021.
[103] Information provided by the project sponsor.

With the Airport's existing recycling programs and the available daily capacity of the Altamont Landfill, non-recyclable construction waste from the proposed project would not cause the landfill to exceed its remaining capacity of 65,400,000 cubic yards.

Based on these factors, the proposed project would not generate solid waste in excess of state or local standards or in excess of the capacity of local infrastructure, and would comply with federal, state, and local management and reduction statutes and regulations related to solid waste. Therefore, this impact would be ***less than significant***.

Impact C-UT-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact on utilities and service systems. ***(Less than Significant)***

The geographic context for the analysis of potential cumulative impacts includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Implementation of the proposed project, in combination with these cumulative projects, would result in temporary increases in water consumption and wastewater and solid waste generation. The San Francisco Public Utilities Commission has accounted for such growth in its water demand and wastewater service projections, and SFO has implemented various programs to divert solid waste from landfills. For these reasons, the proposed project would not combine with cumulative projects to create a significant cumulative impact on utilities and service systems. Therefore, this impact would be ***less than significant***.

---

14. Public Services

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
14. PUBLIC SERVICES. Would the project:					
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services such as fire protection, police protection, schools, parks, or other public facilities?	☐	☐	☒	☐	☐

The proposed project's impacts on parks are discussed in Section E.11, Recreation.

Impact PS-1: The proposed project would not result in substantial adverse physical impacts from new or altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any public services, such as fire protection, police protection, schools, or other public facilities. ***(Less than Significant)***

There are no residential uses at the Airport; therefore, the proposed project would not create any additional demand for schools or other public facilities, such as libraries.

The San Francisco Fire Department and San Francisco Police Department have Airport bureaus that serve SFO. The proposed project could marginally increase the need for fire and emergency medical services, and possibly police services, due to the increased activity on the project site during construction. Incidents requiring law enforcement, fire protection, or emergency medical services could occur during construction of the proposed project. Responding to such incidents is routine for the police and fire departments, as construction projects are common and ongoing at the Airport. The proposed project could increase the number of service calls received from the area because an average of 40 construction workers would be onsite during project construction (and a maximum of 180 construction workers would be onsite during the peak construction period when multiple reaches overlap); however, this increase would be short term. Although the construction duration and design for Reach 16 is not currently known, similar to Reaches 1–15, construction of Reach 16, if necessary, would be temporary and would not result in a permanent increase in the number of employees at the Airport. Therefore, the proposed project would not require the expansion or construction of new or altered fire and police service facilities at the Airport. As such, the proposed project would have a ***less-than-significant*** impact on public services.

Impact C-PS-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact on public services. ***(Less than Significant)***

The geographic context for the analysis of potential cumulative impacts includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Cumulative projects could incrementally increase the demand for public services through the addition of employees or new residents in the project area. However, as described under Impact PS-1, the proposed project would not permanently increase demand for fire and police services at the Airport, and the Airport's fire and police services are adequately staffed to provide appropriate emergency response during construction of the proposed project. Cumulative projects not located on Airport property do not have the same service providers; therefore, the proposed project would not combine with these cumulative projects to affect their service levels. For these reasons, the proposed project would not combine with the cumulative projects to create a significant cumulative impact on public services. Therefore, this impact would be ***less than significant***.

15. Biological Resources

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
15. BIOLOGICAL RESOURCES. Would the project:					
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☒	☐	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☒	☐	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☒	☐	☐	☐	☐
f) Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan?	☒	☐	☐	☐	☐

The proposed project could result in significant impacts on biological resources. All biological resources topics are addressed in Draft EIR Section 4.D, Biological Resources.

16. Geology and Soils

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
16. GEOLOGY AND SOILS. Would the project:					
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:					
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☒	☐	☐	☐	☐
ii) Strong seismic ground shaking?	☒	☐	☐	☐	☐
iii) Seismic-related ground failure, including liquefaction?	☒	☐	☐	☐	☐
iv) Landslides?	☒	☐	☐	☐	☐
b) Result in substantial soil erosion or the loss of topsoil?	☒	☐	☐	☐	☐
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☒	☐	☐	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	☒	☐	☐	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water?	☒	☐	☐	☐	☐
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☒	☐	☐	☐	☐

The proposed project could result in significant impacts related to geology and soils. All geology and soils topics are addressed in Draft EIR Section 4.E, Geology and Soils.

17. Hydrology and Water Quality

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
17. HYDROLOGY AND WATER QUALITY. Would the project:					
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?	☒	☐	☐	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☒	☐	☐	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner that would:					
i) Result in substantial erosion or siltation on- or offsite;	☒	☐	☐	☐	☐
ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on or offsite;	☒	☐	☐	☐	☐
iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☒	☐	☐	☐	☐
iv) Impede or redirect flood flows?	☒	☐	☐	☐	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due a project inundation?	☒	☐	☐	☐	☐
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☒	☐	☐	☐	☐

The proposed project could result in significant hydrology and water quality impacts. All hydrology and water quality topics are addressed in Draft EIR Section 4.F, Hydrology and Water Quality.

18. Hazards and Hazardous Materials

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
18. HAZARDS AND HAZARDOUS MATERIALS. Would the project:					
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☒	☐	☐
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐	☐
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	☐	☐	☐	☐	☒

The project site is not mapped as being in or adjacent to a Very High Fire Hazard Severity Zone.[104] Therefore, topic 18(g) is not applicable to the proposed project and is not discussed further in this section.

CONCEPTS AND TERMINOLOGY

A *hazardous material* is defined as any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment (California Health and Safety Code

[104] California State Geoportal, California Fire Hazard Severity Zone Viewer, https://gis.data.ca.gov/datasets/789d5286736248f69c4515c04f58f414?fullScreen=true, accessed April 1, 2021.

section 25501(n)(1)). The term refers to both hazardous substances and hazardous wastes. Under federal and state laws, any material, including wastes, may be considered hazardous if it is specifically listed by statute as such or if it is toxic (causes adverse human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials), or reactive (causes explosions or generates toxic gases).

Hazardous wastes are hazardous substances that no longer have practical use, such as materials that have been spent, discarded, discharged, spilled, or contaminated, or are being stored until they can be disposed of properly (California Code of Regulations [CCR] title 22, section 66261.10). Soil that is excavated from a site containing hazardous materials is a hazardous waste if it exceeds specific criteria established in CCR title 22, sections 66261.20 through 66261.24. Multiple agencies regulate hazardous substances, and cleanup requirements for hazardous releases are determined on a case-by-case basis according to the agency with lead jurisdiction over a contaminated site (e.g., California Department of Toxic Substances Control, State Water Resources Control Board, or San Mateo County Environmental Health Services).

REGULATORY FRAMEWORK FOR HAZARDOUS MATERIALS HANDLING

The following regulations and agency actions apply to the handling, storage, and disposal of hazardous materials:

- **Federal Toxic Substances Control Act/Resource Conservation and Recovery Act/Hazardous and Solid Waste Act.** These acts established a program administered by the U.S. Environmental Protection Agency to regulate the generation, transport, treatment, storage, and disposal of hazardous waste. The Resource Conservation and Recovery Act was amended in 1984 by the Hazardous and Solid Waste Act, which affirmed and extended the “cradle-to-grave” system of regulating hazardous wastes.
- **U.S. Department of Transportation.** This federal agency regulates and works to ensure the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation. The transportation department develops regulations and standards for classifying, handling, and packaging shipments of hazardous materials within the United States to minimize threats to life, property, or the environment resulting from hazardous materials–related incidents.
- **Occupational Safety and Health Administration.** The state and federal Occupational Safety and Health Administration sets standards for safe workplaces and work practices, including reporting accidents and occupational injuries (Code of Federal Regulations [CFR] title 29, Part 1910) and 8 CCR section 5192). These standards would apply to all construction workers.
- **California Hazardous Materials Release Response Plan and Inventory Law of 1985.** This law, also known as the Business Plan Act, requires businesses storing hazardous materials onsite to prepare a hazardous materials business plan and submit it to the local certified unified program agency, which in this case is San Mateo County Environmental Health Services. This requirement would apply to the businesses that use hazardous materials during construction of the proposed project.
- **California Hazardous Waste Control Act.** Under this law (California Health and Safety Code section 25100 et seq.), the California Department of Toxic Substances Control regulates the generation, transportation, treatment, storage, and disposal of hazardous waste in California. The hazardous waste regulations establish criteria for identifying, packaging, and labeling hazardous wastes; dictate the management of hazardous waste; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills. These criteria would apply to hazardous waste generated as a part of the proposed project.

In addition to the federal and state regulations that apply to the handling, storage, and disposal of hazardous materials, SFO has established standard construction measures that are relevant to the handling, storage, and disposal of hazardous materials.[105] The Airport's Standard Construction Measures related to hazardous materials stipulate procedures for verifying the presence of contaminated soils, sludge, and groundwater and specify measures for remediation and disposal. The measures also specify management practices for installation, removal, and disposal of underground storage tanks and fuel lines. Contractors constructing projects that may accidentally or deliberately disturb or remediate contaminated soil, sludge, or groundwater must prepare a materials management plan and post-project documentation regarding contaminant investigation, remediation, and disposal activity. A hazardous materials site characterization report is required to document the findings of site investigations. The temporary controls division document requires the contractor to implement an onsite maintenance and spill containment program to reduce pollution from construction equipment. Activities subject to the standard construction measures include but are not limited to excavation, equipment and materials staging, soil remediation, and hazardous materials transport and disposal.

Moreover, all Airport projects must comply with the Airport's construction SWPPP guidelines. Projects affecting an area larger than 1 acre must prepare a project-specific SWPPP under the Airport's National Pollutant Discharge Elimination System permit. Projects affecting an area smaller than 1 acre must prepare an erosion and sediment control plan. The Airport must also continue to comply with state water board Order Number 99-045, which identifies areas of known contamination and stipulates soil and groundwater testing procedures for the Airport property. The Airport's Standard Construction Measures related to hazardous materials include the following:

- Division 01 33 16—Hazard and Hazardous Material Investigation and Remediation
- Division 01 35 13.43—Regulatory Requirements for Hazardous Waste
- Division 01 35 43.02—Underground Petroleum Products Storage Tank Removal
- Division 01 35 43.13—Asbestos Remediation
- Division 01 35 43.14—Lead Remediation
- Division 01 35 43.15—PCB Remediation
- Division 01 35 43.16—Excavation and Disposal of Contaminated Soils, Sludge, and Water
- Division 01 57 00—Temporary Controls
- Division 01 57 23.02—Storm Water Pollution Prevention, Erosion Controls

Regarding construction and demolition waste, chapter 7 of the San Francisco Environment Code requires contractors to divert at least 75 percent of construction and demolition waste material. The construction and demolition waste stream varies annually based on the scope and scale of capital improvement and facility maintenance projects; however, all major construction projects must comply with chapter 7 requirements. SFO regularly exceeds the required 75 percent construction and demolition diversion rates through implementation of the Airport's Standard Construction Measure Division 01 35 43.07, Recovery, Reuse, and Recycling Requirements, and maintains a consistent diversion and recycling rate of more than 90 percent.

[105] San Francisco International Airport, *San Francisco International Airport Standard Construction Measures Implementation Subject: In Construction Contracts and Maintenance Projects*, March 3, 2020.

Impact HZ-1: The proposed project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials. *(Less than Significant)*

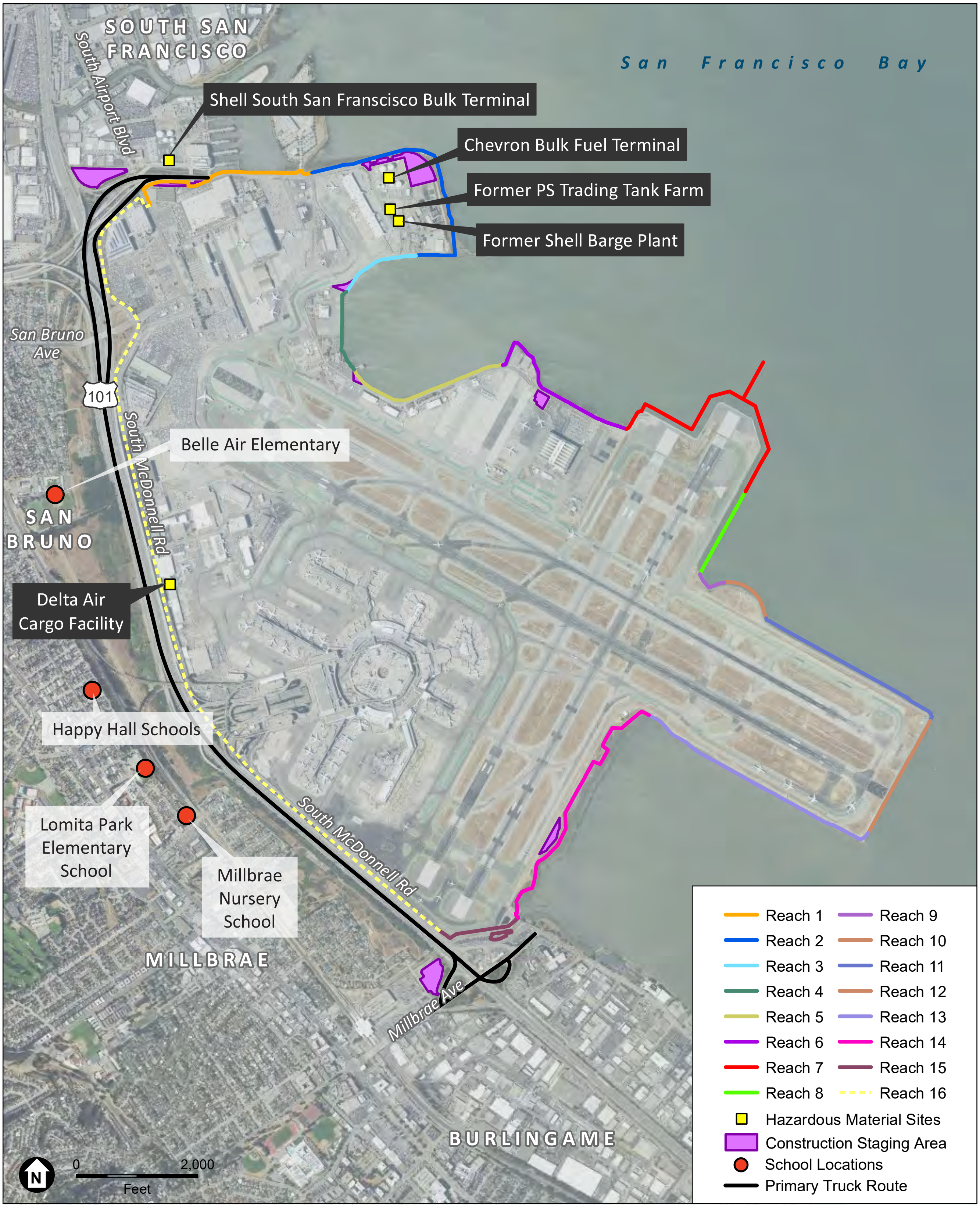
Construction activities would involve the routine transport, storage, use, and disposal of hazardous materials, such as fuel and lubricating oil for equipment, paving materials (asphalt and concrete), and paint and thinners. Such transport, storage, use, and disposal must comply with applicable regulations, such as the Federal Toxic Substances Control Act, Resource Conservation and Recovery Act, and Hazardous and Solid Waste Act; the U.S. Department of Transportation's hazardous materials regulations; and the state and federal Occupational Safety and Health Administration regulations. Hazardous materials would be transported, stored, used, and disposed of during construction; these materials are typically used in construction projects and would not represent the transport, storage, use, or disposal of acutely hazardous materials.[106] In addition, a construction SWPPP must be prepared and implemented during construction for projects disturbing more than 1 acre of soil, in accordance with state requirements, the Airport's Construction General Permit, and the SWPPP. As discussed in Section 4.F, Hydrology and Water Quality, of the Draft EIR and in the "Regulatory Framework for Hazardous Materials Handling" section above, the SWPPP requires projects to implement best management practices for hazardous materials storage and soil stockpiles, conduct inspections and maintenance, train employees, and contain releases to prevent runoff into existing stormwater collection systems or waterways. Because regulatory compliance is mandatory and involves containment activities to minimize the effects of an accidental release of hazardous materials, such an accidental release during construction or operation would have a less-than-significant impact on human health and the environment. Hazards associated with the disturbance of existing soil and groundwater contamination are discussed below under Impact HZ-3.

Because compliance with existing regulations is mandatory, construction activities for the proposed project would not create a significant hazard for the public or the environment through the routine transport, use, or disposal of hazardous materials. Therefore, this impact would be ***less than significant***.

Impact HZ-2: The proposed project would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. *(Less than Significant)*

Four schools are located within 0.25 mile of Reach 16: Millbrae Nursery School, 86 Center Street in Millbrae; Lomita Park Elementary School, 200 Santa Helena Avenue in Millbrae; Happy Hall Schools, 233 Santa Inez Avenue in San Bruno; and Belle Air Elementary School, 450 3rd Avenue in San Bruno (see **Figure 10**). All four schools are located west of U.S. 101 and west of the Caltrain rail line. Construction and materials equipment, along with any hazardous materials, would enter and exit the project site from the U.S. 101 ramps either at San Bruno Avenue, about 0.5 mile north of Belle Air Elementary School, or Millbrae Avenue, about 1 mile south of Millbrae Nursery School. Therefore, construction equipment and materials delivery would not pass by the schools.

[106] *Acutely hazardous materials* are materials that have been found to be fatal to humans in low doses, or that are otherwise capable of causing or significantly contributing to an increase in serious irreversible or incapacitating reversible illness (40 CFR 261.11[a][2]).



SOURCE: SFO, 2021; AECOM 2020, 2021; Arcadis 2020; ATS 2011; ECM 2016

SFO Shoreline Protection Program

FIGURE 10
HAZARDOUS MATERIALS SITES

In addition, and as discussed above under Impact HZ-1, applicable regulations such as the Federal Toxic Substances Control Act, Resource Conservation and Recovery Act, and Hazardous and Solid Waste Act, the U.S. Department of Transportation's hazardous materials regulations, and California Occupational Safety and Health Administration regulations regulate the transportation of hazardous materials to minimize the potential for spills and establish spill cleanup procedures.

Construction equipment and vehicles delivering materials would not pass by the schools and compliance with existing regulations is mandatory. Therefore, construction activities for the proposed project would not create a significant hazard for schools relative to the transport of hazardous materials by schools. As such, this impact would be ***less than significant***.

Impact HZ-3: The proposed project is located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5, but they would not create a significant hazard to the public or environment. *(Less than Significant)*

- The following hazardous materials sites at the locations shown on Figure 10 are known to have contaminated soil and/or groundwater that could affect the proposed project:
- **Shell South San Francisco Bulk Terminal near Reach 1 (Regional Water Quality Control Board Case Number: SL373231180).** This site is an operating petroleum product distribution terminal just north of the Airport across North Access Road and Reach 1.[107] San Bruno Creek is located south of the site across North Access Road. The site is currently undergoing monitoring and cleanup for the release of gasoline, jet fuel, and diesel into soil and groundwater. Monitoring wells along the southern border of the site detected fuel and fuel additives in groundwater during the fourth quarter 2020 monitoring event. It is unknown whether the extent of contamination extends to the area where Reach 1 construction activities would occur.
- **Chevron Bulk Terminal near Reach 2 (Regional Water Quality Control Board Case Number: SL0608146307).** This site is an operating petroleum product distribution terminal located on Airport property at the northeast end of North Access Road.[108] The site is currently undergoing monitoring and cleanup for the release of gasoline and jet fuel into soil and groundwater. Monitoring wells along the border of the site near Reach 2 detected fuel and fuel additives in groundwater during the August 2020 monitoring event. The contamination in groundwater extends at least to North Access Road and may extend into where Reach 2 construction activities would occur. In addition, free-floating product is present in groundwater in the central portion of this site, indicating that cleanup will continue for some time and that this site will remain a source of contamination to downgradient areas.
- **Former PS Trading Tank Farm near Reaches 2 and 3 (Regional Water Quality Control Board Case Number: SL0608182371).** This site is a former petroleum hydrocarbon product tank farm; the four aboveground storage tanks and associated piping were removed in 2002.[109] This site is located on Airport property at the northwest end of North Access Road. The site underwent monitoring and cleanup for the release of jet fuel into soil and groundwater from 1987 to 2010. The cleanup was completed to the low-threat cleanup level established by the regional board, which authorized abandoning the site's monitoring wells and provided a "No Further Action" letter. The regional board is allowing the residual levels of jet fuel in groundwater to naturally attenuate. This means that residual levels of jet fuel may still

[107] AECOM, *2021 Remedial Action Effectiveness Evaluation Report, Shell South San Francisco Terminal, 135 North Access Road, South San Francisco, California*, January 29, 2021.
[108] Arcadis, *Annual Groundwater Monitoring Report, 2020*, December 17, 2020.
[109] ATS, *Well Abandonment Activities, Plot 23 San Francisco International Airport, San Francisco, California*, March 9, 2011.

be present in soil and/or groundwater in this area along North Access Road and ground-disturbing construction activities along Reaches 2 and 3 may encounter residual jet fuel.

- **Former Shell Barge Plant near Reaches 2 and 3 (Regional Water Quality Control Board Case Number: SL374231190).** This site is a former petroleum product tank farm; the eight aboveground storage tanks and associated piping were removed in 1996.[110] This site previously underwent cleanup activities and is currently undergoing monitoring for the release of jet fuel and aviation gasoline to soil and groundwater. During the August 2020 monitoring event, monitoring wells along the southern border of the site detected fuel in groundwater. The extent of contamination in groundwater as of August 2020 did not extend to the area where Reaches 2 and 3 construction activities would occur. It is uncertain whether residual contamination is present along Reaches 2 and 3.
- **Delta Air Cargo Facility near Reach 16** (**Regional Water Quality Control Board Case Number: 41S0131).** This site is an open cleanup site listing for Building 612, located east of North McDonnell Road and Reach 16.[111] The case's status as of 2016 was verification monitoring for jet fuel in groundwater; no monitoring or cleanup activity is reported to have occurred since then. The case for this site has not been closed by the regulatory agency (i.e., the regional board) and no activity is known to have occurred since 2016. It is unknown whether jet fuel in soil and groundwater at this site extends to the construction areas for Reach 16.

As summarized above, the proposed construction areas along Reaches 1, 2, 3, and 16 are close to known fuel leak sites. It is uncertain whether contamination from these sites extends into the proposed project's construction areas. Given the long history of use of fuels and oils, lubricants and greases, paints and thinners, and cleaning solvents at the Airport, ground-disturbing activities could encounter hazardous materials. Therefore, the proposed project would be required to implement health and safety plans and soil and groundwater management plans to reduce potentially significant impacts.

The project sponsor would be subject to federal Occupational Safety and Health Administration regulations (29 CFR section 1910.120) and California Occupational Safety and Health Administration regulations (8 CCR section 5192), which require the preparation of a site-specific health and safety plan. The construction contractor would implement the health and safety plan to protect construction workers, the public, and the environment during all ground-disturbing and demolition activities. The health and safety plan would be submitted to SFO for review before the start of demolition and construction activities. The health and safety plan would include but not be limited to the following elements:

- Designation of a trained, experienced site safety and health supervisor who has the responsibility and authority to develop and implement the site's health and safety plan
- A summary of all potential risks to demolition and construction workers and maximum exposure limits for all known and reasonably foreseeable site chemicals
- Specified personal protective equipment and decontamination procedures, if needed
- Documentation showing that health and safety plan measures have been implemented during construction (e.g., tailgate safety meeting notes with sign-up sheet for attendees)

[110] AECOM, *Annual 2020 Groundwater Monitoring Report, Former Shell Oil Company Barge Plant (Plot 22), San Francisco International Airport, South San Francisco, California*, November 19, 2020.
[111] ECM, *Delta Air Lines Facility, San Francisco International Airport, San Francisco, CA*, October 28, 2016.

- A requirement specifying that any site worker who identifies hazardous materials has the authority to stop work and notify the site safety and health supervisor
- Emergency procedures, including the route to the nearest hospital(s)
- Procedures to follow if evidence of potential soil or groundwater contamination is encountered (such as soil staining, noxious odors, debris, or buried storage containers). These procedures would be followed in accordance with hazardous-waste operations regulations and would specifically include but not be limited to immediately stopping work in the vicinity of the unknown hazardous materials release; notifying SFO; and retaining a qualified environmental firm to perform sampling and remediation.

In support of the health and safety plan described above, and as required by the Airport's Standard Construction Measure Division 01 33 16, Hazard and Hazardous Material Investigation and Remediation, the construction contractors would be required to develop and implement soil and groundwater management plans before any ground-disturbing activity occurs along any of the reaches, not just the reaches near known hazardous materials sites. The plans may be prepared for the combined 16 reaches, a combination of reaches, or individual reaches. Each plan would include the following information, at a minimum:

- Site description, including the hazardous materials that may be encountered
- Roles and responsibilities of onsite workers, supervisors, and regulatory agencies
- Training for site workers focused on the recognition of and response to encountering hazardous materials
- Protocols for the safe, appropriate, and lawful testing, handling, removal, transport, and disposal of all excavated soil materials and dewatering effluent
- A requirement to report to the overseeing regulatory agency and SFO, documenting that site activities were conducted in accordance with the soil and groundwater management plan(s)

The soil and groundwater management plans would be submitted to SFO for review and approval before the start of demolition and construction activities. The contract specifications would mandate full compliance with all applicable federal, state, and local regulations related to the identification, transportation, and disposal of hazardous materials.

For work at locations that would encounter groundwater and require dewatering, as part of the soil and groundwater management plan, contractors would include a groundwater dewatering control and disposal plan specifying how groundwater (i.e., dewatering effluent), if encountered, would be handled and disposed of in a safe, appropriate, and lawful manner. The groundwater portion of the soil and groundwater management plan would include the following information, at a minimum:

- The locations at which groundwater dewatering is likely to be required
- Test methods for analyzing groundwater for hazardous materials
- Appropriate treatment and/or disposal methods
- A discussion of discharge to a publicly owned treatment works or the stormwater system, in accordance with any regulatory requirements the treatment works may have, if this effluent disposal option is to be used.

Although the project site is included on a list of hazardous materials sites, implementing the protocols on the proper use, transport, and disposal of hazardous materials in accordance with the above-mentioned regulatory requirements would ensure that the impact of the proposed project related to the use, transport, and disposal of hazardous materials during construction would be ***less than significant***.

Impact HZ-4: The proposed project would not result in a safety hazard or excessive noise for people residing or working in the project area. ***(Less than Significant)***

The standards and notification requirements for objects affecting navigable airspace are established in 14 CFR Part 77. These requirements apply to safety and noise hazards during both construction (e.g., construction equipment) and operations (e.g., the height of the proposed shoreline protection system). This notification serves as the basis for:

- Evaluating the effect of the construction or alteration on operating procedures
- Determining the potential hazardous effect of the proposed construction on air navigation
- Identifying mitigation measures to enhance safe air navigation
- Charting new objects

- Notification enables the Federal Aviation Administration (FAA) to identify potential aeronautical hazards in advance, thus preventing or minimizing adverse impacts on the safe and efficient use of navigable airspace. Because the proposed project would include construction activities located within 20,000 feet of runways, the project would be required to comply with 14 CFR Part 77. The project sponsor would be required to prepare and submit FAA Form 7460-1, *Notice of Proposed Construction or Alteration*, to the FAA 45 days before construction work. Form 7460-1 would describe the proposed construction activities, measures to prevent conflicts with aircraft, and measures to minimize distractions to aircraft pilots. The FAA evaluates the proposed work and the measures to determine hazards to navigable airspace. The following information is required:
- A drawing (preferably scaled) showing the location of the object relative to the nearest active runways. This may be a marked-up airport layout plan or terminal area sheet.
- The perpendicular distance of the proposed object to the nearest active runway centerlines
- The distance along the centerline (actual or extended) from the runway end to the perpendicular intercept point
- The elevation above mean sea level at the site of the proposed object
- The height of the proposed object, including antennas or other appurtenances
- Accurate geodetic coordinates conforming to North American Datum of 1983
- Sketches, drawings, etc., showing the type of construction or alteration being proposed

The FAA conducts the review as an aeronautical study and makes a determination detailing the study's findings and approving or denying the proposed changes.

All 16 reaches are located within the Airport. Construction transportation routes would not cross active runways and taxiways; however, some road closures or lane restrictions would be required. As discussed in Section E.6, Transportation and Circulation, in compliance with the Airport's Standard Construction Measures Division 01 35 43.01, Demolition, and Division 01 55 26, Traffic Regulation, SFO or its contractors would prepare and implement a traffic control plan that conforms to the California Manual of Uniform Traffic

Control Devices and is consistent with SFO traffic regulations and the policies of the police department's Airport Bureau.

All proposed road or lane closures would require submittal and approval of a site-specific traffic control plan. Implementing the traffic control plan would minimize the potential for hazards related to construction vehicle traffic (e.g., materials and construction waste hauling). Additionally, contractors' vehicles, equipment, and materials must be stored and staged in designated areas. The traffic control plan may be prepared for construction activities in all reaches, for groups of reaches, or for individual reaches. With implementation of a traffic control plan, impacts related to safety hazards resulting from the proposed project would be ***less than significant***.

Construction activities at Reaches 7–14 would occur at the ends of or adjacent to runways. Given the existing noise generated by aircraft, the proposed project would not significantly add to existing noise levels (see Section 4.B, Noise, of the Draft EIR for more information regarding noise impacts). Although the construction activities would comply with the previously noted site-specific traffic control plan, such activities would include movement of equipment and workers close to the runways, which could result in conflicts with aircraft and/or distractions for aircraft pilots.

The proposed project would be subject to the requirements of 14 CFR Part 77. SFO would discuss the proposed construction measures with the FAA and submit Form 7460-1 for review. The FAA would review the proposed construction activities and would determine whether construction must be restricted, aircraft activity needs to be modified, or pilots must be notified. To minimize operational disruptions to aircraft, construction at the end of or parallel to runways would be conducted at night. Compliance with the FAA requirements would prevent conflicts with aircraft and distractions to aircraft pilots. Therefore, impacts related to excessive noise for people residing or working in the project area resulting from the proposed project would be ***less than significant***.

The heights of the proposed shoreline protection system at each reach are shown in Table 2-3, p. 2-9, of Chapter 2, Project Description. About half of the reaches are not located in the vicinity of the runways and therefore would not present hazards to aircraft. Reaches located in the vicinity of the runways include Reach 7 (maximum height of 13.5 feet), Reach 8 (maximum height of 9.5 feet), Reach 9 (maximum height of 7.2 feet), Reach 10 (maximum height of 6 feet), Reach 11 (maximum height of 4.8 feet), Reach 12 (maximum height of 6.7 feet), Reach 13 (maximum height of 9.5 feet), Reach 14 (maximum height of 11.8 feet), and Reach 15 (maximum height of 10 feet tall, including the chain-link fence). The height of each proposed reach is dictated by the FAA airfield design standards specified in Airport Circular 150/5300-13A, Airport Design. The FAA standards prescribe airfield design measures to ensure safety and efficiency at airports, including accommodation of critical airspace surfaces surrounding the runways and taxiways. Critical airspace surfaces must be kept clear of obstructions (i.e., the proposed shoreline protection system) for operational safety purposes. Compliance with the FAA requirements would prevent conflicts with aircraft and distractions to aircraft pilots. Therefore, impacts related to safety hazards for aircraft resulting from the proposed project would be ***less than significant***.

Impact HZ-5: The proposed project would not impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan. *(Less than Significant)*

The transportation of equipment and materials and removal of demolition debris would require the use of Airport roads. Transportation routes would not cross active runways and taxiways, but could require temporary road closures or lane restrictions. The proposed project would have a significant impact on implementation of an adopted emergency response or emergency evacuation plan if construction activities were to interfere with travel by SFO's emergency response vehicles or restrict access to critical Airport facilities. As discussed in Section E.6, Transportation and Circulation, and above under Impact HZ-4, project contractors would be required to prepare and implement a traffic control plan. The traffic control plan would require that all movement of vehicles, equipment, and trucks be coordinated with SFO's Airport Operations department. The plan may be prepared for construction activities in all reaches, for groups of reaches, or for individual reaches. With the implementation of a traffic control plan, traffic flow would be maintained so that emergency vehicles would be able to pass by construction areas. The impact of the proposed project related to effects on emergency access would be ***less than significant***.

Impact C-HZ-1: The proposed project, in combination with cumulative projects, would not result in a significant cumulative impact related to hazards and hazardous materials. ***(Less than Significant)***

As noted above, the proposed project would have no impacts with respect to being located in or adjacent to a Very High Fire Hazard Severity Zone. Accordingly, the proposed project would not combine with cumulative projects to create cumulative impacts related to wildland fires and this topic is not discussed further.

Hazardous materials impacts could result from the proposed project's use and transport of hazardous materials, and from encountering contaminated soil and groundwater during construction. The proposed project also could result in hazards related to the impairment of emergency response and fires. However, these impacts would be primarily restricted to the project area and immediate vicinity. Impacts related to hazardous materials are generally site-specific and depend on the nature and extent of the hazardous materials release, and on soil and groundwater conditions. For example, hazardous materials incidents (e.g., spills, exposure to contaminated soil or groundwater) tend to be limited to a localized area surrounding the immediate incident site, and could result in cumulative impacts if two or more hazardous materials releases were to spatially overlap.

The geographic context for the analysis of potential cumulative impacts includes the development and infrastructure projects located within 0.25 mile of the project site listed in Table 4-1, p. 4-6, in Draft EIR Chapter 4, Environmental Setting, Impacts, and Mitigation Measures, and mapped on Figure 4-1, p. 4-8. Construction activities for the cumulative projects at the Airport would be subject to compliance with the same existing hazardous materials regulations as discussed for the proposed project. The regulations cover the transportation, use, and disposal of hazardous materials, including spill response. Cumulative projects that have spills of hazardous materials would be required to remediate their respective sites to the same established regulatory standards as the proposed project. This would be the case regardless of the number, frequency, or size of the release(s). The less-than-significant effects that would remain after cleanup of one project would not combine with the effects of cumulative projects to cause a potential significant cumulative impact, because residual impacts are highly site-specific and would be below the regulatory standards for each site. For these reasons, the proposed project combined with the cumulative projects would not result in a significant cumulative impact related to the use of hazardous materials, and this impact would be ***less than significant***.

Construction of two or more projects that occur at the same time and use the same roads could cause interference with emergency access and response. As discussed in Section E.6, Transportation and Circulation, the contractors for the proposed project would be required to prepare and implement a traffic control plan, which would manage the movement of vehicles to maintain emergency access. Contractors for cumulative projects needing to close or restrict lane access would be required to prepare and implement similar traffic control plans to maintain traffic flow and prevent interference with emergency access. With the implementation of traffic control plans, the proposed project combined with the cumulative projects would not result in a significant cumulative impact with respect to emergency access, and this impact would be ***less than significant***.

As described under Impact HZ-2, some of the proposed project's construction activities would occur at the end of or parallel to runways. Potential impacts related to operational conflicts and aircraft safety would be reduced to a less-than-significant level through completion of the FAA's Form 7460-1 review process and compliance with FAA requirements. None of the cumulative projects would be located at or near the ends of SFO runways or taxiways. Therefore, the proposed project combined with the cumulative projects would not result in a significant cumulative impact related to interference with aircraft operations during landing or takeoff. Therefore, cumulative impacts with respect to aircraft hazards would be ***less than significant***.

Although the cumulative projects would generate some level of noise during their construction activities, the level of noise from both the proposed project combined with the cumulative projects would not be significant compared to the existing noise levels generated by aircraft operations. Therefore, the proposed project combined with the cumulative projects would not result in a significant cumulative impact with respect to excessive noise, and this impact would be ***less than significant***.

---

19. Mineral Resources

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
19. MINERAL RESOURCES. Would the project:					
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒	☐
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒	☐

Impact MR-1: The proposed project would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state. ***(No Impact)***

For purposes of this analysis, mineral resources include sand, clay, gravel, and rock deposits that could be located within the project area and that would be of value to the region and residents of the state.

The California Department of Conservation, Division of Mines and Geology (now known as the California Geological Survey) has mapped mineral resources in the San Francisco Bay Area, including resources such as sand and gravel and other economically valuable resources.[112] The entire project site is designated as MRZ-1, which includes “areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.”[113] Therefore, ***no impact*** related to valuable mineral resources would occur as a result of the proposed project.

Impact MR-2: The proposed project would not result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. *(No Impact)*

The San Francisco General Plan states that, as an urban place, San Francisco does not contain mineral resources to any appreciable extent and, as a result, consideration of mineral resources is omitted from the general plan. The City of Millbrae General Plan, San Bruno General Plan, and South San Francisco General Plan make no mention of locally important mineral resource recovery sites. Therefore, ***no impact*** related to local mineral resource recovery sites would occur as a result of the proposed project.

Impact C-MR-1: The proposed project, in combination with cumulative projects, would not result in the loss of valuable mineral resources. *(No Impact)*

As described above, the entire Airport is in an area designated MRZ-1, which indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence. Because the proposed project would result in no impact on mineral resources, the proposed project would not have the potential to combine with cumulative projects to result in a significant cumulative impact to mineral resources. As such, the proposed project would have ***no impact*** on mineral resources.

20. Energy

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
20. ENERGY. Would the project:					
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐	☐

[112] California Department of Conservation, Division of Mines and Geology, Mineral Land Classification: Aggregate Materials in the San Francisco-Monterey Bay Area, Special Report 146, Part II, Plate 2.41 San Francisco North Quadrangle and Plate 2.42 San Francisco South Quadrangle, 1987.
[113] Ibid.

Impact EN-1: The proposed project would not result in wasteful, inefficient, or unnecessary consumption of energy resources during construction or operation. ***(Less than Significant)***

The proposed project would construct shoreline protection infrastructure and would not include operational uses that would result in wasteful, inefficient, or unnecessary consumption of energy resources. Accordingly, the following analysis addresses potential project impacts related to wasteful, inefficient, or unnecessary consumption of energy resources during construction of the proposed project.

Construction of the proposed project would require the use of fuel-powered equipment and vehicles, resulting in the consumption of gasoline or diesel fuel. Heavy construction equipment (e.g., cranes, dump trucks, backhoes, loaders) and generators would be diesel powered, while smaller construction vehicles such as pickup trucks would be gasoline powered. The precise amount of fuel required for construction of the proposed project is uncertain; however, it is expected that the quantity of gasoline and diesel used by construction equipment, workers' vehicles, and haul vehicles would be comparable to the quantity used during large construction projects in the area. Electric power would be used mainly to provide service to the concrete/industrial saws, sweepers/scrubbers, welding machines, air compressors, cranes, forklifts, pumps, cement and mortar mixers, generators, and portable equipment.

The construction fleet—both on-road vehicles and off-road equipment—may also use biodiesel or renewable diesel, provided that the use of such fuels is demonstrated to reduce emissions of criteria air pollutants and GHGs compared to conventional fuel. Further, the construction contractors would be required to use electric equipment where feasible in compliance with the Airport's Standard Construction Measure Division 01 57 00.

In addition, indirect electricity usage would occur for the supply, distribution, and treatment of water used for construction. This analysis conservatively assumes that all electrical power would be obtained from generators. The construction contractor would have a financial incentive to use fuel and energy efficiently, because excess usage would increase costs and reduce profits. The use of fuel and energy during construction would not be wasteful or inefficient, and the impact of construction-related fuel and energy usage would be less than significant.

As a condition of project approval, all plans, specifications, calculations, and methods of construction would meet the requirements of the California Uniform Building Code and SFO standards in accordance with the Airport Building Regulations (Appendix F of the SFO Rules and Regulations), which would ensure efficient use of fuel, water, and energy during project construction.[114] Therefore, the proposed project would not result in the wasteful, inefficient, or unnecessary consumption of energy resources. Therefore, the impact would be ***less than significant***.

Impact EN-2: The proposed project would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency. ***(Less than Significant)***

California's renewable energy and energy efficiency plans include the Renewables Portfolio Standard Program (as revised by SB X1-2), which requires utilities to increase their renewable energy generation to 33 percent by 2020, and the California Energy Efficiency Strategy Plan, which was developed to provide a roadmap for energy efficiency in California through the year 2020 and beyond. At the local level, the majority of San Francisco's energy-efficiency requirements are geared toward commercial and residential

[114] San Francisco International Airport, *Rules and Regulations*, 2019, Appendix F, Building Regulations, https://www.flysfo.com/sites/default/files/media/sfo/about-sfo/2018-10_RR_Appx_F.pdf, accessed February 12, 2021.

development and do not apply to the proposed project. The proposed project would involve a seven-year construction period associated with constructing a new shoreline protection system around the Airport. The proposed project would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency. Therefore, this impact would be ***less than significant***.

Impact C-EN-1: The proposed project, in combination with cumulative projects, would increase the use of energy, fuel, and water resources, but not in a wasteful manner. ***(Less than Significant)***

The geographic context for the analysis of potential cumulative impacts includes the development and infrastructure projects located within 0.25 mile of the project site identified in Table 4-1, Draft EIR p. 4-6, and Figure 4-1, Draft EIR p. 4-8. The cumulative projects would develop commercial and Airport-related uses that would result in a cumulative increase in the demand for energy, fuel, and water.

Although overall energy demand in California is increasing commensurate with the increasing population, the state is also making concerted energy conservation efforts. Cumulative projects would create demand for energy and fuel; however, both local and state policies seek to minimize increases in demand through conservation and energy efficiency regulations and policies so that energy is not used in a wasteful manner. Nearby cumulative projects would be subject to the same statewide energy and water conservation ordinances as the proposed project. Therefore, the proposed project, in combination with cumulative projects, would result in a ***less-than-significant*** cumulative impact related to the wasteful use of energy, fuel, and water resources.

---

21. Agriculture and Forestry Resources

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
21. AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:					
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☐	☒

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use or forest land to non-forest use?	☐	☐	☐	☐	☒

The project site is an operational international airport and is not used for farming or agricultural activities. The land on the project site is designated by the California Department of Conservation's Farmland Mapping and Monitoring Program as urban and built-up land.[115] Because the project site does not contain agricultural uses and is not zoned for such uses, the proposed project would not require the conversion of any land designated as prime farmland, unique farmland, or Farmland of Statewide Importance to nonagricultural use. The proposed project would not conflict with any existing agricultural zoning or Williamson Act contracts.[116] Moreover, the Airport does not contain forest or timberlands, does not support timber uses, and is not zoned for timber uses. Therefore, the proposed project would not conflict with zoning for forest land, cause a loss of forest land, or convert forest land to a different use. For these reasons, agriculture and forestry topics are ***not applicable*** to the proposed project.

---

[115] California Department of Conservation, Division of Land Resource Protection, California Important Farmland Finder, https://maps.conservation.ca.gov/DLRP/CIFF/, accessed April 1, 2021.
[116] California Department of Conservation, *California Important Farmland: 1984–2018*, https://maps.conservation.ca.gov/dlrp/ciftimeseries/, accessed February 22, 2021; San Francisco International Airport is identified as "Urban and Built-Up Land" according to this map.

22. Wildfire

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
22. WILDFIRE. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:					
a) Substantially impair an adopted emergency response plan or emergency evacuation plans?	☐	☐	☐	☐	☒
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☐	☐	☒
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☐	☐	☒
d) Expose people or structure to significant risks including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☐	☒

The project site is not mapped as being in or adjacent to a Very High Fire Hazard Severity Zone.[117] Therefore, these topics are ***not applicable*** to the proposed project.

[117] California State Geoportal, California Fire Hazard Severity Zone Viewer, https://gis.data.ca.gov/datasets/789d5286736248f69c4515c04f58f414?fullScreen=true, accessed April 1, 2021.

23. Mandatory Findings of Significance

Topic	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact	Not Applicable
23. MANDATORY FINDINGS OF SIGNIFICANCE. Does the project:					
a) Have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐	☐
b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☒	☐	☐	☐	☐
c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐	☐	☐

As discussed in this initial study, the proposed project is anticipated to have less-than-significant impacts on most of the environmental topics discussed. Where necessary, mitigation measures have been identified to reduce impacts to less-than-significant levels. Mitigation measures are included for the following topics: archeology, tribal cultural resources, noise, air quality, biological resources, and hydrology and water quality. However, even with implementation of mitigation measures, the proposed project could have potentially significant impacts related to noise, air quality, biological resources, geology and soils, and hydrology and water quality; therefore, these topics are discussed and analyzed further in the Draft EIR.

The proposed project, in combination with cumulative projects, as described in Section E of this initial study, would not result in significant cumulative impacts on land use and planning, population and housing, archeological resources, tribal cultural resources, transportation and circulation, GHG emissions, wind, shadow, recreation, utilities and service systems, public services, hazards and hazardous materials, mineral resources, energy resources, agriculture and forestry resources, and wildfire with implementation of the identified mitigation measures. However, the proposed project, in combination with cumulative projects, could result in cumulative impacts related to noise, air quality, biological resources, geology and soils, and hydrology and water quality. These cumulative impacts are discussed and analyzed further in the Draft EIR.

Potential adverse effects on human beings have been considered as a part of the analysis of individual environmental topics in this initial study. As discussed above, the proposed project has the potential to result in significant impacts with respect to noise, air quality, biological resources, geology and soils, and hydrology and water quality, which could adversely affect human beings. The Draft EIR analyzes these topics and identifies mitigation measures where applicable.

F. Mitigation Measures

The following mitigation measures have been identified in this initial study to reduce potentially significant impacts resulting from the proposed project to less-than-significant levels. The project sponsor has agreed to implement all mitigation measures identified in the initial study.

Mitigation Measure M-CR-2a: Accidental Discovery. The following mitigation measure is required to avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in CEQA Guidelines section 15064.5(a) and (c).

ALERT Sheet. SFO shall distribute the Planning Department archeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor (including demolition, excavation, grading, foundation, pile driving, etc. firms); or utilities firm involved in soils-disturbing activities within the project site. Prior to any soils-disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel, including machine operators, field crew, pile drivers, supervisory personnel, etc. SFO shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) confirming that all field personnel have received copies of the Alert Sheet.

Discovery, Stop Work, and Notification. Should any indication of an archeological resource be encountered during any soils-disturbing activity of the project, SFO shall immediately notify the ERO and shall immediately suspend any soils-disturbing activities in the vicinity of the discovery until the ERO has determined what additional measures should be undertaken.

Archeological Consultant Identification and Evaluation. If the ERO determines that an archeological resource may be present within the project site, SFO shall retain the services of an archeological consultant. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource as well as if it retains sufficient integrity and is of potential scientific/ historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify, document, and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by SFO.

Discovery Treatment Determination. Measures might include preservation *in situ* of the archeological resource; an archeological monitoring program; an archeological testing program; and/or an archeological interpretation program. If an archeological interpretive, monitoring, and/or testing program is required, it shall be consistent with the Environmental Planning Division guidelines for such programs and shall be implemented immediately. The ERO may also require that SFO immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.

Consultation with Descendant Communities. On discovery of an archeological site associated with descendant Native Americans, the Overseas Chinese, or other potentially interested descendant group an appropriate representative of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site.

Archeological Data Recovery Plan. An archeological data recovery program shall be conducted in accordance with an Archeological Data Recovery Plan (ADRP) if all three of the following apply: (1) a resource has potential to be significant, (2) preservation in place is not feasible, and (3) the ERO determines that an archeological data recovery program is warranted. The project archeological consultant, SFO, and ERO shall meet and consult on the scope of the ADRP. The archeological consultant shall prepare a draft ADRP that shall be submitted to the ERO for review and approval.

The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- *Field Methods and Procedures.* Descriptions of proposed field strategies, procedures, and operations.
- *Cataloging and Laboratory Analysis.* Description of selected cataloging system and artifact analysis procedures.
- *Discard and Deaccession Policy.* Description of and rationale for field and post-field discard and deaccession policies.
- *Security Measures.* Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- *Final Report.* Description of proposed report format and distribution of results.
- *Curation.* Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Funerary Objects. The treatment of human remains and of funerary objects discovered during any soils disturbing activity shall comply with applicable State and federal laws. This shall include immediate notification of the San Mateo County Coroner and, in the event of the

Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission (NAHC), which will appoint a Most Likely Descendant (MLD). The MLD will complete his or her inspection of the remains and make recommendations or preferences for treatment within 48 hours of being granted access to the site (Public Resources Code section 5097.98). The ERO also shall be notified immediately upon the discovery of human remains.

SFO and ERO shall make all reasonable efforts to develop a Burial Agreement (Agreement) with the MLD, as expeditiously as possible, for the treatment and disposition, with appropriate dignity, of human remains and associated or unassociated funerary objects (as detailed in CEQA Guidelines section 15064.5(d)). The Agreement shall take into consideration the appropriate excavation, removal, recordation, scientific analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. If the MLD agrees to scientific analyses of the remains and/or associated or unassociated funerary objects, the archeological consultant shall retain possession of the remains and associated or unassociated funerary objects until completion of any such analyses, after which the remains and associated or unassociated funerary objects shall be reinterred or curated as specified in the Agreement.

Both parties are expected to make a concerted and good faith effort to arrive at a Burial Agreement. However, if SFO and the MLD are unable to reach an Agreement on scientific treatment of the remains and/or funerary objects, the ERO, with cooperation of SFO, shall ensure that the remains and/or funerary objects are stored securely and respectfully until they can be reinterred on the project site, with appropriate dignity, in a location not subject to further or future subsurface disturbance, in accordance with the provisions of state law.

Treatment of historic-period human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity, additionally, shall follow protocols laid out in the project archeological treatment document, and other relevant agreement established between SFO, the San Mateo County Coroner, and the ERO.

Public Interpretation Plan. The project archeological consultant shall submit a Public Interpretation Plan (PIP) if a significant archeological resource is discovered during a project. The PIP shall describe the interpretive product(s); locations or distribution of interpretive materials or displays; the proposed content and materials; persons or groups to be consulted for input on culturally appropriate interpretation, as applicable; the producers or artists of the displays or installation; and a long-term maintenance program. The PIP shall be sent to the ERO for review and approval. The PIP shall be implemented prior to occupancy of the project.

Archeological Resources Report. The project archeological consultant shall submit a confidential draft Archeological Resources Report (ARR) to the ERO that evaluates the historical significance of any discovered archeological resource, describes the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken, and discusses curation arrangements.

Once approved by the ERO, copies of the approved ARR shall be distributed as follows: California Archeological Site Survey Northwest Information Center (NWIC) shall receive one copy, and the ERO shall receive a copy of the transmittal of the ARR to the NWIC. The environmental planning division of the planning department shall receive one bound hardcopy of the ARR. Digital files that shall be submitted to the environmental division include an unlocked, searchable PDF version of the ARR, GIS shapefiles of the site and feature locations, any formal site recordation forms (CA DPR 523 series), and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The PDF ARR, GIS files, recordation forms, and/or nomination documentation should be submitted via USB or other stable storage device. If a descendant group was consulted during archeological treatment or will be consulted in the development of interpretive materials, a PDF of the ARR shall be provided to the representative of the descendant group.

Curation. If archeological data recovery is undertaken, materials and samples of future research value from significant archeological resources shall be permanently curated at a facility approved by the ERO.

Mitigation Measure M-CR-2b: Archeological Testing. Based on a reasonable presumption that buried or submerged archeological resources that qualify as historical resources under CEQA may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effects from the proposed project on such archeological resources.

In consultation with the ERO, SFO shall retain the services of an archeological consultant with demonstrated geoarcheological expertise. The archeological consultant shall undertake an archeological testing program as specified herein. In addition, the consultant shall be available to conduct an archeological monitoring and/or data recovery program if required pursuant to this measure. The archeological consultant's work shall be conducted in accordance with this measure at the direction of the Environmental Review Officer (ERO). All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the ERO for review and comment and shall be considered draft reports subject to revision until final approval by the ERO. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the ERO, the suspension of construction can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less-than-significant-level potential effects on a significant archeological resource as defined in CEQA Guidelines section 15064.5(a)(c).

Archeological Testing Program. The purpose of the archeological testing program will be to determine to the extent possible the presence or absence of archeological resources and to identify and to evaluate whether any archeological resource encountered on the site constitutes an historical resource under CEQA.

The archeological testing program shall be conducted in accordance with an approved Archeological Testing Plan (ATP). The archeological consultant and the ERO shall consult on the scope of the ATP, which shall be approved by the ERO prior to any project-related soils disturbing activities commencing. The ATP shall be submitted first and directly to the ERO for review and comment and shall be considered a draft subject to revision until final approval by the ERO. The archeologist shall implement the approved testing as specified in the approved ATP prior to and/or during construction.

The ATP shall identify the property types of the expected archeological resource(s) that potentially could be adversely affected by the proposed project, lay out what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. The ATP shall also identify the testing method to be used, the depth or horizontal extent of testing, and the locations recommended for testing and shall identify archeological monitoring requirements for construction soil disturbance as warranted.

Discovery Treatment Determination. At the completion of the archeological testing program, the archeological consultant shall submit a written summary of the findings to the ERO. The findings memo shall describe and identify each resource and provide an initial assessment of the integrity and significance of encountered archeological deposits.

If the ERO in consultation with the archeological consultant determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, the ERO, in consultation with SFO, shall determine whether preservation of the resource in place is feasible. If so, the proposed project shall be re-designed so as to avoid any adverse effect on the information potential or other characteristics that were the basis for determining the archeological resource to be significant, and the archeological consultant shall prepare a cultural resource preservation plan (CRPP), which shall be implemented by SFO during construction. The consultant shall submit a draft CRPP to the planning department for review and approval.

If preservation in place is not feasible, a data recovery program shall be implemented, unless the ERO determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible. The ERO in consultation with the archeological consultant shall also determine if additional treatment is warranted, which may include additional testing and/or construction monitoring.

Consultation with Descendant Communities. On discovery of an archeological site associated with descendant Native Americans, the Overseas Chinese, or other potentially interested descendant group an appropriate representative of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to offer recommendations to the ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Archeological Resources Report (ARR) shall be provided to the representative of the descendant group.

Archeological Data Recovery Plan. An archeological data recovery program shall be conducted in accordance with an Archeological Data Recovery Plan (ADRP) if all three of the following apply: (1) a resource has potential to be significant, (2) preservation in place is not feasible, and (3) the ERO determines that an archeological data recovery program is warranted. The archeological consultant, SFO, and ERO shall meet and consult on the scope of the ADRP prior to preparation of a draft ADRP. The archeological consultant shall submit a draft ADRP to the ERO. The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- Field Methods and Procedures. Descriptions of proposed field strategies, procedures, and operations.
- Cataloging and Laboratory Analysis. Description of selected cataloging system and artifact analysis procedures.
- Discard and Deaccession Policy. Description of and rationale for field and post-field discard and deaccession policies.
- Security Measures. Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- Final Report. Description of proposed report format and distribution of results.
- Curation. Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Funerary Objects. The treatment of human remains and funerary objects discovered during any soils disturbing activity shall comply with applicable State and federal laws. This shall include immediate notification of the San Mateo County Coroner and, in the event of the Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission, which will appoint a Most Likely Descendant (MLD). The MLD will complete his or her inspection of the remains and make recommendations or preferences for treatment within 48 hours of being granted access to the site (Public Resources Code section 5097.98). The ERO also shall be notified immediately upon the discovery of human remains.

SFO and ERO shall make all reasonable efforts to develop a Burial Agreement (Agreement) with the MLD, as expeditiously as possible, for the treatment and disposition, with appropriate dignity, of human remains and associated or unassociated funerary objects (as detailed in CEQA Guidelines section 15064.5(d)). The Agreement shall take into consideration the appropriate excavation, removal, recordation, scientific analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. If the MLD agrees to scientific analyses of the remains and/or associated or unassociated funerary objects, the archeological consultant shall retain possession of the remains and associated or unassociated funerary objects until completion of any such analyses, after which the remains and associated or unassociated funerary objects shall be reinterred or curated as specified in the Agreement.

Nothing in existing state regulations or in this mitigation measure compels SFO and the ERO to accept treatment recommendations of the MLD. However, if the ERO, SFO, and MLD are unable to reach an agreement on scientific treatment of the remains and associated or unassociated funerary objects, the ERO, with cooperation of SFO, shall ensure that the remains associated or unassociated funerary objects are stored securely and respectfully until they can be reinterred on the property, with appropriate dignity, in a location not subject to further or future subsurface disturbance.

Treatment of historic-period human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity, additionally, shall follow protocols laid out in the project's archeological treatment documents, and in any related agreement established between SFO, the San Mateo County Coroner, and the ERO.

Archeological Public Interpretation Plan. The project archeological consultant shall submit an Archeological Public Interpretation Plan (APIP) if a significant archeological resource is discovered during a project. The APIP shall describe the interpretive product(s); locations or distribution of interpretive materials or displays; persons or groups consulted in the development of interpretive content; the proposed content and materials; the producers or artists of the displays or installation; and a long-term maintenance program. The APIP shall be sent to the ERO for review and approval. The APIP shall be implemented prior to occupancy of the project.

Mitigation Measure M-TCR-1: Tribal Cultural Resources Program.

Preservation in Place. In the event of the discovery of an archeological resource of Native American origin, the Environmental Review Officer (ERO), SFO, and the tribal representative, shall consult to determine whether preservation in place would be feasible and effective in preserving the cultural values represented by the resource. If it is determined that preservation-in-place of the tribal cultural resource (TCR) would be both feasible and effective, then the archeological consultant shall consult with tribal representative to incorporate measures (e.g., placement of an on-site marker of the location of the resource, land acknowledgement in public materials, or registration of the resource in NAHC Sacred Lands Files) for the preservation of tribal cultural values represented by the resource, in the cultural resource preservation plan (CRPP). The consultant shall submit a draft CRPP to Planning for review and approval. The CRPP, including identified tribal cultural resource preservation measures, shall be implemented by SFO prior to and during construction.

Interpretive Program. If the ERO, in consultation with the affiliated Native American tribal representatives and SFO, determines that preservation-in-place of the tribal cultural resources is not a sufficient or feasible option, then archeological data recovery shall be implemented as required by the ERO and in consultation with affiliated Native American tribal representatives. In addition, SFO shall develop and implement an interpretive program, in consultation with affiliated tribal representatives, that includes interpretation of the tribal cultural values represented by the resource. A Public Interpretation Plan (PIP) prepared in consultation with the ERO and affiliated tribal representatives, at a minimum, and approved by the ERO, would be required to guide the interpretive program. This interpretive plan may be combined with the archeological PIP (described under Section E.4, Cultural Resources, under Mitigation Measure M-CR-2a). The plan shall identify, as appropriate, proposed locations for installations or displays, the proposed content and materials of those displays or installation, the producers or artists of the displays or installation, and a long-term maintenance program. The interpretive program may include artist installations (by local Native American artists if requested during consultation), oral histories with local Native Americans, cultural displays and interpretation, and educational panels or other informational displays. Native Americans who participate substantially in interpretive efforts shall be offered compensation for their involvement. Upon approval by the ERO and affiliated Native American tribal representatives, and prior to completion of the project, the interpretive program shall be implemented by SFO.

G. Public Notice and Comment

The planning department prepared and distributed a notice of availability of a notice of preparation of an EIR on November 25, 2020. The notices were mailed to a variety of city departments and neighborhood groups, other public agencies, and interested parties. A virtual public scoping meeting was held on December 9, 2020, during which oral comments from the public were received and transcribed. Written comments regarding the scope of the EIR were accepted for a 30-day period, from November 25, 2020, until December 28, 2020. During the public review and comment period, the planning department received comments from five agencies, two governmental organizations, and two non-governmental organizations. The topics raised in the comment letters are addressed in this initial study and the Draft EIR to which this initial study is attached, as appropriate. Table 1-1, Summary of Scoping Comments, Draft EIR p. 1-4, lists the comments on topics raised during the public scoping period. The planning department considered the comments made by the public in preparation of the initial study and the Draft EIR for the proposed project. The notice of preparation and comment letters are included as Appendix A in the Draft EIR.

H. Determination

On the basis of this Initial Study:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, no further environmental documentation is required.

____
Lisa Gibson
Environmental Review Officer
for
Rich Hillis
Director of Planning

DATE_______________

I. Initial Study Preparers

Planning Department, City and County of San Francisco
Environmental Planning Division
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

- Environmental Review Officer: Lisa Gibson
- Principal Environmental Planner: Tania Sheyner
- Senior Environmental Planner: Michael Li
- Principal Transportation Planner: Wade Wietgrefe
- Senior Transportation Planner: Jenny Delumo
- Senior Archeologist: Sally Morgan

J. Environmental Consultants

Environmental Science Associates
550 Kearny Street, Suite 800
San Francisco, CA 94108

- Project Director: Michael Arnold
- Project Manager: Eryn Brennan
- Deputy Project Manager: Elliott Schwimmer
- Aesthetics: Steve Smith
- Archeological/Tribal Cultural Resources: Heidi Koenig
- Transportation: Shadde Rosenblum
- Wind/Shadow: Elliott Schwimmer, Karl Heisler
- Utilities: Karen Lancelle
- Hazardous Materials: Michael Burns
- Publications: Joel Miller
- Graphics: James Songco

LCW Consulting
3990 20th Street
San Francisco, CA 94114

- Principal: Luba C. Wyznyckyj

PreVision Design
1806 Belles Street, Suite 6B
San Francisco, CA 94129

- Principal: Adam Phillips

K. Project Sponsor

San Francisco International Airport
P.O. Box 8097
San Francisco, CA 94128

- Project Manager: David Kim

APPENDIX C.1
Historic Resource Evaluation, Part 1

Final

SHORELINE PROTECTION PROGRAM SAN FRANCISCO INTERNATIONAL AIRPORT, SAN FRANCISCO, CALIFORNIA

Historic Resource Evaluation Part 1

Prepared for
San Francisco Planning Department

November 2021

Final

SHORELINE PROTECTION PROGRAM SAN FRANCISCO INTERNATIONAL AIRPORT, SAN FRANCISCO, CALIFORNIA

Historic Resource Evaluation Part 1

Prepared for
San Francisco Planning Department

November 2021

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900
www.esassoc.com

ESA

Bend
Camarillo
Delray Beach
Destin
Irvine
Los Angeles
Oakland
Orlando
Pasadena
Petaluma
Portland
Sacramento
San Diego
San Francisco
San José
Santa Monica
Sarasota
Seattle
Tampa

OUR COMMITMENT TO SUSTAINABILITY | ESA helps a variety of public and private sector clients plan and prepare for climate change and emerging regulations that limit GHG emissions. ESA is a registered assessor with the California Climate Action Registry, a Climate Leader, and founding reporter for the Climate Registry. ESA is also a corporate member of the U.S. Green Building Council and the Business Council on Climate Change (BC3). Internally, ESA has adopted a Sustainability Vision and Policy Statement and a plan to reduce waste and energy within our operations. This document was produced using recycled paper.

CONTENTS

SFO Shoreline Protection Program
Historic Resource Evaluation Part 1

Appendix

Figures

Tables

INTENTIONALLY BLANK

CHAPTER I
Introduction

This Historic Resource Evaluation (HRE) Part 1 provides an evaluation of the potential historic significance per the California Register of Historical Resources (California Register) criteria of buildings and structures at San Francisco International Airport (SFO or the Airport) that are located within 100 feet of the Shoreline Protection Program (SPP) project site, including staging areas.[1] All buildings and structures located within 100 feet of the project site are listed in **Table 1**. The buildings and structures that either currently meet (in 2021) or will meet the 45-year age criterion by the full build-out of the SPP anticipated in 2032 (i.e., those constructed in and before 1987) are highlighted in Table 1 and evaluated in this report.

Table 1 Buildings and Structures within 100 Feet of the SPP Project Site

Reach/Construction Staging Area	Building No.	Building Name	Current Use	Year(s) Constructed[a]	To Be Evaluated?
Plot 16 D	—	160 Beacon Street, South San Francisco	Private property (not owned or operated by SFO)	1958	Yes
Plot 16 D	—	168 Beacon Street, South San Francisco	Private property (not owned or operated by SFO)	1958	Yes
Plot 16 D	—	182 Beacon Street, South San Francisco	Private property (not owned or operated by SFO)	1960	Yes
Plot 16 D	—	192 Beacon Street, South San Francisco	Private property (not owned or operated by SFO)	1959	Yes
Plot 16 D	—	508 South Airport Boulevard, South San Francisco	Private property (not owned or operated by SFO)	1961	Yes
2A	—	Outfall E010	Stormwater infrastructure	1970	Yes
2B	2001	Fuel Farm	Airport infrastructure	pre-1968–ca. 2002	No[b]
2B	904	Fuel Maintenance and Operations Building	Airport infrastructure	2000	No[d]
2B	908A	Steel Canopy	Wastewater infrastructure	ca. 2018–19	No[d]
2B	918	Mel Leong Treatment Plant, Sanitary Waste Process Administration	Wastewater infrastructure	ca. 1969–70	Yes
2B	922	Mel Leong Treatment Plant, SBR Sanitary Process	Wastewater infrastructure	ca. 1970–2005	Yes
2C	928	City College of San Francisco Airport Campus	Vacant (will be occupied by SFO Facilities)	1976	No[c]
2C	928A	City College of San Francisco Airport Campus, Ancillary Building	Vacant (will be occupied by SFO Facilities)	ca. 1976	No[c]
2C	—	Storm Drain Pump Station (SDPS)-6 Outfall E013	Stormwater infrastructure	1997	No[d]
3	—	Seaplane Ramp	Airport infrastructure	ca. 1944	Yes

[1] The San Francisco Planning Department uses 100 feet as the standard threshold for indirect impacts to historic resources based on construction-related activities.

Table 1 Buildings and Structures within 100 Feet of the SPP Project Site

Reach/Construction Staging Area	Building No.	Building Name	Current Use	Year(s) Constructed[a]	To Be Evaluated?
3	—	Storage Building	Federal property (not owned or operated by SFO)	ca. 2012	No[d]
4	Various	U.S. Coast Guard Air Station San Francisco	Federal property (not owned or operated by SFO)	1939–1990	Yes[e]
4	—	Outfall E004 [f]	Stormwater infrastructure	1950	Yes
4	1030	Marine Emergency Response Facility (ERF No. 4)	Police and Fire	ca. 2010–12	No[d]
4	—	ERF No. 4 Pier	Police and Fire	ca. 2010–12	No[d]
5	1050	FBO Hangar D	General aviation	1997	No[d]
5	1057	Airfield Operations	Airport operation	2015	No[d]
6	1059	Police Main Training Facility and Shooting Range	Police	1989–2017	No[d]
6	—	SDPS-18 Outfall E009	Stormwater infrastructure	ca. 2007	No[g]
6	—	SDPS-17 Outfall E008	Stormwater infrastructure	ca. 2007	No[g]
7A	—	SDPS-1C and Outfall E007	Stormwater infrastructure	1982	Yes
7B	—	Runway 19L Lighting Trestle	Airport infrastructure	ca. 1970	No[h]
7C	—	FAA MALSF	Airport infrastructure	2014	No[d]
9	—	NAVAIDs	Airport infrastructure	2015	No[d]
10	—	NAVAIDs	Airport infrastructure	2013	No[d]
11	—	SDPS-1B and Outfall E006	Stormwater infrastructure	1983	Yes
12	—	NAVAIDs and ASSC Antenna	Airport infrastructure	2013	No[d]
12	—	Runway 28R Lighting Trestle	Airport infrastructure	ca. 1970	No[h]
12	—	Runway 28L Lighting Trestle	Airport infrastructure	ca. 1970	No[h]
12	—	NAVAIDs	Airport infrastructure	2013	No[d]
13	—	ASSC Antenna	Airport infrastructure	2013	No[d]
13	—	SDPS-1A and Outfall E005	Stormwater infrastructure	1983	Yes
14	1080	Field Lighting Building No. 2	Airport infrastructure	1987	Yes
14	—	SDPS-1D and Outfall E003	Stormwater infrastructure	ca. 2012–13	No[g]
15	—	Load Center	—	2011	No[d]
15	—	Stormwater Retention Pond	Stormwater infrastructure	ca. 2012–14	No[d]
15	—	Trillium CNG Station	Gas station	ca. 1993–2002	No[d]

SOURCE: SFO, 2020; ESA, 2020.

NOTES:

General: The highlighted rows indicate the buildings and structures that either currently meet (in 2021) or will meet the 45-year age criterion by the full build-out of the SPP anticipated in 2032 (i.e., those constructed in and before 1987).

a. Data provided by SFO includes the "Build Year" for each building and structure, which generally reflects the completion of construction. As such, "Year(s) Constructed" reflects construction dates confirmed by ESA.

b. Tanks within the 100-foot buffer are not age eligible.

c. Buildings 928 and 928A were previously evaluated as part of the *Recommended Airport Development Plan Historic Resource Evaluation Part 1* (ESA, 2018). On June 7, 2019, the San Francisco Planning Department determined these buildings were not individually eligible or eligible as part of a historic district for listing in the California Register.

d. The building/structure is not age eligible.

Table 1 Buildings and Structures within 100 Feet of the SPP Project Site

Reach/Construction Staging Area	Building No.	Building Name	Current Use	Year(s) Constructed[a]	To Be Evaluated?

e. The U.S. Coast Guard Air Station San Francisco was previously evaluated as part of the *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California* (Carey & Co. 1998) and determined to be eligible for listing in the National Register of Historic Places as a historic district. It has been re-evaluated in the appended technical report (Appendix A) and summarized in this HRE Part 1.

f. Outfall E004 is associated with SDPS-2 (constructed in 1950) and SPDS-2A (constructed in 2005). The pump stations are not located within 100 feet of the project site.

g. Note that SDPS-18 and associated Outfall E009 and SDPS-17 and associated Outfall E008 were demolished and reconstructed ca. 2007 (SFO Contract No. 8256BR2). Additionally, SFO had confirmed that SDPS-1D and associated Outfall E003 were demolished and reconstructed ca. 2012-13; therefore, they would not meet the 45-year age criterion by full buildout of the proposed project in 2032 and are not addressed in this report.

h. All three runway lighting trestles were evaluated and found to be ineligible for listing in the National Register of Historic Places and the California register under any criteria. The San Francisco Planning Department determined that they were not eligible for listing in the California Register in April 2011. Therefore, these structures are not addressed in this report. See Tara Sullivan (San Francisco Planning Department), Memorandum to Irene Nishimura (San Francisco Planning Department), April 20, 2011, on file at the San Francisco Planning Department as part of Case File No. 2010.0755E.

SFO is located on the west shore of San Francisco Bay, approximately 13 miles south of downtown San Francisco in San Mateo County. The Airport is owned by the City and County of San Francisco (the City) and operated and managed by and through the San Francisco Airport Commission. In March 1927, the San Francisco Board of Supervisors leased 150 acres belonging to the descendants of Darius Mills for the site of the City's future airport. SFO, then known as Mills Field, opened in June 1927. By 1930, the San Francisco Board of Supervisors had purchased 1,112 acres of property from the Mills Estate, and the following year the Airport became known as the San Francisco Municipal Airport. None of the original Mills Field buildings remain at the present-day Airport.

As the SPP would demolish or alter buildings and structures that are currently 45 years old or older, or will be 45 years old by the full build-out of the SPP anticipated in 2032, an evaluation of these buildings with regard to the California Register criteria is being undertaken. This report provides a discussion of the current historic status and architectural descriptions of the buildings and structures and evaluates their potential individual historic significance and/or their significance as contributors to potential historic districts.

Johanna Kahn, M.Ar.H., an architectural historian, is the author of this report. Becky Urbano, M.S., a senior architectural historian, and Eryn Brennan, M.Ar.H., M.U.E.P, an architectural historian and urban planner, provided senior review. The author and reviewers of this report meet the Secretary of the Interior’s Professional Qualification Standards for architectural history.

INTENTIONALLY BLANK

CHAPTER II
Summary

The buildings and structures evaluated in this HRE are identified in Table 1. Those operated by SFO were originally constructed between ca. 1949–50 and 1987 and serve a variety of functions including stormwater, wastewater, and airport infrastructure. Five additional buildings that are not owned or operated by SFO were constructed between 1958 and ca. 1965. None of these buildings or structures were found to be individually significant under any California Register criteria, nor do they appear to contribute to any known or potential historic districts on the SFO property. As such, none of the buildings or structures evaluated in this HRE are considered historical resources for the purposes of the California Environmental Quality Act (CEQA).[2]

[2] The U.S. Coast Guard Air Station is not operated by SFO and is not included in this HRE. However, as part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station San Francisco in 2020, a portion of which is located within the project site (see Figure 6, p. 22), and found that it appears eligible as a historic district under California Register Criteria 1 and 3 and, therefore, would be considered a historical resource for the purposes of CEQA. The complete evaluation is included as Appendix A and is only summarized in this HRE.

INTENTIONALLY BLANK

CHAPTER III
Current Historic Status

A. Previous Architectural Surveys Conducted at SFO

As the SFO property is outside the physical boundaries of the city, it is not included in any of the city's primary historical listings or surveys, such as the Junior League of San Francisco Architectural Survey (*Here Today*, 1968), the Department of City Planning Architectural Quality Survey (1976), the San Francisco Heritage (formerly San Francisco Architectural Heritage) surveys (1970s–present), or any neighborhood surveys.

Historic evaluations of portions of SFO or of the entire Airport have been conducted in the last 30 years. Those relevant to the proposed project are summarized below.

1. Surveys Conducted between 1991 and 2001

Studies conducted between 1991 and 2000 are referenced in the *Final Historical Resources Report: Information Regarding the Eligibility of Properties at San Francisco International Airport for Inclusion on the National Register of Historic Places or the California Register of Historic Resources* and Addendum (herein referred to as the 2000–2001 Historical Resources Report and Addendum).[3] This report draws from the information contained in three previous studies conducted at SFO:

- *San Francisco International Airport Master Plan Final Environmental Impact Report*[4] and the *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR*.[5] Age-eligible buildings that were identified included the Flying Tiger hangar (since demolished), the buildings associated with the U.S. Coast Guard Air Station San Francisco (U.S. Coast Guard Air Station),[6] and two metal maintenance buildings identified as Building 1000 and the Val Boiler House. None of these buildings were found to be eligible under any criteria.
- *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*.[7] The U.S. Coast Guard Air Station was found to be eligible for listing on the National Register of Historic Places (National Register) as a historic district with five contributing buildings, one contributing structure, and four non-contributing buildings. The National Register-eligible historic district is located within 100 feet of the SPP project site.

As part of the 2000–2001 Historical Resources Report and Addendum, an inventory of the existing buildings and structures at SFO was compiled for the purpose of determining the eligibility of properties for inclusion in the National Register and California Register. The inventory excluded moveable structures (e.g., trailers), minor

---

[3] ESA, *Final Historical Resources Report Final Historical Resources Report: Information Regarding the Eligibility of Properties at San Francisco International Airport for Inclusion on the National Register of Historic Places or the California Register of Historic Resources*, December 2000, addendum (by ESA/Carey & Co.), 2001.

[4] San Francisco Department of City Planning, *San Francisco International Airport Master Plan Final Environmental Impact Report*, May 1992.

[5] David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991.

[6] U.S. Coast Guard Air Station San Francisco is located entirely within a federally-owned property boundary within the SFO property and is located within 100 feet of the SPP project site.

[7] Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

equipment and infrastructure elements, and buildings and structures that were recently constructed at the time the inventory was compiled.[8]

Although the 2000–2001 Historical Resources Report and Addendum did not include any of the buildings evaluated in this HRE, it did include the following structures:

- **SDPS-1B and Outfall E006** (listed as "Drainage out fall/pump station Ds-Ib [*sic*, should be 1B] North of the intersection of Taxiways C and N")
- **SDPS-1A and Outfall E005** (listed as "Drainage out-fall/pump station Ds-1A South of the intersection of Taxiways F and N")

Note Building 1080 (Field Lighting Building No. 2) was omitted from the inventory and not accounted for as part of the existing building stock. Additionally, the Mel Leong Treatment Plant was identified on a map as "Buildings 27, 87/Water Quality Control,"[9] but it was not listed in the inventory.

None of the buildings and structures evaluated in this HRE was evaluated for historic significance as part of the 2000–2001 Historical Resources Report and Addendum, nor have they subsequently been evaluated for historic significance.

2. Surveys Conducted between 2010 and 2020

Historic evaluations conducted since 2010 for buildings and structures located within or near the SPP project site include:

- *Historic Architecture Survey Report for the Runway Safety Area Program at SFO*.[10] The Airport's four extant runways (i.e., 10L-28R, 10R-28L, 1L-19R, and 1R-19L) and three extant runway lighting trestles (i.e., 19L, 28R, and 28L) were found to be ineligible for listing in the National Register and California Register under any criteria.[11]
- *Recommended Airport Development Plan Historic Resource Evaluation Part 1*[12] and *Recommended Airport Development Plan Historic Resource Evaluation Part 1, Addendum*.[13] Twelve buildings constructed between 1950 and 1981, which serve a variety of functions including cargo, airline and airport administration, parking, and airport maintenance, were found to be ineligible for listing in the California Register under any criteria, either individually or as contributors to any known or potential historic districts on the SFO property. These included Buildings 928 and 928A, both of which are located within 100 feet of the SPP project site. The San Francisco Planning Department determined these buildings were not eligible individually nor as part of a historic district for listing in the California Register on June 7, 2019.[14]
- *Re-Evaluation of U.S. Coast Guard Air Station San Francisco for Eligibility for Listing in the California Register of Historical Resources*. As part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station according to current professional standards for continued eligibility for listing in the

[8] URS, *Historic Architecture Survey Report for the Runway Safety Area Program at San Francisco International Airport*, June 2011, p. 35.
[9] On the map included with the inventory, Building 27 appears to be in the location of the industrial waste treatment facility, and Building 87 appears to be in the location of the sanitary waste treatment facility.
[10] URS, *Historic Architecture Survey Report for the Runway Safety Area Program at San Francisco International Airport*, June 2011.
[11] Tara Sullivan (San Francisco Planning Department), Memorandum to Irene Nishimura (San Francisco Planning Department), April 20, 2011, on file at the San Francisco Planning Department as part of Case File No. 2010.0755E.
[12] ESA, *Final Historic Resources Evaluation Part 1 for the Recommended Airport Development Plan, San Francisco International Airport*, prepared for the San Francisco Planning Department, June 2018.
[13] ESA, *Final Historic Resources Evaluation Part 1 Addendum for the Recommended Airport Development Plan, San Francisco International Airport*, prepared for the San Francisco Planning Department, June 2019.
[14] San Francisco Planning Department, *Preservation Team Review Form*, June 6, 2019.

California Register. Two buildings that were previously identified as historic district contributors have been demolished since 1998 (the date of the last evaluation). Based on a site survey, archival research, and analysis, none of the extant historic-age buildings and structures that comprise the U.S. Coast Guard Air Station appear to be individually eligible for listing in the California Register under any criteria. However, the air station appears eligible as a historic district under Criteria 1 and 3. This technical memorandum is summarized below and appended to this HRE (**Appendix A**).

B. California Register of Historical Resources

The California Register is an authoritative guide to significant architectural, archaeological, and historic resources in the State of California. Resources can be listed in the California Register through a number of methods. California Historical Landmarks and/or National Register-eligible properties (both listed and formal determinations of eligibility) are automatically listed. Properties can also be nominated to the California Register by local governments, private organizations, or citizens. This includes properties identified in historic resource surveys with status codes of 1 through 5[15] and resources designated as local landmarks or listed by a city or county ordinance. A building or structure identified in the California Office of Historic Preservation's (OHP) Built Environment Resource Directory (BERD) with a California Historical Resource Status Code rating of 1 or 2 (on or determined eligible for the National Register) is also considered to be listed on the California Register. Properties of local significance that have been designated under a local preservation ordinance (i.e., local landmarks), or that have been identified in a local historical resources survey, may also be eligible for listing in the California Register.

The evaluative criteria used by the California Register for determining eligibility are closely based on those developed for use by the National Park Service for the National Register. In order to be eligible for listing in the California Register a property must demonstrate significance under one or more of the following criteria:

- **Criterion 1 (Event):** Resources that are associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States.
- **Criterion 2 (People):** Resources that are associated with the lives of persons important to local, California, or national history.
- **Criterion 3 (Design/Construction):** Resources that embody the distinctive characteristics of a type, period, region, or method of construction or represent the work of a master or possess high artistic values.
- **Criterion 4 (Information Potential):** Resources or sites that have yielded, or have the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

[15] California Historical Resource Status Codes 1 through 5 include: 1) Properties listed in the National Register or the California Register; 2) Properties determined eligible for listing in the National Register or the California Register; 3) Appears eligible for National Register or California Register through survey evaluation; 4) Appears eligible for National Register or California Register though other evaluation; and 5) Properties recognized as historically significant by local government.

C. Known Historic Resources on the Project Site and in the Project Vicinity

1. Records Search

ESA conducted a records search of the project site at the Northwest Information Center (NWIC) of the California Historical Resources Information System (CHRIS) at Sonoma State University in Rohnert Park, California on June 4, 2019 (NWIC File No. 18-2340), which was updated on July 23, 2020 (NWIC File No. 20-0162). The NWIC maintains the official CHRIS records of previous cultural resources studies and recorded cultural resources for the project site and vicinity. The records search covered the project site and all areas within 0.5 mile of the project site. The records search included a review of previous studies, records, and maps on file at the NWIC as well as the BERD with summary information from the National Register, Registered California State Landmarks, California Historic Points of Interest, Archaeological Determinations of Eligibility, and California Inventory of Historical Resources (March 1976). The purpose of the records search was to: (1) determine whether known cultural resources have previously been recorded in a 0.5-mile radius around the project site; and (2) assess the likelihood for unrecorded cultural resources to be present based on historical references and the distribution of nearby cultural resources.

The records search results, as well as additional background research completed by ESA, did not identify any recorded historic architectural resources within the project site or within the 0.5-mile search radius. According to a review of OHP's BERD for San Mateo County, there are no historic resources listed on the California and/or National Registers located immediately adjacent to the SFO property.[16] There are also no locally listed historic resources in the cities of South San Francisco,[17] San Bruno,[18] Millbrae,[19] or Burlingame[20] that are adjacent to the SFO property.

2. U.S. Coast Guard Air Station

As described above, the U.S. Coast Guard Air Station is not owned or operated by SFO but is located on federally owned property within the larger SFO property, a portion of which is located within the project site (see Figure 6, p. 22). It was determined to be eligible for listing on the National Register as a historic district in 1998, and the historic district was subsequently listed in the California Register.[21] As part of the SPP project, ESA re-evaluated the property in 2020 (Appendix A). The U.S. Coast Guard Air Station appears eligible as a historic district under Criteria 1 and 3 and would be considered a historical resource for the purposes of CEQA. The three buildings that contribute to the significance of the U.S. Coast Guard Air Station historic district include Buildings A/1019A (main hangar), B/1019B (administration), and G (utility/storage).

[16] California Office of Historic Preservation, *Built Environment Resource Directory (BERD) for San Mateo County*, March 2020.
[17] City of South San Francisco, *South San Francisco Historic Preservation*, http://www.ssf.net/departments/economic-community-development/planning-division/historic-preservation, accessed March 19, 2018.
[18] Dyett & Bhatia, *Environmental Resources and Conservation Element of the San Bruno General Plan*, March 2009, p. 6.11, https://www.sanbruno.ca.gov/civicax/filebank/blobdload.aspx?BlobID=24019, accessed November 16, 2020.
[19] Sam Fielding (Senior Planner at the City of Millbrae), telephone discussion with Johanna Kahn (ESA), March 29, 2018.
[20] PBS&J, *Burlingame Downtown Specific Plan Initial Study/Mitigated Negative Declaration*, May 2010, pp. 218-222, https://www.burlingame.org/document_center/Planning/General%20and%20Specific%20Plans/Draft%20Initial%20Study%20Mitigated%20Negative%20Declaration.pdf, accessed November 16, 2020.
[21] California Code of Regulations, Title 14, Chapter 11.5, § 4851, Historical Resources Eligible for Listing in the California Register of Historical Resources, https://govt.westlaw.com/calregs/Document/IFF8DB730D48511DEBC02831C6D6C108E?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default), accessed November 16, 2020.

CHAPTER IV
Project Description

A. Shoreline Protection Program

SFO proposes to implement the SPP project to address flood protection and future sea level rise for the expected lifespan of the shoreline improvements. The project proposes to install new shoreline protection infrastructure that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection and incorporate protection for future sea level rise. The proposed project would remove most of the existing shoreline protection structures and would construct a new shoreline protection system comprised of a combination of concrete walls and steel king and sheet pile walls. These structures would vary, depending on the existing site characteristics, and would range in height from approximately 3.9 to 13.5 feet above the existing ground for the steel sheet pile and concrete walls. In total, the proposed project would construct an approximately 55,550-foot-long (approximately 10.5 miles) new shoreline protection system, which would require approximately 26 acres of fill in the bay and approximately 3 acres of impacts to wetland areas.

SFO's 8-mile shoreline and western landside boundary are divided into 16 reaches based on shoreline orientation, existing protection type, existing foreshore conditions, and existing landside conditions.[22] The project proposes to construct shoreline protection improvements specific to 15 of the reaches to eliminate the probability of substantial inundation at the Airport until 2085 (see **Figure 1**). In order to address landside flood protection, Reach 16 may be required to form a continuous, closed flood protection system. However, landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae. As such, while Reaches 1 through 15 will be analyzed at the project level, landside Reach 16 will be analyzed at a programmatic level. Other proposed shoreline improvements would include:

- Reconstruction of nine stormwater outfalls to rise above the proposed wall;
- Relocation of the vehicle service road for a portion of Reach 7 as well as Reaches 8, 9, 10, 11, 13, and 14;
- Construction of a non-publicly accessible road along the alignment of Reach 2; and
- Demolition of the Runway 19L lighting trestle and construction of a new lighting trestle in the same location.

[22] A "reach" is defined as a longshore segment of a shoreline where influences and impacts, such as wind direction, wave energy, littoral transport, etc. mutually interact. Reach 16 extends between Reach 1 and Reach 15 roughly parallel to Highway 101.

SOURCE: SFO, 2021

Shoreline Protection Program HRE Part 1

FIGURE 1

SHORELINE PROTECTION PROGRAM PROJECT SITE

CHAPTER V
Property and Building Descriptions

The following provides a description of SFO's setting and exterior architectural descriptions of the buildings and structures identified in Table 1.[23] Construction chronologies and known alterations to these buildings and structures are also discussed below.

A. Setting

SFO is owned by the City and County of San Francisco and operated by and through the San Francisco Airport Commission. The Airport is located approximately 13 miles south of downtown San Francisco and encompasses approximately 5,130 acres in San Mateo County. The majority of the Airport property is located in unincorporated San Mateo County, with parts of the Airport located within the city boundaries of South San Francisco to the north, San Bruno to the west, and Millbrae to the south. SFO is bordered on the south and east by San Francisco Bay, on the west by the City of San Bruno, and on the north by the City of South San Francisco. Of the 5,100 acres of Airport property, approximately 2,110 acres located east of U.S. 101 serve Airport functions. Approximately 2,810 acres are located in San Francisco Bay waters, and the remaining 180 acres (called "West-of-Bayshore" property) are mostly undeveloped land located west of U.S. 101.

B. SPP Project Site

The project site for the SPP includes the area within 100 feet inland from the shoreline and a 100-foot area around construction staging areas. The Airport's shoreline and western landside boundary are divided into 16 reaches based on shoreline orientation, existing protection type, foreshore type,[24] and existing landside conditions.[25] Existing shoreline protection systems for the 15 water-facing reaches vary by reach and include a combination of concrete walls, *sheet pile walls*,[26] concrete debris, armor rocks, sandbags, *K-rails*,[27] tidal flats, embankment walls/dikes, and earthen and vegetated *berms* (see **Figure 1**).[28] The existing shoreline protection features for each reach typically include varying combinations of these systems that were installed, repaired, and/or replaced during different periods of the Airport's expansion, as described below in more detail. Some sections of the existing shoreline system show wear and evidence of distress, including seepage through sections of berm, cracks and holes in concrete and vinyl sheet pile walls, and overall deterioration of the sheet pile wall.

Although historic-age buildings associated with the United Airlines Maintenance Operations Center (MOC) are located within the 100 feet of Reach 1, construction of the shoreline protection system would consist of a 6.1-foot-tall concrete wall located along the north and south sides of North Access Road, and no construction would

[23] None of the buildings and structures evaluated in this HRE include publicly accessible interior spaces (i.e., interiors that are intended to be used by the general public). For this reason, no interior spaces are described or documented herein.
[24] The foreshore refers to the area between low and high tide along the shoreline.
[25] Reach 16 extends between Reach 1 and Reach 15 roughly parallel to Highway 101.
[26] A *sheet pile wall* is made of interlocking sheet piles that form a wall. The wall is driven into the ground and meant to retain earth, water, or other filling material. Sheet piles can be made of materials such as timber, concrete, or steel, or of polyvinyl chloride (typically referred to as *vinyl sheet piles*).
[27] A *K-rail* is a modular concrete barrier typically used to separate traffic lanes.
[28] A *berm* acts as a barrier and is a raised bank or terrace bordering a road, river, canal, or other body of water.

occur on the MOC site. Construction of the concrete wall would not require high-impact pile driving, so there would be no construction-related impacts to historic-age MOC buildings. Additionally, no construction would occur on the MOC site, and the addition of a 6.1-foot-tall concrete wall along the existing road would not alter the character or setting of the MOC buildings. Therefore, the MOC buildings are not evaluated in this HRE.

In addition, since no historic-age buildings or structures that have not been previously evaluated are located within 100 feet of the project site for Reach 5 (Seaplane Harbor 2), Reach 6 (Superbay), Reach 8 (Runway 19 Edge), Reach 9 (Intersection 1), Reach 10 (Intersection 2), Reach 12 (Runway 28 End), and Reach 15 (Millbrae Channel), these reaches are not included in this HRE. Construction staging would occur on Plot 16D, a parcel located north of North Access Road between South Airport Boulevard and U.S. 101. Five historic-age buildings not owned or operated by SFO are located within 100 feet of Plot 16D. The existing conditions of Plot 16D and the eight reaches in which the historic-age subject buildings and structures are located are summarized below. The locations of the subject buildings and structures are shown in Figure 2 through Figure 15, pp. 15 through 31.

1. Reach 1: San Bruno Channel

Reach 1 extends along the San Bruno Channel on the north side of the Airport from the U.S. 101 overpass to the intersection of North Access Road and North Field Road. The channel is naturally lined along this length, with dense vegetation occurring in places toward the top of the channel banks. At the downstream end, the channel discharges into the bay via a flood control tide gate. The channel banks provide existing flood protection along the channel; no additional vertical structures exist between the channel and the Airport property. North Access Road abuts the south side of the San Bruno Channel.

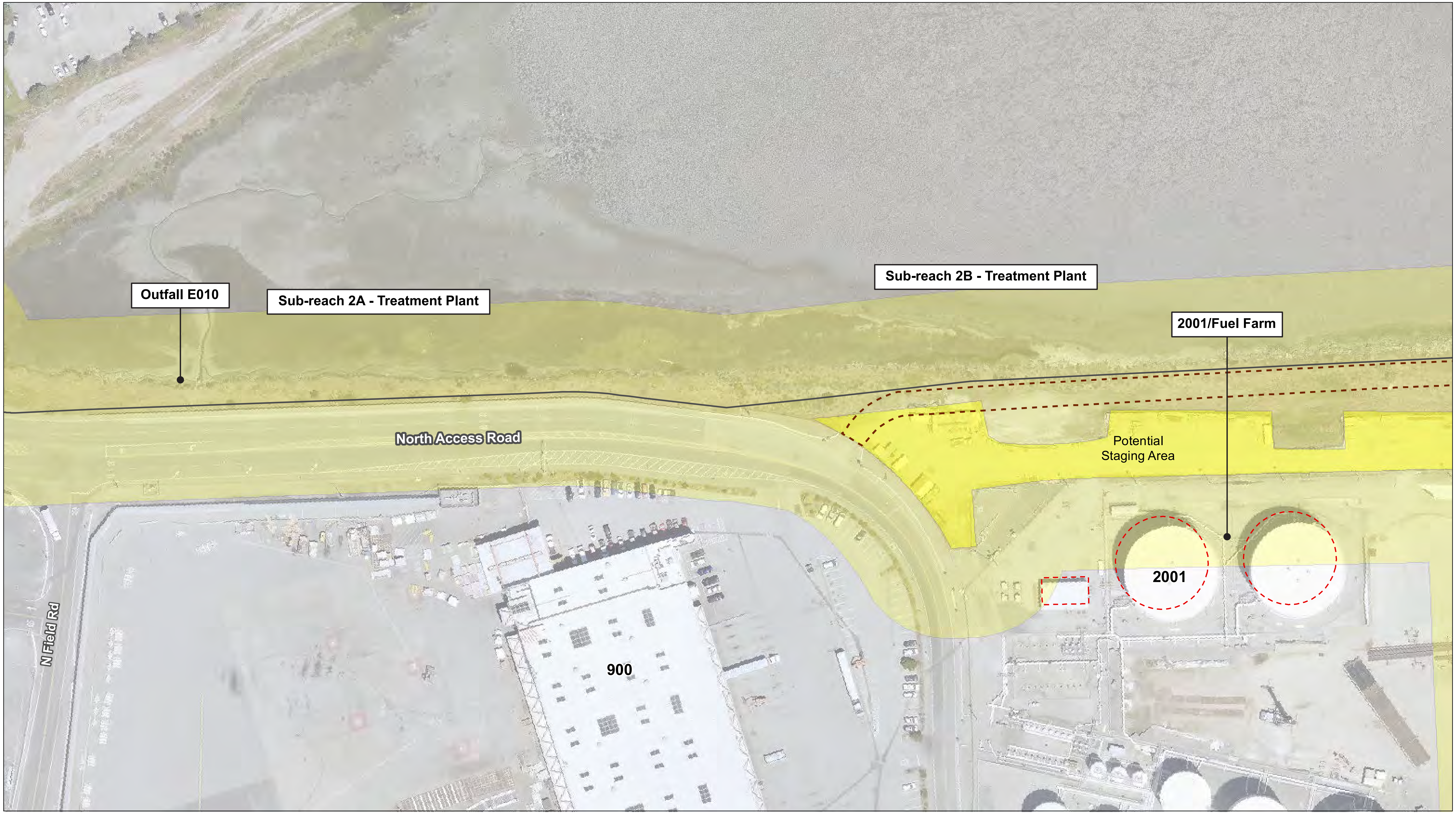
Reach 1 extends beyond the flood control gate for approximately 1,400 feet to the junction of North Access Road and the entrance to the San Mateo County Transit District (SamTrans) peninsula at North Field Road. The SamTrans peninsula, accessible via North Access Road, contains a SamTrans bus yard and the Safe Harbor Shelter.

2. Reach 2: Treatment Plant

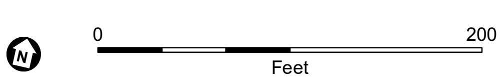
Reach 2 begins just east of the intersection of the SamTrans peninsula and North Access Road and extends along the shoreline, wrapping around the northeastern boundary of the Mel Leong Treatment Plant and Buildings 928 and 928A, finishing at a point along the south-facing shoreline of Seaplane Harbor (see **Figure 2 through Figure 4**). The reach is divided into three different sub-reaches to account for the different shoreline orientations; however, buildings located within 100 feet of the project are located only in Sub-reaches 2A and 2B, as described below.

Sub-reach 2A extends from the beginning of the reach and runs for 700 feet along North Access Road. This reach is composed of a natural vegetated shoreline fronted by mudflats. A concrete wall built in 1996 runs along the shoreline with a maximum elevation of 2.6 feet above the existing road grade. The shoreline along this section of SFO is a gentle sloping vegetated mudflat, with concrete debris located at the base of the slope leading up to North Access Road.

Sub-reach 2B starts at the end of the concrete wall in Sub-reach 2A and continues east and south along the boundary of the treatment plant, which is set back from the shoreline approximately 120 feet on the east side and 150 to 500 feet on the south side and follows the shoreline around Buildings 928 and 928A. This sub-reach has a wide, mostly flat, vegetated area, ranging from 150 to 400 feet in width, separating the treatment plant and the shoreline edge. The shoreline itself is mostly natural and vegetated with small amounts of non-uniform rocks and debris on the fronting slope. The shoreline intersects with a deteriorated dock and several miscellaneous concrete landing pads.

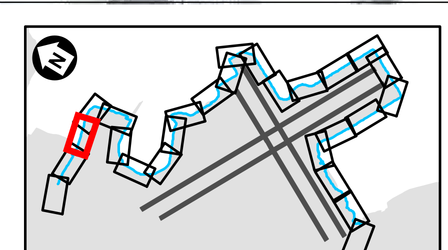


SOURCE: Airport Conditions-SFO, 2021



100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Proposed Access Road

Alignment Type
Sheet Pile Wall



Shoreline Protection Program HRE Part 1

FIGURE 2

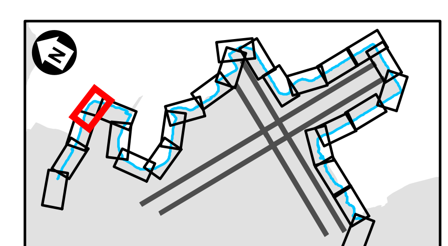
SUB-REACHES 2A AND 2B

SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

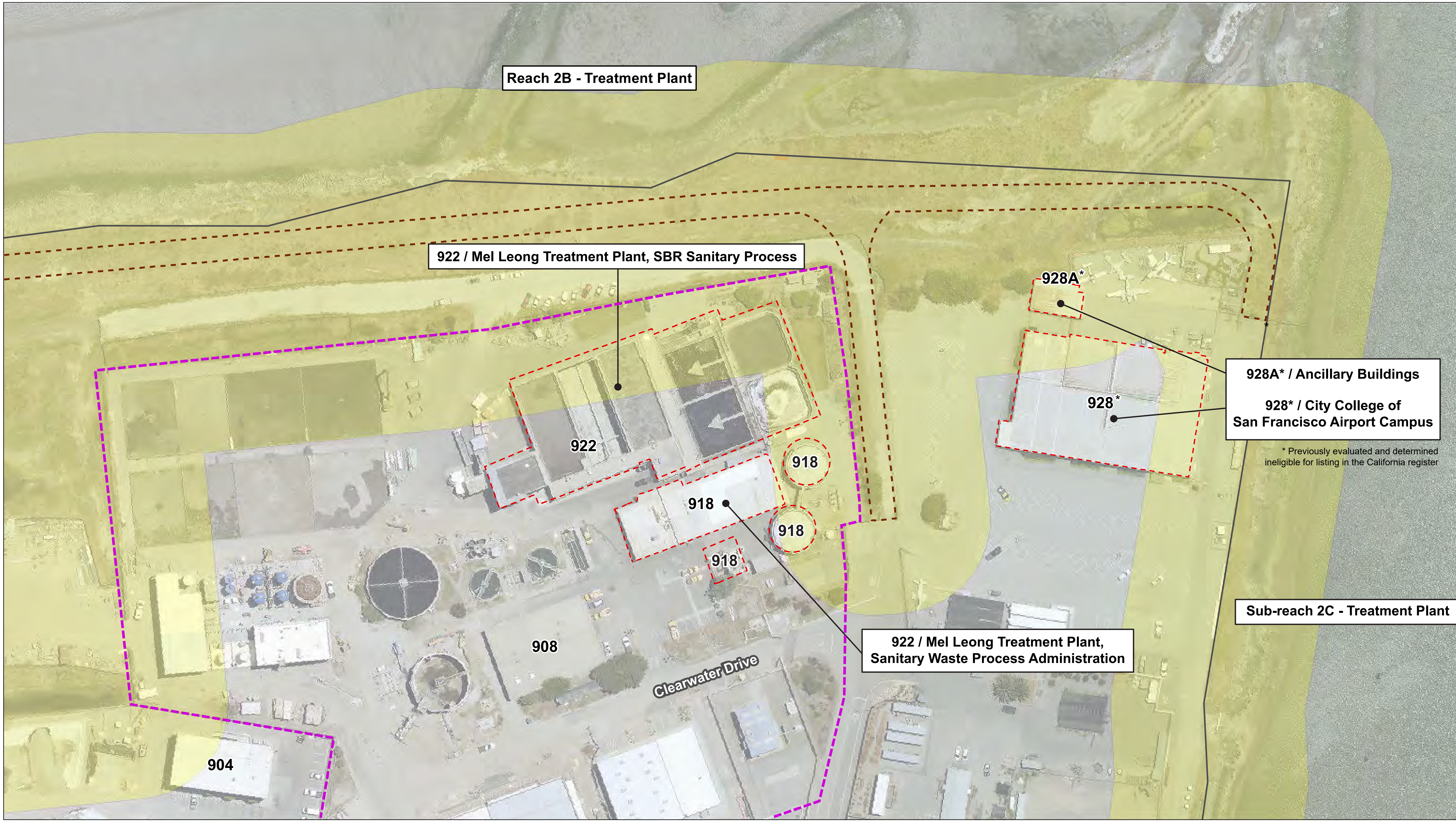
100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Proposed Access Road

Alignment Type
Sheet Pile Wall



Shoreline Protection Program HRE Part 1

FIGURE 3
SUB-REACHE 2B



SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Proposed Access Road
Mel Leong Water Treatment Plant

Alignment Type
Sheet Pile Wall

FIGURE 4
SUB-REACHES 2B AND 2C

THIS PAGE INTENTIONALLY LEFT BLANK

Outfall E010 is located within 100 feet of the project site in Sub-reach 2A. Buildings 918 and 922 are part of the Mel Leong Treatment Plant and are located within 100 feet of the project site in Sub-reach 2B. These buildings and structures are evaluated in this HRE.

3. Reach 3: Seaplane Harbor 1

Reach 3 runs 1,400 feet along the north side of Seaplane Harbor, paralleling North Access Road for most of its length (see **Figure 5**). The existing shoreline protection features include a reinforced-concrete wall topped with a 7-foot-tall chain-link fence fronted by an armor rock slope. The maximum elevation of the wall is 3 feet above the existing grade, with a total height of 10 including the chain-link fence. The wall is continuous except for two locations: a 100-foot break occurs at a decommissioned seaplane ramp/boat launch at the beginning of the reach and a 30-foot break occurs at a pipe outfall in the center of the reach.

The seaplane ramp is located within 100 feet of the project site in Reach 3, and this structure is evaluated in this HRE.

4. Reach 4: Coast Guard

Reach 4 is located along the east-facing shoreline of Seaplane Harbor and lies in front of the U.S. Coast Guard Air Station (see **Figure 6**, p. 22). A steep armor rock section exists along the entire reach except for a 50-foot break for a decommissioned seaplane ramp. A security fence separates the armor rock slope from the U.S. Coast Guard Air Station. A low concrete curb at the top of the armor slope topped with a chain-link fence, located on the seaward edge of the U.S. Coast Guard Air Station, defines the top of this reach.

The U.S. Coast Guard Air Station and Outfall E004 are located within 100 feet of the project site in Reach 4. This HRE evaluates Outfall E004, and Appendix A includes an updated evaluation of the U.S. Coast Guard Air Station.

5. Reach 7: Runway 19 End

Reach 7 is approximately 3,900 feet long and lies around and at the end of Runways 19L and 19R (see **Figure 7 and Figure 8**, pp. 23 and 24). At the western end of the reach, four large outfall pipes extend from SDPS-1C through the flood protection system, creating a 25-foot-wide gap in the system. The outfall pipes range in diameter from 16 to 30 inches.

The existing shoreline protection system is composed of an earthen berm with a rock revetment on the bay side.[29] The elevation of the berm reaches a maximum height of 5.5 feet. The backside of the berm is lined with concrete to prevent erosion resulting from wave overtopping.

SDPS-1C and Outfall E007 are located within 100 feet of the project site in Sub-reach 7A, and these structures are evaluated in this HRE.

6. Reach 11: Runway 28R

Reach 11 runs parallel to the northeast edge of Runway 28R and spans approximately 3,300 feet (see **Figure 9**, p. 25). The existing shoreline protection is characterized by a concrete wall fronted by armor rocks with an

[29] Revetments are sloping structures meant to barricade or prevent erosion due to wave action. Rock armor is a rock used to reinforce or "armor" shorelines and shoreline structures like pilings against erosion.

average elevation of approximately 4.5 feet above the existing road grade. As the reach transitions from the gravel beach of Reach 10, the fronting slope steepens to an armor rock slope. A series of four large outfall pipes are supported by a timber structure extending from the shoreline, approximately 750 feet into the reach, creating a 45-foot-wide gap in the seawall.

SDPS-1B and Outfall E006 are located within 100 feet of the project site in Reach 11, and these structures are evaluated in this HRE.

7. Reach 12: Runway 28 End

Reach 12 runs along the end of Runways 28R and 28L (see **Figure 10**, p. 26). The proposed double steel sheet pile wall for Reach 12 would be approximately 2,200 feet long, with a maximum height of 6.6 feet above the newly graded ground surface. Note that the lighting trestles at the end of Runways 28R and 28L were previously evaluated and determined ineligible for listing on the California Register.

8. Reach 13: Runway 28L

Reach 13 is 3,300 feet in length and runs parallel to Runway 28L along the southeast-facing section of shoreline (see **Figure 11**, p. 27). It is mostly characterized by a reinforced-concrete wall fronted by large armor rocks. At the east end of the reach a spit of shells has formed as a result of wave and current action. The maximum height of the concrete wall is 1.5 feet above the existing road grade, and a 20-foot gap in the concrete wall exists to accommodate outfall pipes from SDPS-1A. The concrete wall is fronted by large armor rocks.

SDPS-1A and Outfall E005 are located within 100 feet of the project site in Reach 13, and these structures are evaluated in this HRE.

9. Reach 14: Mudflat

Reach 14 runs parallel to Runway 1R and is located in a small embankment where it is sheltered from large wave activity by Runway 28L (see **Figure 12 through Figure 14**, pp. 28 to 30). The reach is 4,700 feet in length and is characterized by very mild tidal flats that are visible for over 1,000 feet at low tide. A vinyl sheet pile wall runs the entire length of this reach with a maximum height of 2 feet above the existing grade. At high tide, the shoreline advances to approximately 100 feet from the sheet pile wall, creating a wide section of grass and vegetation. A 20-foot-wide gap exists in the wall, providing a boat launch ramp and access point to the mudflat area.

Building 1080 is located within 100 feet of the project site in Reach 14, and this building is evaluated in this HRE.

10. Plot 16D: Construction Staging

Plot 16D is an irregularly shaped parcel bounded by South Airport Boulevard to the east, San Bruno Channel and the onramp to northbound U.S. 101 to the south, and U.S. 101 to the west. The northern boundary of the parcel borders five historic-age buildings (160, 168, 182, and 192 Beacon Street and 508 South Airport Boulevard). These five buildings are not owned or operated by SFO and are located within the city boundaries of South San Francisco (see **Figure 15**, p. 31). The parcel is currently used as a construction staging area by SFO.

The buildings located at 160, 168, 182, and 192 Beacon Street and 508 South Airport Boulevard are located within 100 feet of the construction staging site on Plot 16D and are evaluated in this HRE.

SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer	**Alignment Type**
U.S. Coast Guard Air Station San Francisco	Sheet Pile Wall
U.S. Coast Guard Historic District	
Existing Buildings Within 100-Foot Buffer	

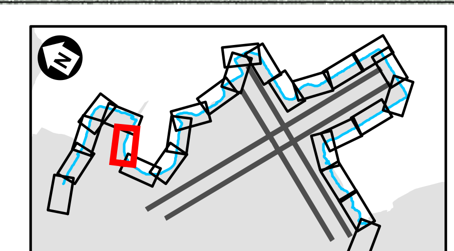


FIGURE 5
REACHE 3

SOURCE: Airport Conditions-SFO, 2021

Shoreline Protection Program HRE Part 1

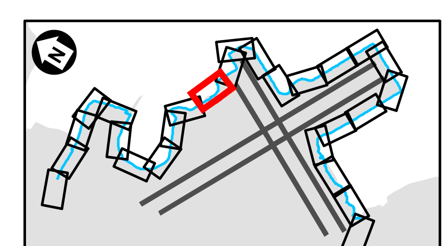
FIGURE 6

REACH 4

SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

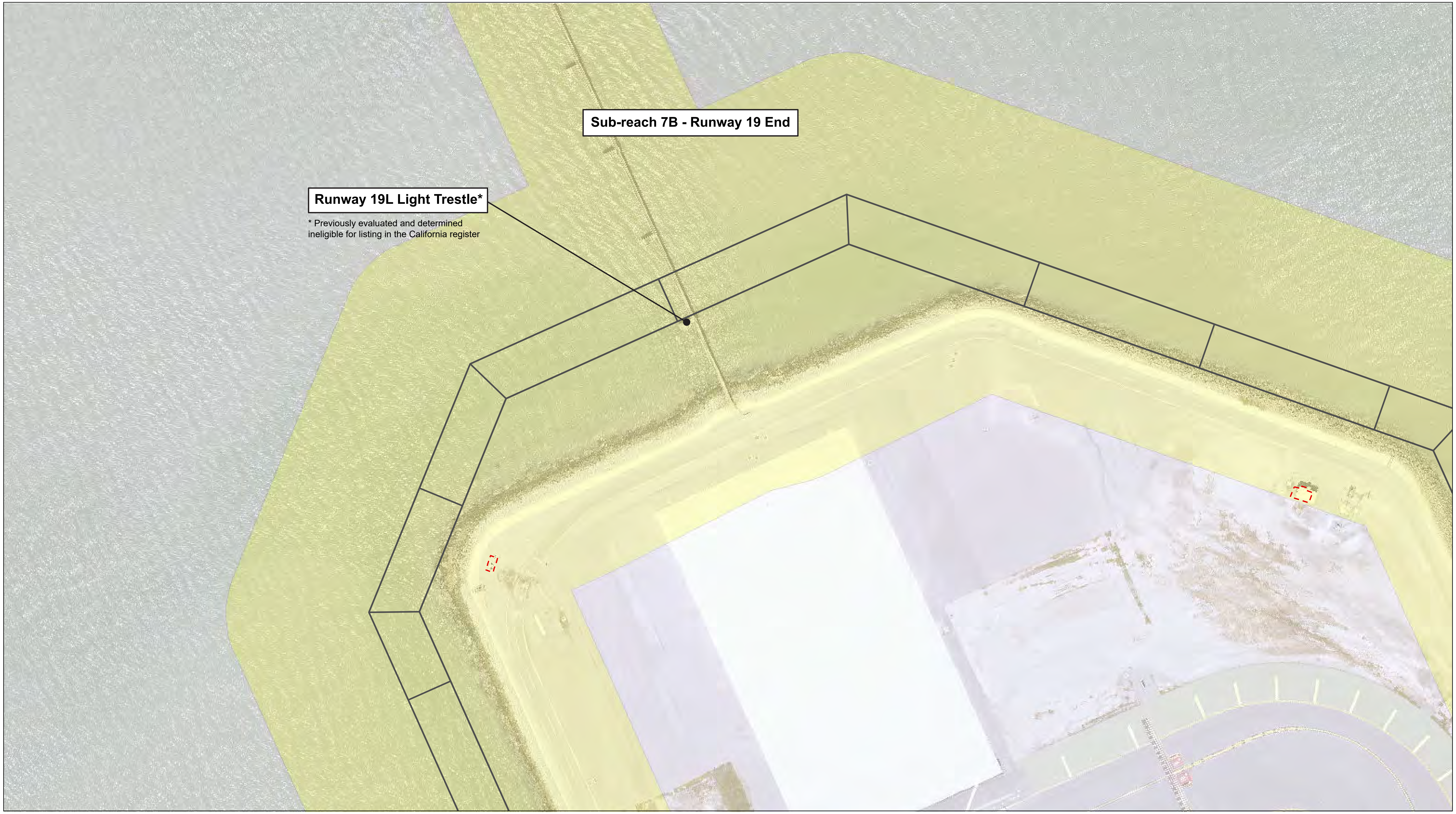
100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Alignment Type
Sheet Pile Wall



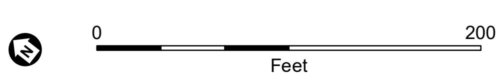
Shoreline Protection Program HRE Part 1

FIGURE 7

REACH 6 AND SUB-REACH 7A

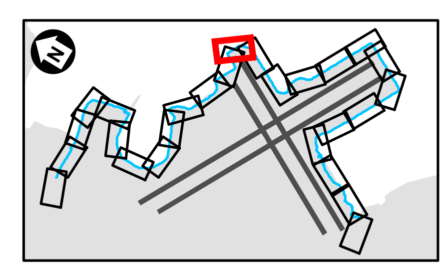


SOURCE: Airport Conditions-SFO, 2021



100-Foot Buffer
Existing Buildings Within 100-Foot Buffer

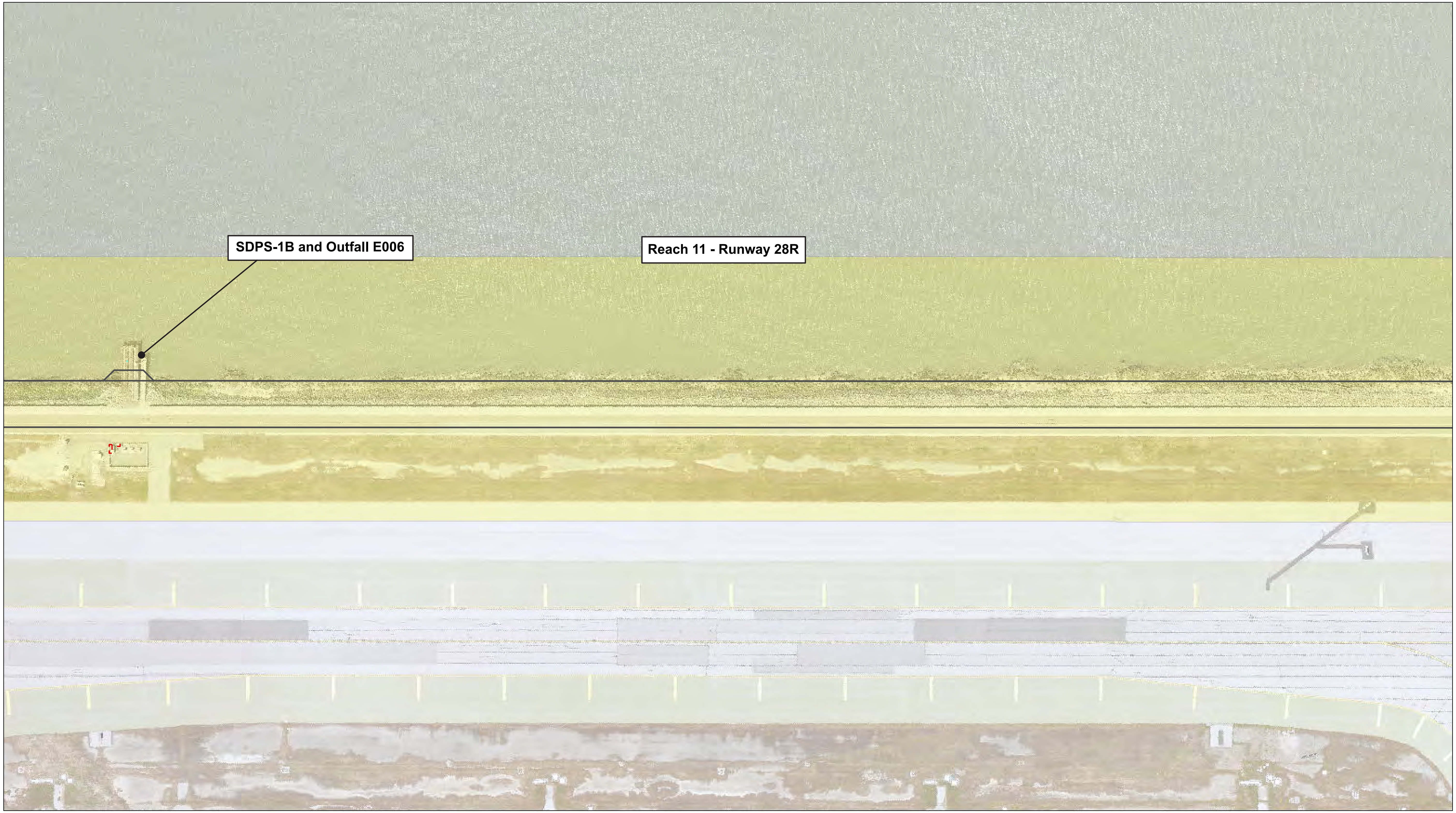
Alignment Type
Sheet Pile Wall



Shoreline Protection Program HRE Part 1

FIGURE 8

REACH 7B



SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Alignment Type
Sheet Pile Wall

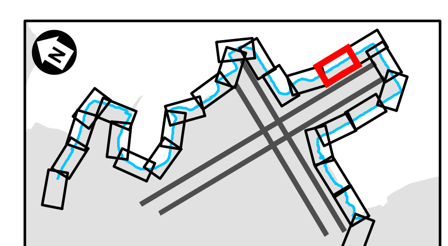
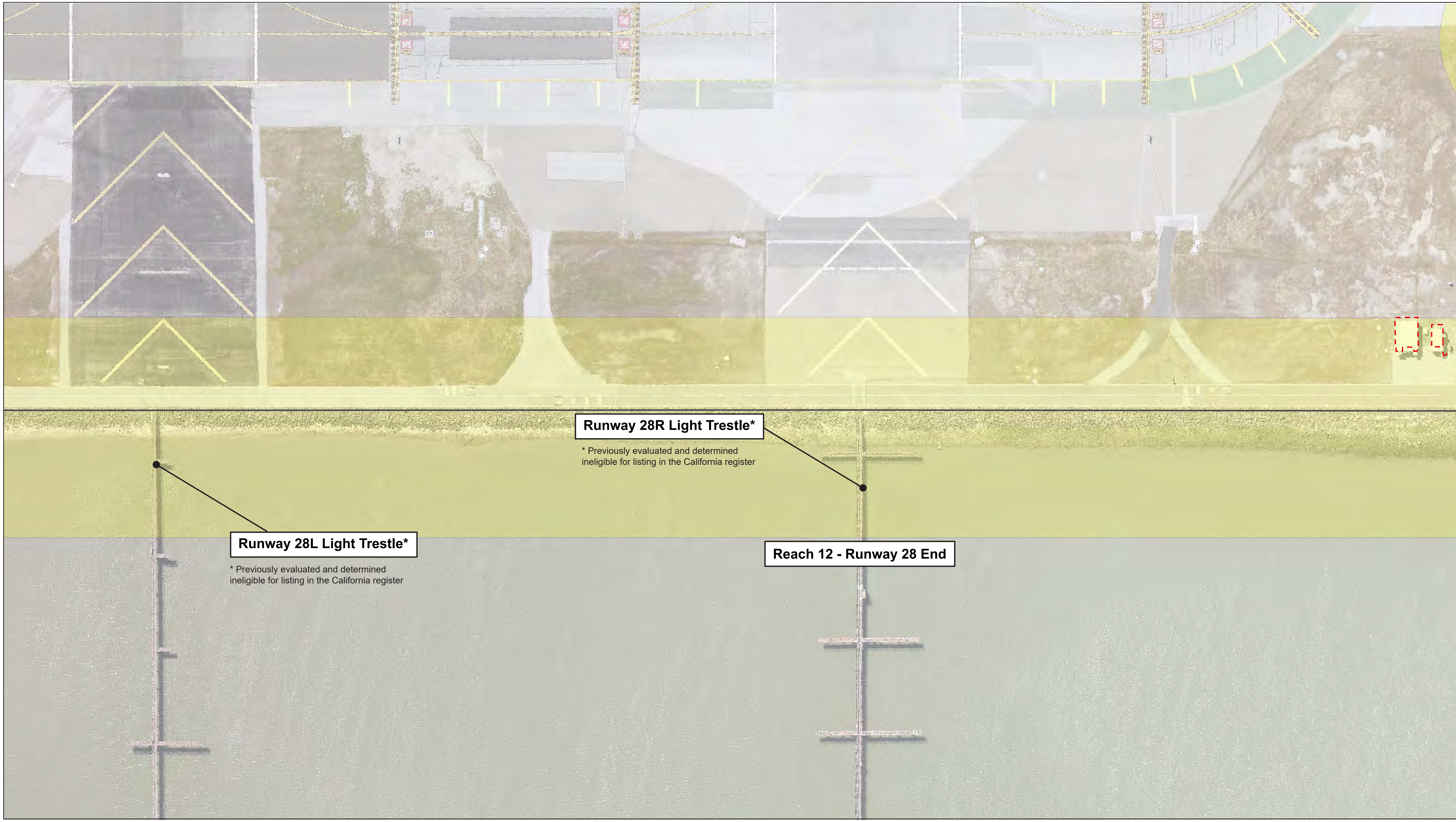


FIGURE 9
REACH 11



SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Alignment Type
Sheet Pile Wall

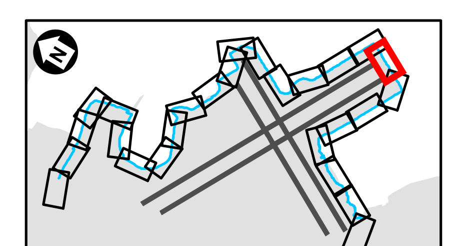
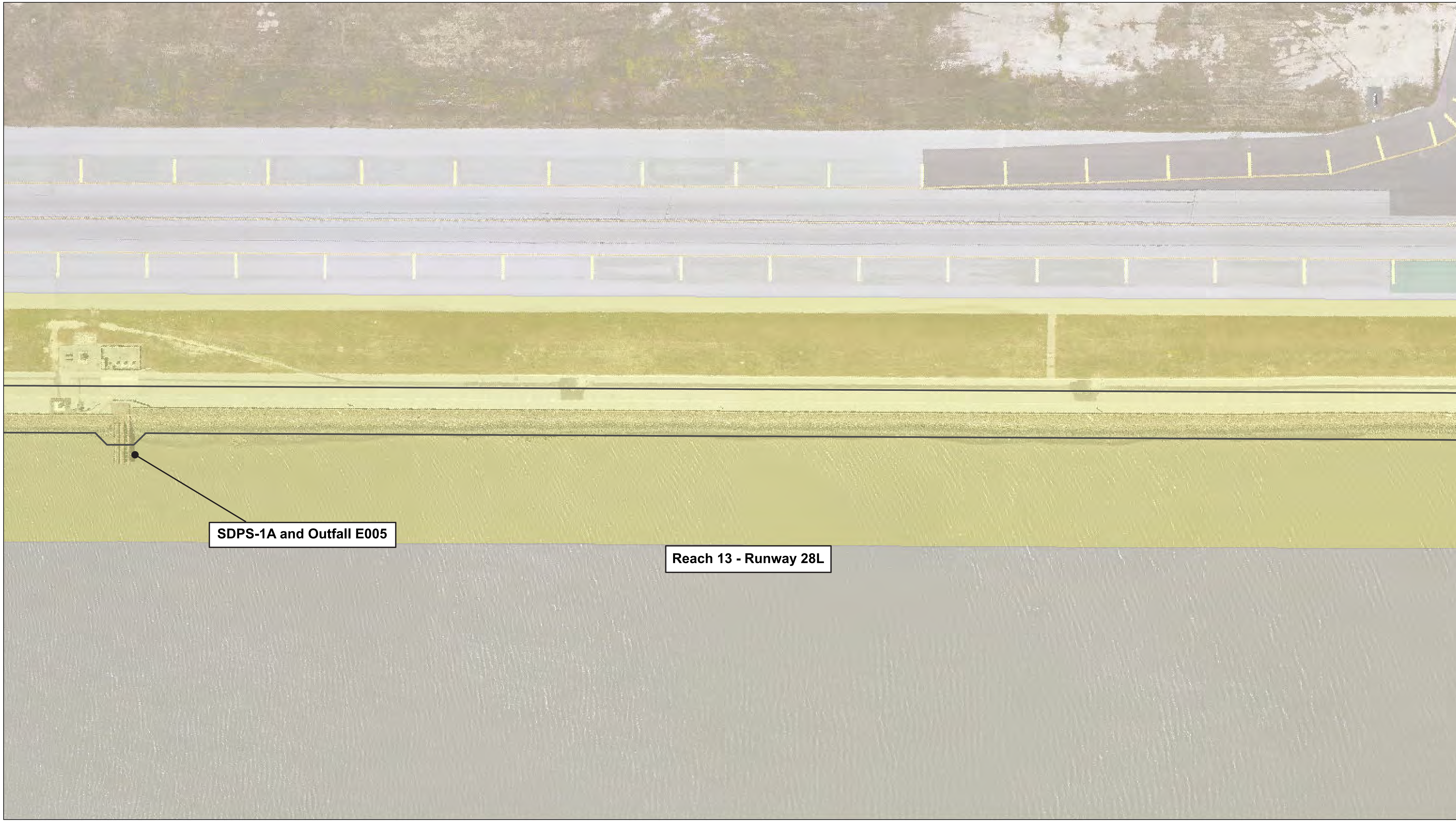


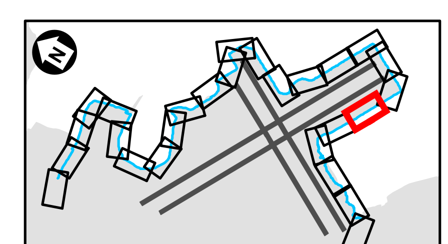
FIGURE 10
REACHE 12



SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer
Alignment Type
Sheet Pile Wall



Shoreline Protection Program HRE Part 1

FIGURE 11
REACH 13

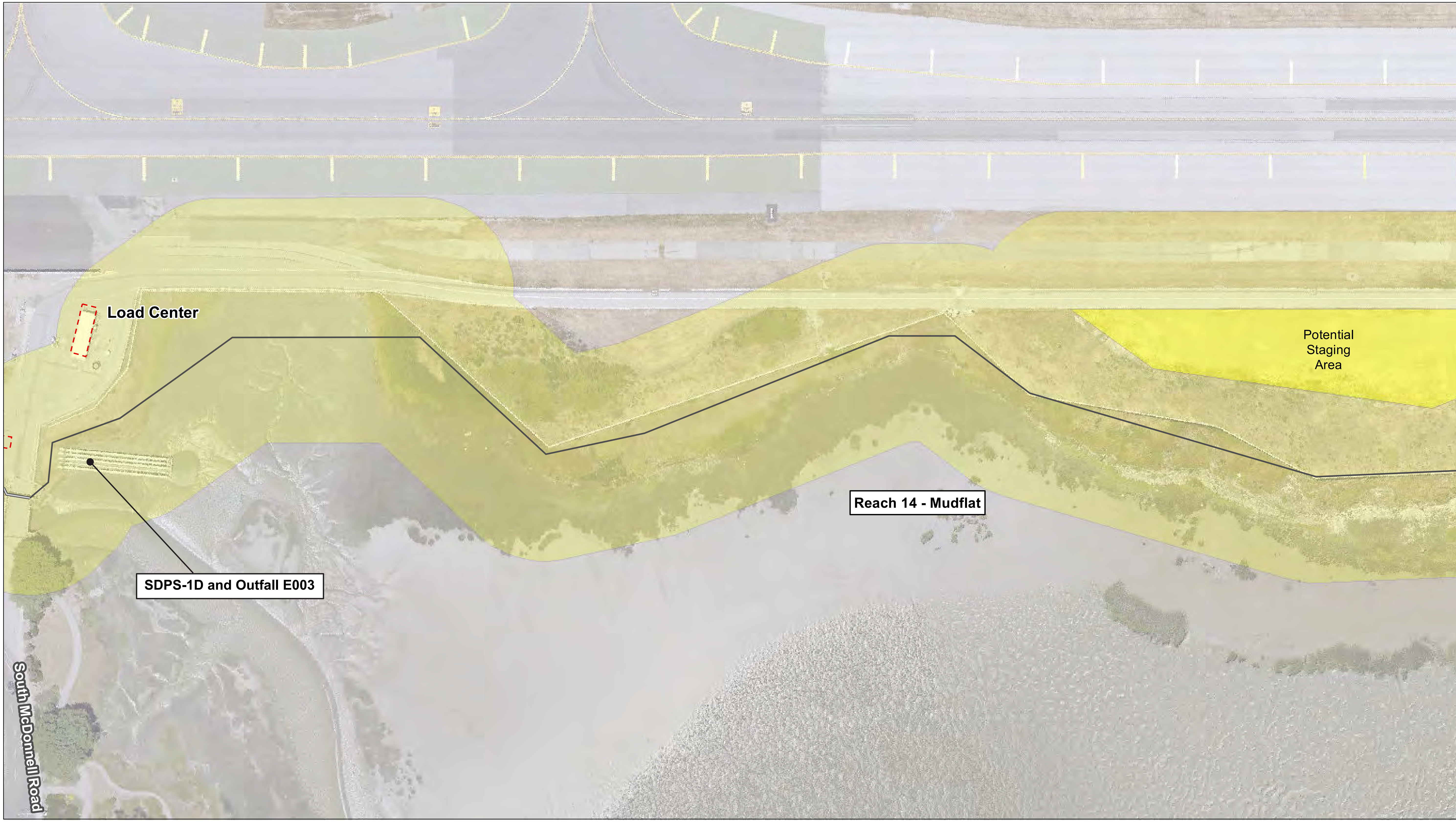
SOURCE: Airport Conditions-SFO, 2021

0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer

Alignment Type
Sheet Pile Wall

FIGURE 12
REACHES 13 AND 14



SOURCE: Airport Conditions-SFO, 2021

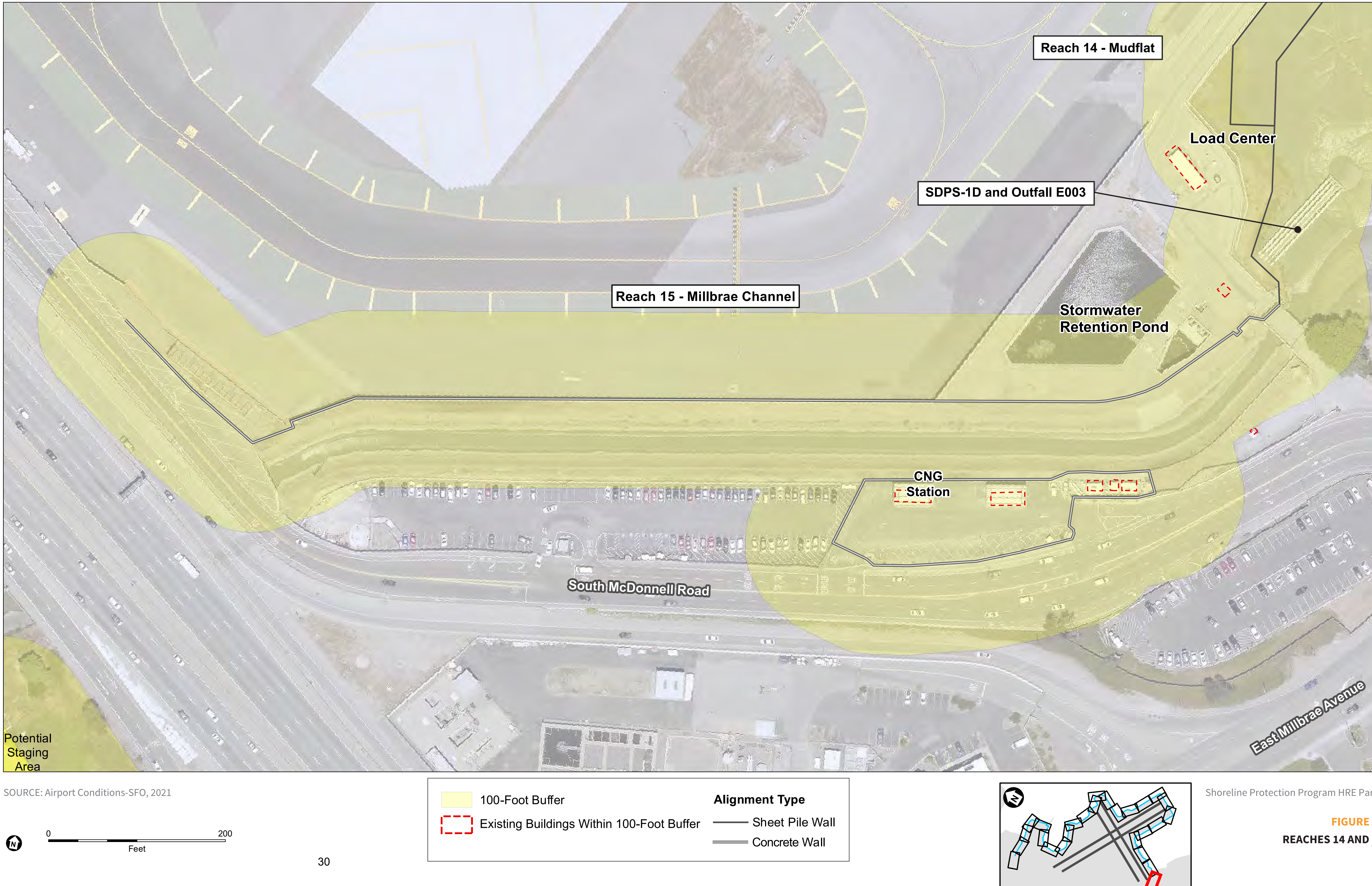
0 200
Feet

100-Foot Buffer
Existing Buildings Within 100-Foot Buffer

Alignment Type
Sheet Pile Wall
Concrete Wall

Shoreline Protection Program HRE Part 1

FIGURE 13
REACH 14



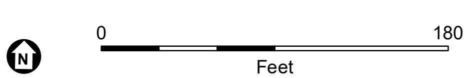
SOURCE: Airport Conditions-SFO, 2021

Shoreline Protection Program HRE Part 1

FIGURE 14

REACHES 14 AND 15

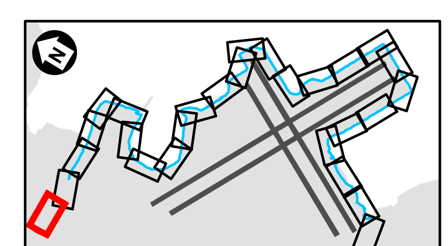
SOURCE: Airport Conditions-SFO, 2021



- 100-Foot Buffer
- Existing Buildings Within 100-Foot Buffer
- United Airlines Maintenance Operations Center

Alignment Type

- Sheet Pile Wall



Shoreline Protection Program HRE Part 1

FIGURE 15

PLOT 16D CONSTRUCTION STAGING AREA

INTENTIONALLY BLANK

C. Architectural Descriptions

1. 160 Beacon Street (Plot 16D Construction Staging Area)

The building located at 160 Beacon Street is a one-story, reinforced concrete building that is roughly rectangular in plan. The exterior concrete walls are clad in stucco. The building is capped by a flat roof covered with light-colored rolled roofing. The building is sited at the southwestern corner of the lot.

The primary (east) façade faces a surface parking lot accessed from Beacon Street and is composed of 14 structural bays. Six bays feature a roll-up vehicular door; two bays feature a large, four-over-three fixed aluminum-frame window; and the three northernmost bays feature an aluminum-frame storefront with fixed windows and a pair of glazed metal doors below a horizontal awning. The upper half of the primary façade is painted in an offset checkerboard pattern. An illuminated "K1 SPEED" sign is mounted in the middle of the checkerboard design.

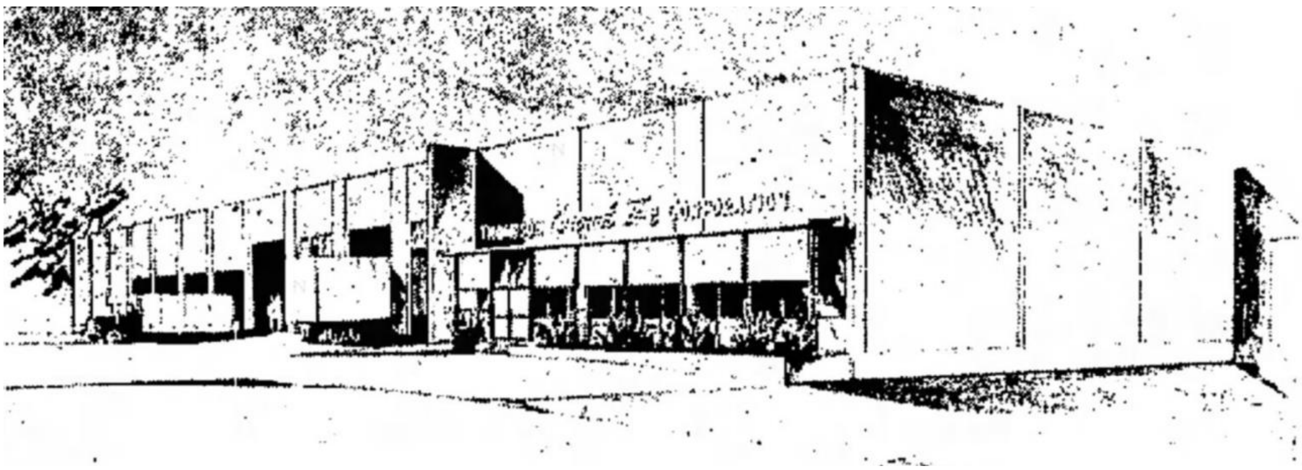
The west (rear) façade faces the U.S. 101 onramp. It is composed of 14 structural bays and features two roll-up vehicular doors. The south façade, composed of nine structural bays and one flush metal entrance door, faces the Plot 16D construction staging area. The north façade partially abuts the adjacent building to the north, so only the three easternmost structural bays are visible. This façade faces a small parking lot and contains no fenestration.

SOURCE: ESA, October 2021. Shoreline Protection Program HRE Part 1

Figure 16
160 Beacon Street, Looking Southwest

Construction Chronology and Alterations[30]

The building located at 160 Beacon Street is located within the Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east). The tract was platted in 1955 and subdivided in 1957.[31,32] Archival research confirms that the building was constructed and occupied in 1958 as a factory for Thompson Aircraft Tire.[33] The building's "modern, attractive design [met the] high standards of the industrial park."[34]



SOURCE: *San Mateo Times*, May 7, 1958, p. 17. Shoreline Protection Program HRE Part 1

Figure 17
Rendering of 160 Beacon Street, 1958

In 2012, the building was converted to an indoor go kart racing track; alterations include an accessible ramp, trash enclosures with new plumbing, new furring to existing framing, a new lobby wall, and construction of interior walls.[35] That same year, the building underwent a seismic retrofit,[36] and the roof was repaired.[37] Structural upgrades to the timber framing were completed in 2014.[38] A new roof membrane was added in 2016.[39]

[30] No building permits or historical photographs prior to 2012 were available to verify earlier modifications to the building.
[31] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[32] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[33] *Aviation Week, Including Space Technology*, Vol. 69, Part 2, 1958, p. 61, https://www.google.com/books/edition/Aviation_Week_Including_Space_Technology/2oVKAQAAIAAJ?hl=en&gbpv=1&bsq=%22160+beacon+street,+south+san+francisco%22&dq=%22160+beacon+street,+south+san+francisco%22&printsec=frontcover, accessed October 1, 2021.
[34] "Thompson Tire Breaks Ground," *San Mateo Times*, May 7, 1958, p. 19.
[35] Building permit no.B12-0838, issued July 30, 2012, https://permits.ssf.net/Search/permit.aspx?activityNo=B12-0838, accessed October 1, 2021.
[36] Building permit no.B12-0837, issued June 27, 2012, https://permits.ssf.net/Search/permit.aspx?activityNo=B12-0837, accessed October 1, 2021.
[37] Building permit no.B12-1508, issued August 28, 2012, https://permits.ssf.net/Search/permit.aspx?activityNo=B12-1508, accessed October 1, 2021.
[38] Building permit no.B14-0937, issued June 3, 2014, https://permits.ssf.net/Search/permit.aspx?activityNo=B14-0937, accessed October 1, 2021.
[39] Building permit no.B16-1302, issued August 18, 2016, https://permits.ssf.net/Search/permit.aspx?activityNo=B16-1302, accessed October 1, 2021.

2. 168 Beacon Street (Plot 16D Construction Staging Are)

The building located at 168 Beacon Street is a one-story, reinforced concrete building that is rectangular in plan. The exterior concrete walls are clad in stucco. The building is capped by a flat roof covered with light-colored rolled roofing and occupies the full depth of the lot.

The primary (north) façade faces a narrow strip of landscaping along Beacon Street and is composed of three structural bays marked by full-height blue vertical stripes. The western and central bays feature pairs of fixed-sash windows, and the eastern bay contains a fixed sash window and an aluminum-framed entrance door. A full-width pent roof covered with standing-seam metal is located above the entrance. The upper portion of the primary façade features a metal sign printed with “PRECISE MAILING, INC.”

The rear (south) façade faces the Plot 16D construction staging area and is composed of four structural bays and features no fenestration. The west (side) façade faces a parking lot and is composed of eight structural bays and features no fenestration. The east façade also faces a parking lot and is composed of eight structural bays. Two glazed, single-leaf pedestrian doors with transoms are located in the two northernmost bays. A double-leaf, metal pedestrian door below a sloped awning covered with standing-seam metal is located in the third bay. The fourth bay contains a freight dock with two roll-up loading doors below a sloped awning covered with standing-seam metal. Another roll-up vehicular door is located in the seventh bay. The eighth (southernmost) bay contains a pedestrian entrance and a fixed, plate-glass storefront window. A sloped awning covered with standing-seam metal is located above the window and entry in the southernmost bay.

SOURCE: ESA, October 2021. Shoreline Protection Program HRE Part 1

Figure 18
168 Beacon Street, Looking Southwest

Construction Chronology and Alterations

The building located at 168 Beacon Street is located within the Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east). The tract was platted in 1955 and subdivided in 1957.[40,41] The building was constructed in 1958 by Associated Construction and Engineering for the Raybestos-Manhattan Co.[42] No building permits or historical photographs were available to verify modifications to the building.

3. 182 Beacon Street (Plot 16D Construction Staging Area)

The building located at 182 Beacon Street is a one-story, reinforced concrete building that is rectangular in plan. The exterior concrete walls are clad in stucco. The building is capped by a bowstring-truss roof covered with light-colored rolled roofing and occupies the full depth of the lot.

The primary (north) façade faces a narrow strip of landscaping along Beacon Street and is composed of seven structural bays marked by engaged pilasters that run three-quarters of the building height. The façade is dominated by a projecting central bay that contains two pairs of glazed, aluminum-frame doors with transoms. The two bays flanking the central entries feature three-over-four, fixed metal-sash windows. The western bay features a slight variation with a four-over-four, fixed metal-sash window. The eastern bay features a metal roll-up vehicular door.

The rear (south) façade, which faces the Plot 16D construction staging area, is composed of seven structural bays and features a full-width, shed-roof addition covered with corrugated metal. A single vehicular roll-up door is located in the eastern bay. The west (side) façade, which faces a parking lot is composed of eight structural bays and features three vehicular roll-up doors. Two of the doors have small loading docks, and the third door is at grade level. A wooden fence encloses an area of the parking lot along the southern half of the façade that is used for storage. The east (side) façade is also composed of eight structural bays and faces a parking lot and features no fenestration. The green horizontal stripe continues around all four façades.

SOURCE: ESA, October 2021. Shoreline Protection Program HRE Part 1

Figure 19
182 Beacon Street, Looking Southwest

[40] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[41] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[42] "Raybestos to Build in South City," *San Mateo Times*, August 26, 1958, p.19.

Construction Chronology and Alterations

The building located at 182 Beacon Street is within the Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east). The tract was platted in 1955 and subdivided in 1957.[43,44] The building was constructed in 1960 for the P.L. Badt Co.[45] The primary façade was repaired with new stucco and a bowstring-truss roof replaced the original flat roof ca. 2020.[46] No building permits or historical photographs were available to verify other modifications to the building.

4. 192 Beacon Street (Plot 16D Construction Staging Area)

The building located at 192 Beacon Street is a one-story, reinforced concrete building that is rectangular in plan. The exterior concrete walls are clad in stucco. The building is capped by a flat roof covered with light-colored rolled roofing and is sited at the northern edge of the lot facing a rectangular strip of grass and landscaping along Beacon Street.

The primary (north) façade is composed of four structural bays marked by full-height engaged pilasters. The main entrance to the building is located in the easternmost bay through a single-leaf, glazed, aluminum-frame door with a fixed transom and sidelite. An asymmetrical two-over-two, fixed, aluminum-sash window is located west of the door, and a horizontal awning covers only the easternmost bay. The remaining three structural bays feature three-over-two, fixed, aluminum-sash windows.

The rear (south) façade, which faces a parking lot and the Plot 16D construction staging area is composed of four structural bays and features one, flush-mounted pedestrian entrance. The west (side) façade, which faces a parking lot, is composed of five structural bays and features two aluminum-sash windows and a single-leaf, glazed, aluminum-frame pedestrian entrance. A small electrical panel enclosure is located within the northernmost structural bay. The east (side) façade partially abuts the neighboring building at 500 South Airport Boulevard. Only the northernmost structural bay, which faces a small parking lot, is visible, and contains no fenestration.

---

[43] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[44] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[45] "Badt to Move," *San Francisco Chronicle*, May 17, 1960, p.43.
[46] Google Street View, November 2020.

SOURCE: ESA, October 2021. Shoreline Protection Program HRE Part 1

Figure 20
192 Beacon Street, Looking South

Construction Chronology and Alterations

The building located at 192 Beacon Street is located within the Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east). The tract was platted in 1955 and subdivided in 1957.[47,48] The building was constructed in 1959 by Harvis Construction Co. for RCA as an 800-square-foot service facility.[49] The building was reroofed in 2010.[50] No building permits or historical photographs were available to verify other modifications to the building.

5. 508 South Airport Boulevard (Plot 16D Construction Staging Area)

The building located at 508 South Airport Boulevard is a one-story, reinforced concrete building with an L-shaped plan. The exterior concrete walls are clad in rectangular metal panels mounted to a tall metal frame, giving it the appearance of a two-story building. The building is capped by a flat roof covered with rolled roofing and occupies most of the trapezoidal lot.[51]

[47] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[48] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[49] "RCA Breaks Ground in S.S.F.," *San Mateo Times*, August 4, 1959, p. 3.
[50] Building permit no.B10-0042, issued January 8, 2010, https://permits.ssf.net/Search/permit.aspx?activityNo=B10-0042, accessed October 1, 2021.
[51] The roof shape and materials are based on aerial views in Google Earth. These views are dated March 2021 and show the re-cladding with metal panels in progress. At that time, the one-story concrete building is clearly visible, and no construction related to a new second-story addition is evident. The re-cladding appears to be a surface treatment only and not an expansion of the building's usable volume.

The primary (east) façade is composed of two distinct sections. The southern section contains the main entry composed of a glazed, aluminum-frame pedestrian door with a transom and three fixed, aluminum-sash windows. The entrance is covered by a horizontal awning. A roll-up vehicular door is located on this section of the façade. The northern section, which is set back, is similar to the southern section, with the same window and entrance, awning, and vehicular roll-up door. Additionally, a smaller, pedestrian-height roll-up door is located between the glazed door and the vehicular roll-up door.

The rear (west) façade faces a small parking lot shared with the building located at 192 Beacon Street and is not visible from the public right-of-way. The south (side) façade, which faces the Plot 16D construction staging area, features three three-over-three, aluminum-sash windows, two flush-mounted, single-leaf pedestrian doors, and a vehicular roll-up door. The north (side) façade partially abuts the neighboring building at 500 South Airport Boulevard. No fenestration is visible.

SOURCE: ESA, October 2021. Shoreline Protection Program HRE Part 1

Figure 21
508 South Airport Boulevard, Looking West

Construction Chronology and Alterations

The building located at 508 South Airport Boulevard is located within the Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east). The tract was platted in 1955 and subdivided in 1957.[52,53] The building was constructed in 1961 for the S.K. Wellman Co.[54] Metal panel cladding was recently installed over the stucco façade, creating the appearance of a two-story building.[55] No building permits or historical photographs were available to verify other modifications to the building.

6. Outfall E010 (Sub-reach 2A)

Outfall E010 is located on the north (bay) side of North Access Road, a short distance east of the intersection with North Field Road (see Figure 2, p. 15, and **Figure 22**). A wood platform with wood handrails is situated on top of a metal pipe. The platform was previously used to collect water samples, but it is no longer in use as it is frequently submerged below water.[56] The outfall is difficult to see from the public right-of-way, especially at high tide.

The outfall is identified by the red arrow. The Fuel Farm is visible in the right background.

SOURCE: SFO, September 2020. Shoreline Protection Program HRE Part 1

Figure 22
Outfall E010, Looking East Toward the Fuel Farm

[52] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[53] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[54] "New SSF Plant Begun," *San Mateo Times*, April 10, 1961, p.10.
[55] The recladding was in progress when the building was recorded for this report.
[56] Art Castro (SFO), email to David Kim (SFO), September 2, 2020.

Construction Chronology and Alterations

Outfall E010 was constructed in 1970.[57] The wood platform was constructed ca. 2000 and has been reconstructed multiple times. It is no longer in use at the time of this writing.[58]

7. Mel Leong Treatment Plant

The Mel Leong Treatment Plant is a facility for the treatment of industrial and sanitary wastewater generated by SFO. The plant is a campus of buildings and structures constructed between ca. 1969 and 2020 that occupies approximately 9.9 acres in the Airport's North Field. The historic-age buildings and structures located within 100 feet of the project site are described below.

Building 918/Sanitary Waste Process Administration (Sub-reach 2B)

Building 918 is a one-story building that is roughly rectangular in plan (see Figure 4, p. 17, and **Figure 23**).[59] According to original design documents, it is clad in Galbestos (i.e., galvanized steel with asbestos felt) "Box Rib" siding, and capped by two low-pitched gabled roofs covered with Galbestos "Huski-Rib" roofing (Contract No. A-570). The primary entrance is located at the north end of the primary (southwest) façade and is composed of a single glazed, aluminum-frame door with fixed sidelights and a transom flanked by fixed, steel-sash windows with awning-sash transoms. To the south is a small addition clad in standing-seam metal siding and featuring three fixed windows with awning-sash transoms, which replaced the original roll-up metal door in this location. The south portion of the façade features one large vehicular opening without a door, two roll-up metal doors, and two flush metal pedestrian doors. Steel-sash windows are located below the roofline.

SOURCE: SFO, September 2020. Shoreline Protection Program HRE Part 1

Figure 23
Primary Façade of Building 918, Looking Southeast

The secondary (northwest) façade features two vertical smooth metal panels. One contains a fixed window, and the other contains a single metal pedestrian door that has been altered to include a louvered panel. A metal ladder is affixed to the north end of the façade and provides access to the roof.

[57] SFO, "Drainage Areas and Storm Water Outfalls Map," May 2019. Annotated to include construction dates by Colton Yee (SFO), August 2020.
[58] Art Castro (SFO), email to David Kim (SFO), September 2, 2020.
[59] Two digester tanks and a headworks are associated with Building 918. These structures were built concurrently with the administration building (see Construction Chronology below). The digester tanks—round, utilitarian structures approximately 45 feet in diameter—are located within 100 feet of the project site, and the headworks is outside of the 100-foot buffer. Construction of the Reach 2 roadway, which would occur adjacent to the digester tanks, would not require high-impact pile driving; therefore, there would be no construction-related impacts to the digester tanks. As such, the two digester tanks are not included in this HRE.

The rear (northeast) façade is separated from Building 922 by a short distance (approximately 10 feet). As originally designed, it features four metal pedestrian doors and a ribbon of steel-sash windows below the roofline.

The side (northeast) façade contains no window or door openings.

Building 922/SBR Sanitary Process (Sub-reach 2B)

Building 922 is composed of two structures built more than 30 years apart. The older component, constructed ca. 1969–70, is located at the southeast end of the building. It is of reinforced concrete construction and features a roughly rectangular footprint. The structure contains a narrow chlorine contact basin and four basins of approximately equal size—one holding tank and three equalization basins. The individual basins have metal guardrails around the perimeters (see **Figure 24**).

SOURCE: SFO, September 2020. Shoreline Protection Program HRE Part 1

Figure 24
Older Portion of Building 922, Looking North

The newer component, constructed ca. 2002–05, is located at the northwest end of the building. It is of reinforced concrete construction and features an irregular footprint. The structure contains three 900,000-gallon sequencing batch reactor (SBR) basins, a three-story-over-basement process building at the northwest corner, and a detached two-story hopper tower (see **Figure 25**).

The process building is visible at the left, and the SBR basins are visible at the right.

SOURCE: SFO, September 2020. Shoreline Protection Program HRE Part 1

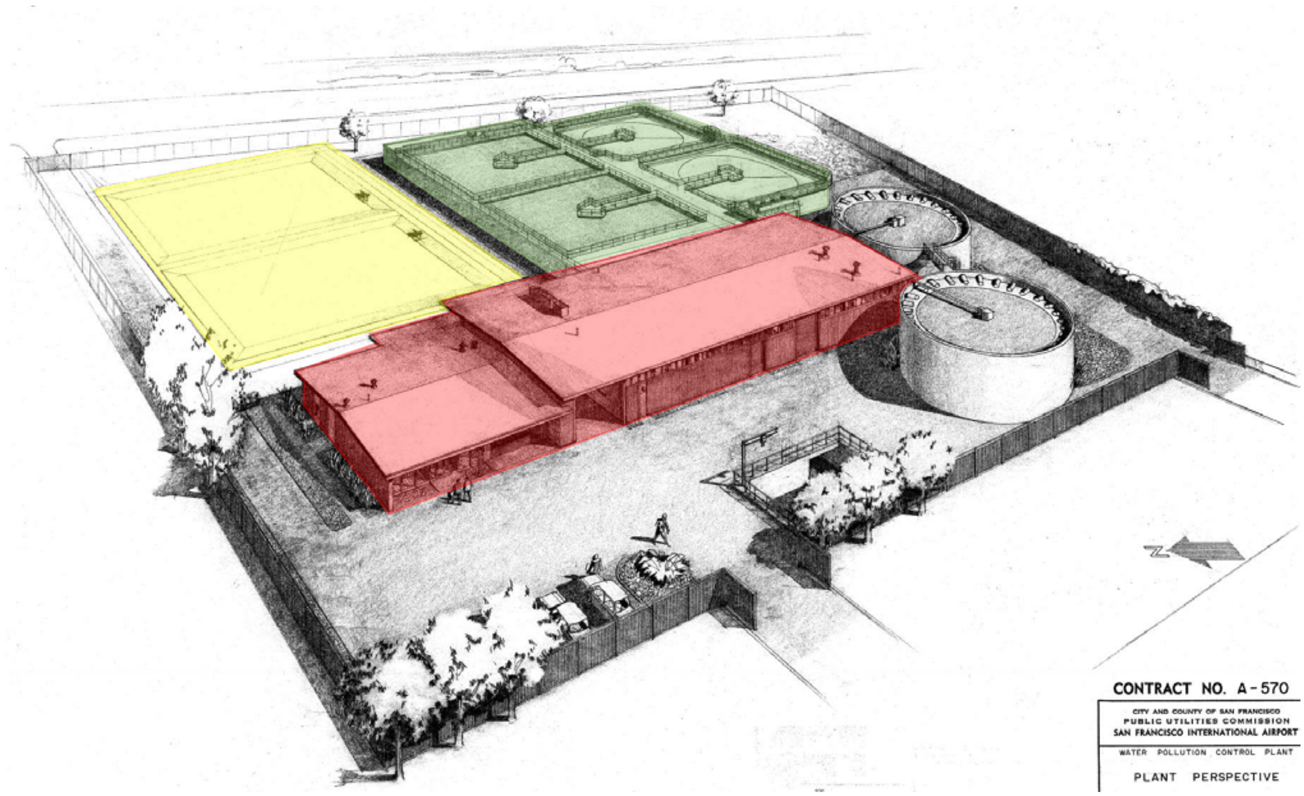
Figure 25
Newer Portion of Building 922, Looking East

Construction Chronology and Alterations

First Major Phase

The present-day Mel Leong Treatment Plant was constructed in multiple phases. The first major phase, which was originally known as the water pollution (variously water quality) control plant and later as the sanitary waste treatment plant, was operational beginning in August 1970 (Contract No. A-570). Following the anaerobic sludge digestion and the vacuum filtration processes, the effluent was discharged to the South San Francisco-San Bruno outfall and into the bay.[60] As designed, the plant was composed of the following components: a combined administration and operations building (extant; today known as Building 918); a headworks to screen influent (extant); two digestion tanks (extant); a treatment unit made up of a primary sedimentation tank, a secondary sedimentation tank, and two aeration tanks (extant; today part of Building 922); and two sludge drying beds (replaced by the newer portion of Building 922 ca. 2002–05) (see **Figure 26** and **Figure 27**). Building 918 was designed by Kitchen & Hunt Architects of San Francisco, and the other components of the treatment plant were designed by Kennedy Engineers of San Francisco.[61]

[60] Landrum & Brown, *San Francisco International Airport Expansion Program: Environmental Impact Assessment Report*, Vol. 1, 1975: II-46, https://archive.org/details/sanfranciscointe1975land/page/n137/mode/2up, accessed September 29, 2020.
[61] George Golding, "OK Millions for Airport Improvement," *The Times* (San Mateo), October 16, 1968, p. 26.

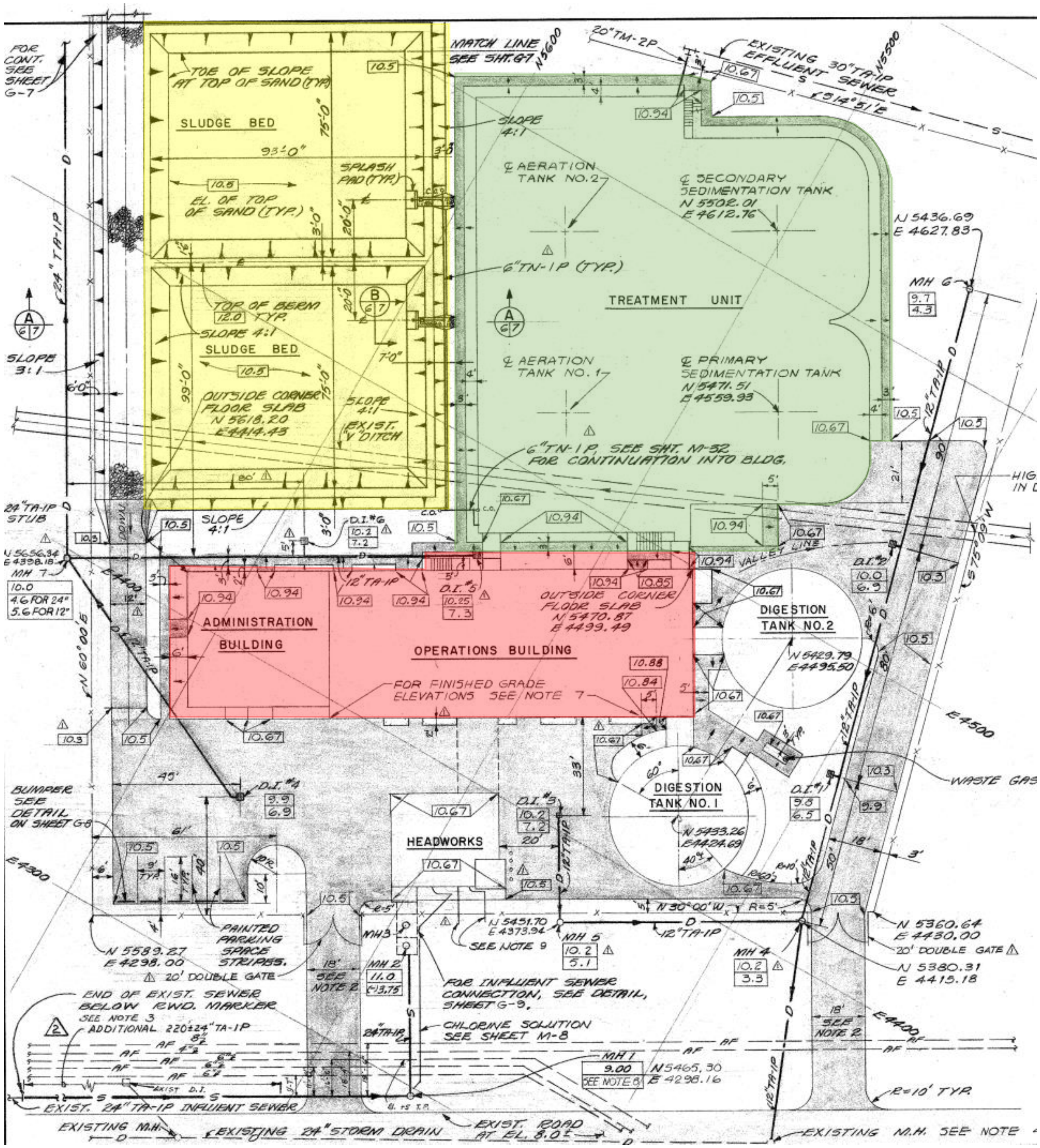


Building 918 is shown in red (the digester tanks and headworks are not evaluated in this HRE), the older portion of Building 922 is shown in green, and the sludge beds shown in yellow have been demolished and replaced with the newer portion of Building 922.

SOURCE: City and County of San Francisco Public Utilities Commission, *San Francisco International Airport Water Pollution Control Plant* (architectural drawings, December 1, 1969, sheet G-2/drawing CA-13287); edited by ESA.

Shoreline Protection Program HRE Part 1

Figure 26
Architectural rendering of the Sanitary Waste Treatment Plant (First Phase of Construction), 1969



Building 918 is shown in red (the digester tanks and headworks are not evaluated in this HRE), the oldest portion of Building 922 is shown in green, and the sludge beds shown in yellow have been demolished and replaced with the newer portion of Building 922.

SOURCE: City and County of San Francisco Public Utilities Commission, *San Francisco International Airport Water Pollution Control Plant* (architectural drawings, December 1, 1969, sheet G-6/drawing CA-13291).

Shoreline Protection Program HRE Part 1

Figure 27
Site Plan of the Sanitary Waste Treatment Plant (First Phase of Construction), 1969

Second Major Phase

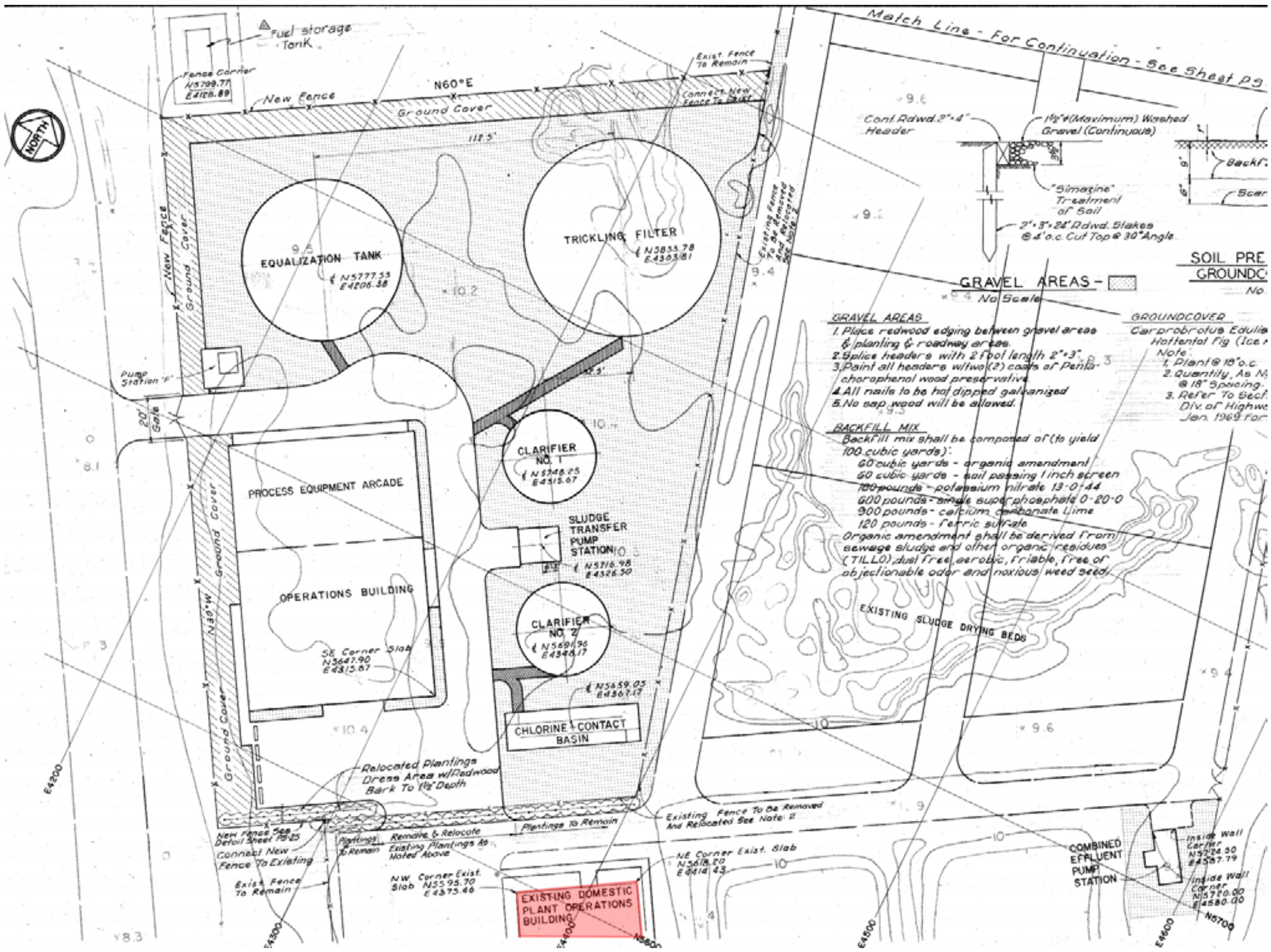
In the 1970s, an airport expansion program included plans to construct an industrial wastewater treatment system whose treated flow would be subjected to combined treatment with treated flow from the existing sanitary treatment plant.[62] This was the second major phase of construction, and all components are located outside of the SPP project site. Between 1970 and 1978, eight additional sludge drying beds were constructed on the north side of the sanitary treatment plant.[63] After studying the functionality of a pilot plant constructed at SFO,[64] the new facility was designed by Consoer, Townsend & Associates Consulting Engineers of San Jose in 1978, and the new industrial wastewater and combined treatment plant was operational by 1980 (Contract No. 936; see **Figure 28**). Prior to that time, each airport tenant was responsible for the collection of their own wastewater, which was then pumped into one of two oxidation ponds (also known as first flush ponds) or directly to the industrial wastewater treatment facility. Necessary components of the industrial wastewater treatment facility included: an equalization tank with a capacity of approximately 600,000 gallons; two types of oil separators for easily removed oil and for dispersed oil and acid; chemical treatment for the removal of heavy metals; and a biological, flocculation, and chlorination treatment. Components of the joint treatment system included a final filtration step to reduce the concentration of suspended solids. The combined effluent was then discharged to the South San Francisco-San Bruno Water Quality Control Plant and ultimately into the bay.[65] Building 908 was designed in 1978 as part of the second major phase of development (Contract No. 936). Based on a review of historic aerial photographs, it was constructed ca. 1980–82.

[62] City and County of San Francisco Airports Commission, *San Francisco International Airport Expansion Program: Modernization and Replacement Phase*, April 1977, p. 6, https://archive.org/details/sanfranciscointe3197sanf/page/n17/mode/2up, accessed September 29, 2020.

[63] The note "Existing sludge drying beds" is shown on City and County of San Francisco Public Utilities Commission, *San Francisco International Airport Industrial Treatment Plant* (architectural drawings), Sheet SD-1/drawing CA-15391, September 1978.

[64] Consoer, Townsend & Associates, *Pilot Plant Study for the Treatment of Industrial Waste Vol. 1*, prepared for the San Francisco Airports Commission, April 1977.

[65] Landrum & Brown, *San Francisco International Airport Expansion Program: Environmental Impact Assessment Report, Vol. 1*, 1975: II-48-50, https://archive.org/details/sanfranciscointe1975land/page/n139/mode/2up, accessed September 29, 2020.



The north end of Building 918 is shown in red at the bottom of the drawing.

SOURCE: City and County of San Francisco Public Utilities Commission, *San Francisco International Airport Industrial Treatment Plant* (architectural drawings, September 1978, sheet SD-1/drawing CA-15391).

Shoreline Protection Program HRE Part 1

Figure 28
Site Plan of the Industrial Waste Treatment Plant (Second Phase of Construction), 1978

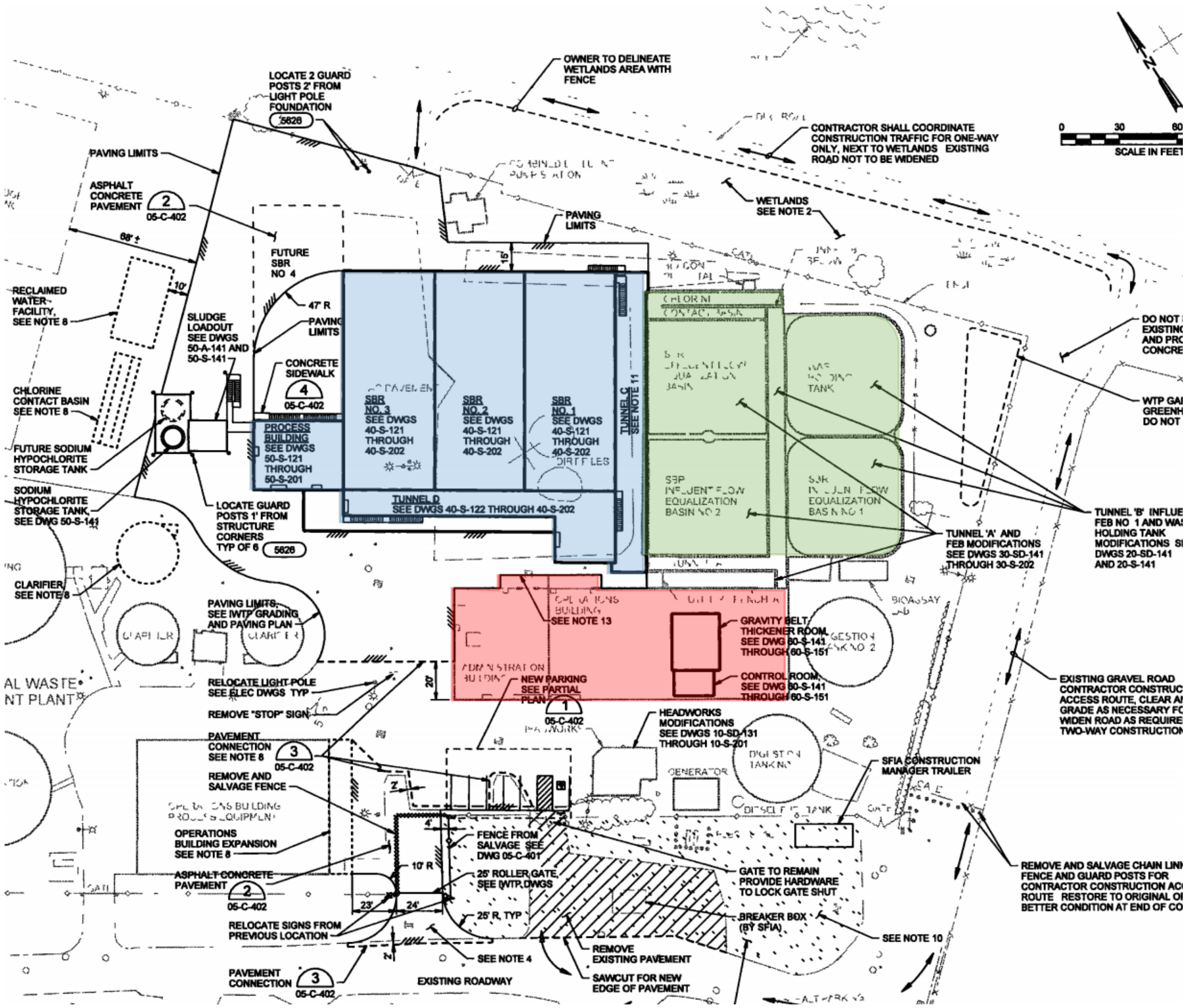
Third Major Phase

In July 2002, another expansion program was approved by the Airport Commission to upgrade and expand the water treatment plant; this was the third major phase of construction.[66] Studies for the expansion were led by the engineering firm CH2M HILL beginning in the early 1990s,[67] and this ultimately resulted in the construction of three 900,000-gallon SBR basins, comprising most of the present-day Building 922 (see **Figure 29**). The expansion was designed by SFO engineering staff and CH2M HILL in association with Ocampo-Esta Corp., Michael Willis & Associates, and KPA Consulting Engineers Inc. (Contract No. 1962) and was constructed by

[66] San Francisco International Airport, "Airport's Wastewater Treatment Plant Expansion Approved" (press release), July 23, 2002, https://media.flysfo.com/SF-02-44.pdf, accessed September 29, 2020.
[67] Airports Commission of the San Francisco International Airport, "Airport Contract 1962: Professional Services Contract for Engineering Work, Waste Treatment Plant Improvement" (memo), August 10, 1993, on file at San Francisco International Airport, Engineering Division.

Amoroso Construction.[68] A new belt press facility, which separates solid waste from liquid as a pre-treatment process, was constructed adjacent to the basins ca. 2002–05. The architect was Michel Tauber Architecture of San Francisco.[69] Under Contract No. 4378R, a new generator building was constructed on the south side of Clearwater Drive ca. 2002–05.

[68] Amoroso Construction, "SFO Waste Water Treatment Plant," https://www.sjamoroso.com/project-sfo-waste-water-treatment-plant-13.htm, accessed September 29, 2020.
[69] Michael Tauber Architecture, "SF Int. Airport Waste Water Treatment Plant," http://www.michaeltauberarchitecture.com/944612688034, accessed September 29, 2020.



Building 918 (minus the digester tanks and headworks, which are not evaluated in this HRE) is shown in red, the oldest portion of Building 922 is shown in green, and the newer portion of Building 922 is shown in blue.

SOURCE: San Francisco International Airport, *Waste Treatment Plant Improvement Project, Volume 6 WTP Drawings* (architectural drawings, October 2000, sheet 05-CL-01/Civil Site Plan).

Shoreline Protection Program HRE Part 1

Figure 29
Site Plan of the Waste Treatment Plant Improvement Project (Third Phase of Construction), 2000

In 2005, the water treatment plant was renamed in honor of Mel Leong, who supervised the construction and operation of the facility and died that year.[70] For more information, see Chapter VII, Historic Context, below.

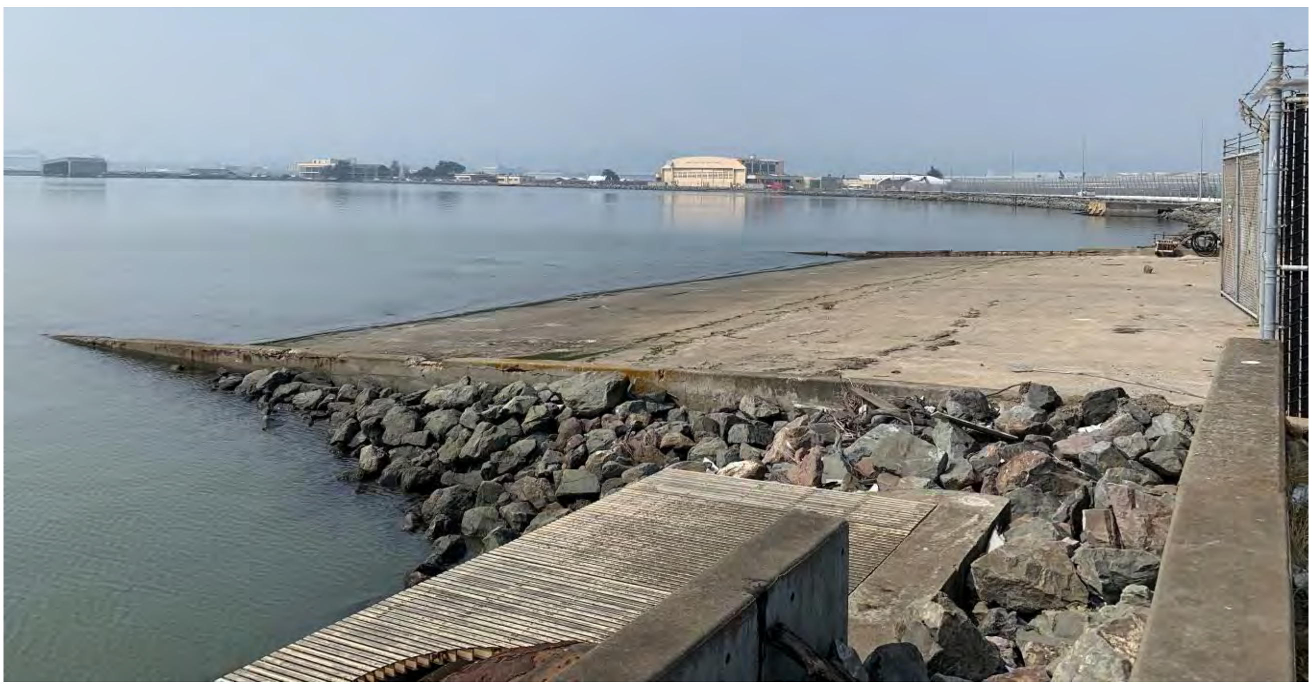
[70] San Francisco Airport Commission, "Special Advisory Committee to Consider and Recommend Action on the Nomination of Edwin M. Lee for Naming or Dedication at the San Francisco International Airport" (meeting minutes), October 16, 2018, https://www.flysfo.com/sites/default/files/media/sfo/about-sfo/commission/101618_SAC_Minutes.pdf, accessed September 29, 2020.

Fourth Major Phase

In the late 2000s, a rehabilitation project was completed to upgrade the Airport's existing industrial wastewater and stormwater facilities by installing modern dissolved air flotation and trickling filter treatment technologies.[71] This work included reinforcing the steel structure, repairing concrete and grout, and extensively testing various construction materials.[72] Under this rehabilitation project, the water treatment plant expanded to the west side of Clearwater Drive. Building 924, a pre-engineered metal building containing 8,500 square feet of administration and shop space, was designed by SFO engineering staff, manufactured by Butler, and constructed by Quality Erectors and Construction, Inc. in 2010.[73] In 2020, Building 910, an administration and laboratory building, was completed.

8. Seaplane Ramp (Reach 3)

The seaplane ramp is a reinforced concrete structure located on the south side of North Access Road where it turns west to follow Seaplane Harbor southward (see Figure 5, p. 21, and **Figure 30**). The ramp is 100 feet wide and features sloped concrete curbs on the east and west sides. It is currently used by the San Francisco Fire Department, and a metal security fence prevents public access to the ramp.



SOURCE: SFO, September 2020. Shoreline Protection Program HRE Part 1

Figure 30
Seaplane Ramp, Looking Southwest

[71] PMA Consultants, "Mel Leong Industrial Waste Treatment Plant, San Francisco," https://pmaconsultants.com/projects/mel-leong-industrial-waste-treatment-plant/, accessed September 29, 2020.
[72] Apex Testing Laboratories, "Mel Leong Treatment Plant Rehabilitation," https://apextestinglabs.com/portfolio/us-gas-company-7/, accessed September 29, 2020.
[73] Quality Erectors and Construction, Inc., "Mel Leong Treatment Plant," https://www.qec-inc.com/project/3/mel-leong-treatment-plant, accessed September 29, 2020.

Construction Chronology and Alterations

Improvements to the San Francisco Municipal Airport during the 1930s and 1940s were, in part, Department of Defense installations that were funded by the Works Progress Administration (WPA) and the Public Works Administration (PWA) and also by two bond measures passed in 1933 and 1937.[74] "[The WPA] improved the airport by grading, draining, paving and lighting, installing water, gas, electricity, telephone and sewers; building walks, curbs, pavements, new buildings; dredging for seaplane harbor; building seaplane wharves, ramp and seawalls, rock and earth levees and work incidental to making a first class seaplane port."[75]

The seaplane ramp was the second of two such ramps constructed on Seaplane Harbor. (The first extant ramp was built in 1941 for use by the U.S. Coast Guard during World War II.) The subject ramp was constructed ca. 1944 for use by Pan American World Airways (Pan Am), whose flying boats (also known as Clippers) and Pacific-Alaska division were relocated that year from Treasure Island to the San Francisco Municipal Airport (see **Figure 31**).[76] When first constructed, the ramp measured 291 feet in length by 100 feet in width and had a weight capacity of 75,000 pounds.[77] Long-range, land-based airplanes soon replaced the flying boats, and the final Pan Am Clipper flight from Hawaii to San Francisco landed on April 9, 1946.[78] The seaplane ramp was used for its intended purpose for approximately two years from 1944 to 1946.

---

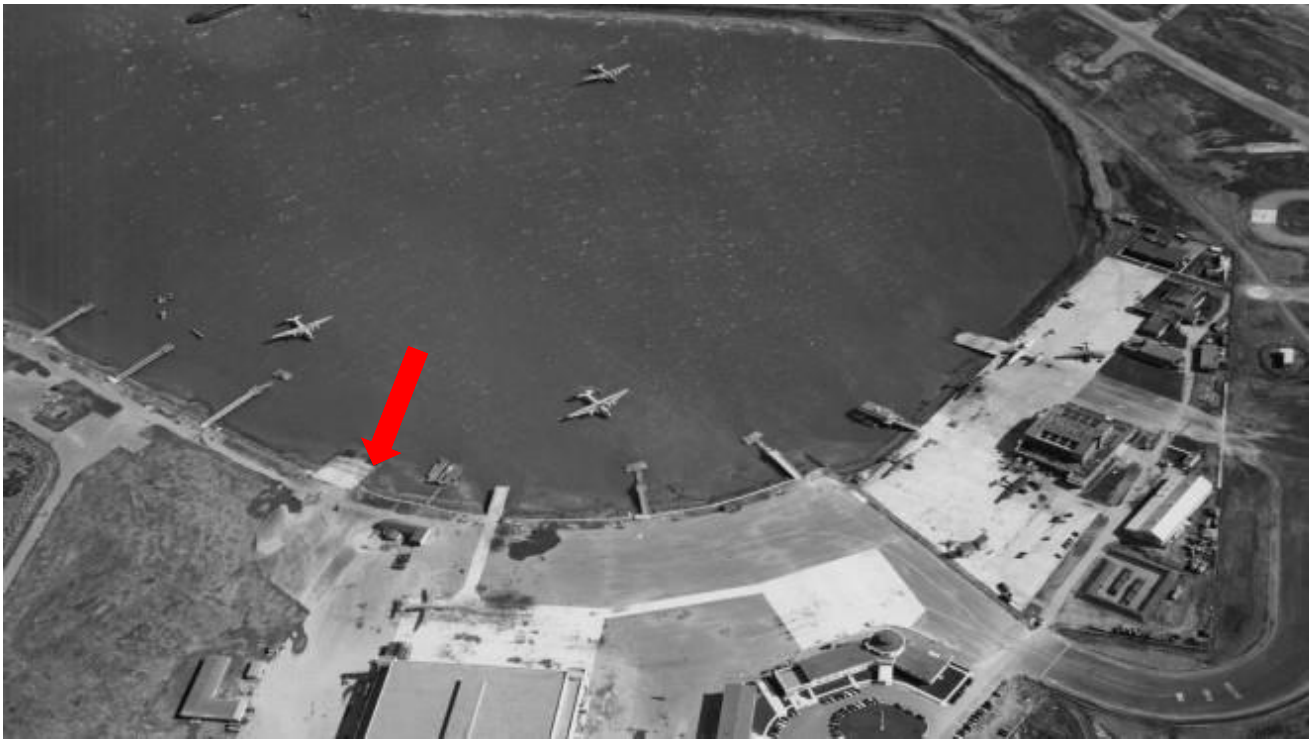
[74] City and County of San Francisco, *Journal of Proceedings Board of Supervisors*, Vol. 37, No. 4 (January 26, 1942) (San Francisco, CA: A.F. Heuer, 1942), p. 128.

[75] Clyde E. Healy, *San Francisco Improved: Report of Clyde E. Healy, Assistant City Engineer, City of San Francisco and Coordinator of W.P.A. Projects, Period October 10, 1935, to August 31, 1939*, (San Francisco, CA: s.n., 1939), p. 70.

[76] "Pan American Airways Moves Its Pacific-Alaska Division to San Francisco Airport," San Francisco International Airport, https://www.flysfo.com/content/pan-american-airways-moves-its-pacific-alaska-division-san-francisco-airport, accessed November 3, 2020.

[77] "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," *California State Military Museum*, http://www.militarymuseum.org/cgassf.html, accessed September 29, 2020.

[78] SFO Museum, *China Clipper* (San Francisco, CA: San Francisco International Airport, 2013), 36, https://issuu.com/sfomuseum/docs/china_clipper/6, accessed November 3, 2020.



The seaplane ramp is identified by the red arrow. Pan Am's facilities are visible in the center foreground, and the U.S. Coast Guard Air Station is visible at the right.

SOURCE: Collection of SFO Museum, Accession No. 2000.058.1407. Shoreline Protection Program HRE Part 1

Figure 31
Seaplane Harbor with the Newly Completed Pan Am Pacific-Alaska Division, 1944

No known alterations have been made to the seaplane ramp. Unlike the other extant seaplane ramp in the U.S Coast Guard Air Station property, which is not owned or operated by SFO, it does not have patched areas of asphalt or concrete. Its reinforced concrete curbs are badly deteriorated and do not appear to have been repaired over time.

9. Outfall E004 (Reach 4)

Outfall E004 is located on the north (bay) side of North Access Road, just south of the U.S. Coast Guard Air Station property (see **Figure 32** and **Figure 33**). It is associated with SDPS-2 and SDPS-2A, which are located on the south (airfield) side of North Access Road and beyond 100 feet of the project site. Ten parallel metal pipes compose the outfall. The pipes are buried below an asphalt-paved parking lot and extend out over the water, supported by timber trusses.

SOURCE: SFO, July 2016. Shoreline Protection Program HRE Part 1

Figure 32
Outfall E004, Looking Northeast

SOURCE: SFO, July 2016. Shoreline Protection Program HRE Part 1

Figure 33
Outfall E004, Looking Southeast

Construction Chronology and Alterations

SDPS-2 and the associated Outfall E004 were originally constructed in 1950, and SDPS-2A and its associated outfall were constructed in 2005.[79] The timber supports for Outfall E004 had become severely deteriorated by 2017, so the timbers were replaced in order "to update and enhance the existing support structure in place."[80]

10. SDPS-1C and Outfall E007 (Sub-reach 7A)

SDPS-1C and the associated Outfall E007 are located on the SFO shoreline, a short distance west of the north end of Runway 19R. The pump station contains four pumps that are located on a concrete pad with low concrete walls and metal railings around the perimeter (see **Figure 34**). Four parallel metal pipes compose the outfall and range in diameter from 16 to 30 inches. The pipes are buried below the pump station and extend out over the water, supported by timber trusses (see **Figure 35**).

Outfall E007 is visible at the right.

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 34
SDPS-1C, Looking Northwest

[79] San Francisco International Airport, "Storm Water Pollution Prevention Plan (Contract No. IW SWPPP 2019), Drainage Areas and Storm Water Outfalls Map," Sheet D-3, May 2019; annotated by Colton Yee (SFO), August 2020.
[80] David Kim (SFO), Email to Eryn Brennan (ESA), August 19, 2020.

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 35
Outfall E007, Looking Northeast

Construction Chronology and Alterations

SDPS-1C and associated Outfall E007 were constructed in 1982, and unspecified repairs were made in 1990.[81] Archival research did not confirm any specific repairs or alterations completed to date.

11. SDPS-1B and Outfall E006 (Reach 11)

SDPS-1B and the associated Outfall E006 are located on the SFO shoreline, approximately 600 feet east of the beginning of Reach 11. The pump station, located on the south side of the vehicle service road along the shoreline, contains four pumps that are located on a concrete pad with low concrete walls and metal railings around the perimeter (see Figure 9, p. 25, and **Figure 36**). Four parallel metal pipes compose the outfall. The pipes are buried below the vehicle service road and extend out over the water, supported by timber trusses (see **Figure 37**).

[81] San Francisco International Airport, "Storm Water Pollution Prevention Plan (Contract No. IW SWPPP 2019), Drainage Areas and Storm Water Outfalls Map," Sheet D-3, May 2019; annotated by Colton Yee (SFO), August 2020.

Outfall E006 is visible in the background.

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 36
SDPS-1B, Looking Northeast

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 37
Outfall E006, Looking Northeast

Construction Chronology and Alterations

SDPS-1B and Outfall E006 were constructed in 1983, and unspecified repairs were made in 1990.[82] Archival research did not confirm any specific repairs or alterations.

12. SDPS-1A and Outfall E005 (Reach 13)

SDPS-1A and the associated Outfall E005 are located on the SFO shoreline, approximately 1,400 feet west of where Reach 13 begins (see Figure 11, p. 27, and **Figure 38**). The pump station, located on the north side of the vehicle service road along the shoreline, contains four pumps that are located on a concrete pad with low concrete walls and metal railings around the perimeter. Four parallel metal pipes compose the outfall. The pipes are buried below the vehicle service road and extend out over the water, supported by timber trusses.

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 38
SDPS-1A (Left) and Outfall E005 (right), Looking Southeast

Construction Chronology and Alterations

SDPS-1A and Outfall E005 were constructed in 1983, and unspecified repairs were made in 1990.[83] Archival research did not confirm any specific repairs or alterations.

13. Building 1080/Field Lighting Building No. 2 (Reach 14)

Building 1080 is located in the airfield, immediately west of where Reach 14 begins (see Figure 12, p. 28). Paved driveways and parking areas surround the building on its north, east, and west sides. As shown in **Figure 39**, the one-story building is rectangular in plan, and the concrete masonry unit construction is exposed on the exterior. It is capped by a flat roof covered with corrugated metal roofing. Typical fenestration on the north, west, and south façades consists of aluminum-sash awning windows, single flush metal doors, and metal roll-up vehicular doors. An addition was constructed on the south façade in 2010 to accommodate electrical equipment. The addition is one story in height and rises above the older portion of the building, constructed of concrete masonry units, clad in corrugated metal siding, and capped by a curved roof covered with corrugated metal roofing. Typical fenestration on the addition includes awning-sash clerestory windows, partially-glazed metal doors, and a roll-up vehicular door.

[82] San Francisco International Airport, "Storm Water Pollution Prevention Plan (Contract No. IW SWPPP 2019), Drainage Areas and Storm Water Outfalls Map," Sheet D-3, May 2019; annotated by Colton Yee (SFO), August 2020.
[83] Ibid.

SOURCE: SFO, August 2020. Shoreline Protection Program HRE Part 1

Figure 39
Building 1080, Looking South

Construction Chronology and Alterations

Building 1080 was constructed in 1987 as part of the Airport Development Aid Project (Contract No. 823). The prime contractor was the joint venture of Stacy & Witbeck, Inc. and West Bay Contractor's Engineers. The building "provides the power to the airfield at SFO, including runway and taxiway lighting [and] is a mission critical building that has two backup power sources."[84] (Note that the lights are controlled from the air traffic control tower located between Terminals 1 and 2.) Building 1080 is one of two extant field lighting buildings at SFO.[85] In 2010, a large, pre-engineered metal-frame addition was constructed on the south side of the building to house electrical equipment. The builder was Schembri Construction of San Francisco.[86]

[84] BASS Electric, "Endorsements," http://www.basselectric.net/endorsements/, accessed July 30, 2020; updated https://web.archive.org/web/20200730101412/http://www.basselectric.net/endorsements/.
[85] According to historic aerial photographs, Building 1071/ Field Lighting Building No. 1, was constructed ca. 1990–93.
[86] Schembri Construction, "SFO – Field Lighting," http://www.schembri.com/sfo-field-lighting#!/page/461834/sfo-field-lighting, accessed September 29, 2020.

CHAPTER VI
Methodology

The methodology used for completion of this report included a records search and literature review of pertinent records of the subject buildings and structures, as well as field surveys. Each of these methodologies is described below.

A. Records Search and Literature Review

ESA conducted a records search and literature review of the subject property in August through October 2020. The records search consisted of an examination of the following sources:

- **SFO Records.** Various Airport divisions have maintained architectural and engineering drawings since the Airport's creation in 1927. The Airport currently maintains a database of architectural and engineering drawings, and project files are organized by contract number. The database is not for use by the general public, but the Airport provided ESA staff with access to various records. In October 2020, ESA staff reviewed several dozen drawing sets, contracts, and miscellaneous reports to determine precise construction dates for the subject buildings and structures. ESA staff was able to locate architectural drawings for construction of and/or alterations to several of the subject buildings and structures. Where precise construction dates were not confirmed, approximate construction dates or date ranges have been provided in this report.[87] The San Francisco Department of Building Inspection does not hold records for SFO, which has a separate permitting process from the San Francisco Planning Department.[88]
- **Published Resources.** Published records in the SFO Museum Collection include hard copies of various planning and design documents that are not available through the database listed above, as well as annual reports of the San Francisco Public Utilities Commission and the San Francisco Airport Commission.[89] Other published sources include:
  - John H. Hill's *SFO: A Pictorial History of the Airport* (2000)
  - R.E.G. Davies' *Airlines of the Jet Age: A History* (2016)
  - *Final Historical Resources Report: Information Regarding the Eligibility of Properties at San Francisco International Airport for Inclusion on the National Register of Historic Places or the California Register of Historic Resources* (ESA, 2000) and Addendum (ESA/Carey & Co. 2001)
  - *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR* (David Chaves and Associates 1990)
  - *Historic Architecture Survey Report for the Runway Safety Area Program at SFO* (URS 2011)
  - *Final Historic Resources Evaluation Part 1 for the Recommended Airport Development Plan* (ESA 2018)

[87] Certain documents in SFO's data may not be publicly accessible records due to security constraints.
[88] San Francisco Department of Building Inspection, Records Management Division, telephone discussion with Johanna Kahn (ESA), May 22, 2018.
[89] Originally part of the San Francisco Public Utilities Commission (PUC), the Airport Commission was established by City Charter (Article 4, Sec. 4.115) in 1970.

- **Photographs.** Historical photographs of SFO were provided by the SFO Museum, including photographs of individual buildings and aerial photographs from every decade dating back to the 1920s. Many have been digitized and are available on the museum's website: https://millsfield.sfomuseum.org.
- **Internet Research.** Internet research included the following online sources:
  - Internet Archive (www.archive.org) for various issues of *Architect & Engineer* as well as assorted SFO publications, including marketing, planning, and environmental documents.
  - Newspapers.com and NewsBank.com for newspaper articles about SFO published in the *San Francisco Chronicle*, *San Francisco Examiner*, and *San Mateo Times*.

B. Field Survey

Pedestrian surveys of the subject buildings and structures were completed in August and September 2020 and October 2021. The buildings and structures were recorded through digital photography (see Chapter V, Property and Building Descriptions, above).

CHAPTER VII

Historic Context

A. SFO History

The following history of SFO from 1927 to approximately 1966 is excerpted from the 1991 *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR*:

> As the Peninsula's fishing industry was dying, San Francisco's aviation industry was being born. The antics of barnstorming pilots resulting from the 1911 San Francisco Air Show, the aerobatics over Lincoln Beach during the 1915 Panama Pacific International Exposition, the aeronautical improvements made during World War I and the 1924 dawn-to-dusk flight between New York City and San Francisco all served to promote an interest in flying. With Crissy Field and Ingleside district sand dunes [functioning] as sites for [early aircraft] takeoffs and landings, the people of San Francisco realized that public safety demanded that a permanent airfield be developed outside the boundaries of the city. Late in 1926 the citizens of San Francisco voted 81,552 to 16,592 to approve a charter amendment that would permit the city to purchase such land. Six sites were investigated and in March 1927 the San Francisco supervisors opted to lease 150 acres belonging to the descendants of Darius Mills for the site of the city's future airport.
>
> The land lays 14 miles south of San Francisco and could be reached by automobile in less than twenty-five minutes. The Mills estate property was above the Bay tides, offered hundreds of acres of submerged land which airport engineers could later reclaim and, most important, the site was available immediately. The city agreed to rent the 150 acres for $15,000 a year, and on May 7, 1927, Mayor James Rolph dedicated the Mills Field Municipal Airport of San Francisco.
>
> The airport opened in June of 1927, and for the next 10 years, it conducted business from a terminal building that "was little more than a two-room wooden shack." By the end of that first year the Bayshore Highway had been constructed, which provided easy automobile access to the airport. In addition, four hangers [sic] were erected, three graded dirt runways were constructed, 2,895 aircraft landed carrying 4,562 passengers. Nevertheless, many carriers located or moved to the newly established Oakland Airport, the pilots disenchanted with the fog at the San Francisco facility.
>
> City officials hoped that the popularity of the airfield would improve when Charles Lindbergh arrived at Mills Field in September 1927, a few months after his historic transatlantic flight in "The Spirit of St. Louis."
>
> > But a second Lindbergh visit a couple of years later, with a 32-passenger Boeing plane, was … catastrophic. It was said the news flashed around the world, when Lindbergh's plane, in an effort to let another aircraft pass on the single runway, got stuck in the Peninsula mud, and had to be pulled out by a tractor. A civilian flyer who knew the field in its first years called the fledgling airport 'a mud hole, just a mud hole.'[90]
>
> The Lindbergh incident produced a storm of criticism on a local and national level. San Francisco voters refused to approve bond issues for airport improvements in both 1928 and 1930; the federal government threatened to cancel their airmail carrier contracts unless the runways were expanded.
>
> On August 30, 1930 the San Francisco supervisors completed negotiations that allowed them to purchase 1,112 acres of Mills Estate property for $1,050,000 and the following year the name of the airfield was changed … to the San Francisco Municipal Airport. The administration of the airport also changed hands on January 8, 1931 with the establishment of the Public Utilities Commission (PUC), designed to regulate citizen-owned utilities. Within two years the voters of San Francisco approved a $260,000 airport improvement bond …
>
> By 1934 as many [as] 2,000 people a day were [employed] "at the task of improving the physical facilities of the airport." To widen and lengthen the runways, hundreds of tons of dirt and rocks were carved from the nearby San Mateo Hills, and for months, dozens of trucks could be seen barreling down the Bayshore, carrying the fill.

---

[90] Abby Jane Frederickson, "From a Mud Hole by the Bay to San Francisco's Airport, Part 1," *The Boutique & Villager* (Hillsborough Weekly Newspaper), April 16, 1974, p. B1, quoted in David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991, pp. 15–19.

> Filling in the marsh- and tidelands of the airport property had begun as early as 1927 when 38 acres were reclaimed. By 1935 another 38 acres had been filled and two years later an ambitious project to build a 9,000-foot seawall, fill 315 acres of the Bay and expand the runways was initiated. As a result of reclamation activities the terminal was closed to air traffic for fifty-six days during the 1938–1939 fiscal year.
>
> The construction, largely carried out through the Works Progress Administration (WPA), allowed the San Francisco Municipal Airport to begin the transition from national to international status. The airport now possessed three runways over 3,000 feet in length as well as a new California Mission-style "terminal building … with a weather bureau, control tower, restaurant and buffet, which was touted as the most up-to-date structure of its type in the country." On the eve of the 1940s the city and the PUC looked forward to the construction of a Coast Guard Station and the completion of Seaplane Harbor at the airport.
>
>> Then came Pearl Harbor and the military assumed control of the airport but permitted restricted commercial airline flights, primarily to accommodate military and high government officials. The Navy … began development of a base at the airport's seaplane harbor. This work involved the fill of about 100 acres and the construction of a passenger terminal, hanger [*sic*] and other facilities. It became operational in 1944. Airport facilities in general were modified to meet military requirements. Runways, taxiways and apron areas were enlarged and strengthened to accommodate multi-engine military aircraft.[91]
>
> The [U.S.] Coast Guard Air Station [extant] was also constructed in the early 1940s, at the [west end] of Seaplane Harbor. From the station, guardsmen conducted rescues from the coast of Oregon to southern California to the "point of no return" over the ocean. Throughout the war years, Coast Guard planes made thousands of flights, covered over 4 million square miles and plucked 103 downed-plane survivors from the frigid waters of the Pacific. During the same period, airport officials saw the relocation of United Air Lines' Western Division operations, maintenance, and overhaul facilities from Oakland [extant and located in the North Field; Buildings 800A–800H] and the transfer of Pan American World Airways' Pacific-Alaska Division from Treasure Island to the city's airport.
>
> [As early as 1943, the Airport's first master plan was publicly discussed "for an airport expansion program [estimated to cost $40 million] which will place the field in readiness to handle the great air transports of the future…Expansion of the field westerly, which will mean relocation of the Bayshore highway; reclamation of tide lands to the south and east of the field; extension of runways, construction of hangers [*sic*], freight sheds and railroad terminal facilities will be required." [92] A $20 million bond issue was approved in November 1945 to expand the airport. The first major activities were the reclamation of 400 acres of marshland, followed by the construction of a second runway and planning for a new administration building.[93]]
>
> By the end of the war "the airport had 700 acres in use, another 2,000 under development, and several 16,000-foot runways." In 1946, over a million passengers proceeded through the terminal gates, making San Francisco one of the world's busiest airports. With 6,000 people on the airport payroll and the increased passenger traffic, access roads became inadequate. As a result, by the end of the decade the Old Bayshore Highway, which ran through the airport lands, was abandoned and a new Bayshore Freeway [now U.S. Highway 101] constructed further to the west.
>
> During the 1950s and 1960s, the marshlands between the [old] Bayshore Highway and the Bayshore Freeway were developed [due in part to the advent of the jet], complete with hangars, buildings, airport shops and taxiways. In 1954, after [the airport's final] massive landfill activities and the running of steel piles down to bedrock, a new, ultra-modern, six-story administration building or Central Terminal was erected at the airport, accompanied by a 60,000-car parking lot. By 1963 the Southern Terminal with its 8,000-vehicle parking lot, was also realized. In the spring of 1966, the San Mateo County Historical Association and the public gathered at the airport to bid farewell to the classic [Spanish Revival]-style terminal, built in 1937, as well as Mills Field's first big hanger [*sic*], built in 1927. In order to extend and construct additional runways, both structures were razed [during the] summer [of 1966. This was the final runway extension].[94]

The Airport rapidly expanded during the 1940s and 1950s. By 1960, assets included the Central Terminal (today known as Terminal 2) with capacity to load 33 aircraft, multiple passenger boarding areas with moveable ramp jetways, an on-airport hotel, a bank, dining and retail, various professional services, police and fire departments, and two pairs of parallel runways.[95] The Airport's first master plan for a central terminal area was approved by the

---

[91] Alessandro Baccari & Associates, *San Francisco International Airport: A Socioeconomic View*, 1975, pp. 13-14, quoted in David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991, pp. 15–19.

[92] "San Francisco's Airport of the Future," *San Francisco Chronicle*, March 26, 1943, p. 26.

[93] "$4,000,000 Runway Next Development at Airport," *San Francisco Chronicle*, July 8, 1948, p. 9.

[94] David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991, pp. 15–19.

[95] John H. Hill et al., *SFO: A Pictorial History of the Airport* (San Francisco, CA: San Francisco Airport Commission, 2000), p. 73.

Public Utilities Commission in 1959. Developed by Welton Becket and Associates, a Los Angeles-based architecture and engineering firm, the master plan was "designed to last until the airliner gives way to the rocket ship" and to take place throughout and possibly beyond the 1960s. The first phase of this master plan began immediately: the two-story South Terminal (today known as Terminal 1, which was extensively renovated in 2016) was designed by Becket's firm and completed by 1964. The master plan identified future phases (e.g., the construction of a north terminal, a 6,000-car garage to be constructed in multiple stages, a two-level roadway around the terminal area), but these were never constructed as designed by Welton Becket and Associates.[96]

By 1966, SFO selected a consultant to develop an updated master plan for the long-term growth of the Airport. The chosen consultant, known as the San Francisco Airport Architects, was a joint venture of the prominent architecture firms of John Carl Warnecke & Associates and Dreyfuss & Blackford. In 1968, the firm was awarded a major contract to provide architectural and engineering services for a number of key projects as part of the Terminal Area Master Plan. These projects were part of the Expansion Phase constructed between 1969 and 1981 and included designs for a new North Terminal (today known as Terminal 3, extant and enlarged in 2015) and associated Boarding Areas E (demolished and reconstructed in 2014) and F (extant with multiple additions constructed between 1996 and 2002) that were leased by United Airlines and could accommodate the newer wide-bodied "jumbo" jets; an expanded central parking garage (extant); an elevated terminal roadway surrounding the parking garage (extant); the old Boarding Area A (demolished c. 2005–2009) that was part of the South Terminal designed by Welton Becket and Associates (today known as Terminal 1); and miscellaneous roadwork including the entrance road and underpasses (extensively redesigned leading up to the completion of the new International Terminal in 2000).

Other projects completed under the Airport's expansion program and realized during the 1970s and early 1980s included airside improvements to runways, taxiways, and aprons and landside improvements to reclaim land and construct a power plant, service roads, and a water treatment plant.[97]

The Terminal Area Master Plan included a second Modernization and Replacement Phase that was implemented between 1981 and 1987. Work included renovating the old Central Terminal (today known as Terminal 2) for use as the Airport's new international terminal, with a new Federal Aviation Administration (FAA) air traffic control tower and expanded passenger boarding area (Boarding Area D, designed by Anshen & Allen and subsequently redesigned in the early 2000s by Gensler). The old South Terminal (today known as Terminal 1) received a $512 million renovation (designed by Gensler and demolished in 2016), and aircraft apron facilities were also modified.[98]

By the mid-1980s, passenger traffic at SFO was projected to exceed 56 million annual passengers. A new master plan was prepared in 1989 and approved by the Airport Commission in 1992. Beginning in 1996, an airport rail transit system known as AirTrain was constructed to transport people between the three terminal buildings and the central parking garage. A new, state-of-the-art International Terminal was planned to occupy the area on the west side of the existing terminal complex. The new International Terminal was designed to have capacity and functionality for "super jumbo jet aircraft," such as Air France's high-capacity A380 Airbus. The $2.5 billion project designed by Skidmore, Owings & Merrill also provided new parking facilities and a long-planned BART extension, all of which were completed in 2000. AirTrain was expanded to serve all four terminals and the BART station, and both transit systems began operating in 2003.

---

[96] "Big Jet-Age Airport Play Okayed Here," *San Francisco Chronicle*, February 4, 1959, pp. 1, 4.
[97] San Francisco Airports Commission, *San Francisco International Airport Expansion Program*, 1973, https://archive.org/details/sanfranciscointe1973sanf/page/n7/mode/2up, accessed September 29, 2020.
[98] City and County of San Francisco Airport Commission, *San Francisco International Airport Terminal Area Master Plan*, 1985, p. 1, in the collection of the SFO Museum, Accession No. 2002.133.010.

The old international Central Terminal (Terminal 2), which closed to the public in 2000 following the completion of the new International Terminal, was renovated and expanded by Gensler and reopened for use in 2011 as a domestic terminal. A complete renovation of Boarding Area E on the east side of Terminal 3 began in 2012, and the modernized facility opened to the public in 2015. Subsequently, a separate project to renovate the west side of Terminal 3 was developed with construction anticipated to occur from 2021 through 2023. The construction of a new air traffic control tower located between Terminals 1 and 2 took place between 2012 and 2016, and large-scale renovations of Terminal 1 began in 2016 and are projected to conclude in 2024.

B. Tenant/Occupant Histories

All of the buildings and structures located on Airport property that are evaluated in this HRE have historically been owned, occupied, and/or operated by SFO.[99]

The five industrial buildings located north of the San Bruno Channel are privately owned and are discussed below.

1. 160 Beacon Street

The building located at 160 Beacon Street was constructed in 1958 for Thompson Aircraft Tire Co.,[100] which occupied the building until at least 1993.[101] By 1996, Gateway Freight Services maintained an office and warehouse in the building.[102] By 2000, the Cargo Service Center operated a cargo handing business at 160 Beacon Street.[103] From 2004 to 2012, the building was occupied as a retail office, showroom, and warehouse for Galaxy Granite, a residential architectural stone products company.[104] In 2012, the building was renovated and occupied by its current tenant, K1 Speed, as an indoor go-kart racetrack.

2. 168 Beacon Street

The building located at 168 Beacon Street was constructed in 1958 for the Raybestos-Manhattan Co. in 1958 and was the first of several buildings that the company constructed in the area.[105] It is unknown how long the company occupied the space. In 1988, the building was occupied by G.M. Miller & Co. International, a freight forwarding and customs company.[106] In 1996, the local electronics retailer Laser City opened a warehouse and clearance center in the building.[107] The building was subdivided into two spaces ca. 2002. The rear commercial unit was given the address “Building B.” From 2002 to the present day, Building B has been occupied by Galleri,

[99] As part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station in 2020 and found that it appears eligible as a historic district under California Register Criteria 1 and 3 and would therefore be considered a historical resource for the purposes of CEQA. The complete evaluation is included as Appendix A and is not presented in detail in this HRE.
[100] Aircraft Tire Firm Breaks Ground in SSF,” *San Mateo Times*, May 22, 1958, p.32.
[101] Job Listing, *San Francisco Chronicle*, March 28, 1993, p.88.
[102] Job Listing, *San Francisco Examiner*, October 20, 1996, p.114.
[103] Job Listing, *San Francisco Chronicle*, December 10, 2000, p.104.
[104] Advertisement, *San Francisco Chronicle*, November 17, 2004, p.82.
[105] “Raybestos to Build in South City,” *San Mateo Times*, August 26, 1958, p. 19.
[106] U.S. Small Business Administration, *International Trade, State and Local Resource Directory: California*, 1988, p. 169, https://www.google.com/books/edition/International_Trade_State_and_Local_Reso/kYlVgbWXxiQC?hl=en&gbpv=1&bsq=%22168%20beacon%20street%22, accessed October 1, 2021.
[107] Advertisement, *San Francisco Chronicle*, May 27, 1996, p. 25.

an adult entertainment retailer.[108] Laser City remained in the main portion of the building until 2003. At that time the current tenant, Precise Mailing, Inc. moved into the space.[109]

3. 182 Beacon Street

The building located at 182 Beacon Street was constructed in 1960 as a warehouse and office for P.L. Badt Co., an automotive service station equipment and fixture supplier that occupied the building until at least May 1964.[110,111] By January 1965, Unitog Uniforms, a national uniform manufacturer and rental company, occupied the building, and the length of tenancy is unknown.[112] By 1974, the building was listed for sublease, noting the availability of 9,075 square feet of warehouse space, 1,600 square feet of office space, three vehicular doors, and a loading dock.[113] The next known tenant was Tricor America, a courier service, which was first listed at this location in September 1977.[114] Tricor America occupied the building until 1993,[115] at which time the Odwalla Juice Co. moved its distribution warehouse from 192 Beacon Street to 182 Beacon Street.[116,117] Odwalla occupied 182 Beacon Street until at least April 1995.[118] Research did not identify occupant information between 1995 and 2007. In 2007, Ultra Clean Technology established a manufacturing facility on Beacon Street and occupied 148 Beacon Street (known as "Building 1"), 150 Beacon Street ("Building 2"), 182 Beacon Street ("Building 3"), and 130 Beacon Street ("Building 4"). Traces of the building designations are still visible on some of the façades.[119,120] Ultra Clean Technology liquidated their facility in November 2019.[121] The building is currently occupied by Lung Shing Inc., a wholesale herbs and grocery distributor.

4. 192 Beacon Street

The building located at 192 Beacon Street was constructed in 1959 for the RCA Service Co., an RCA television repair and parts franchise.[122] The company remained at the site until at least June 1986.[123] By August 1987, the Santa Cruz-based Odwalla Juice Co. occupied the building as a distribution warehouse.[124] Odwalla was listed at the address through August 1992,[125] at which time it relocated to 182 Beacon Street.[126] A series of healthcare-related businesses occupied the building until recently, including Readicare, a worker's compensation care

[108] Advertisement, *San Francisco Chronicle*, June 9, 2002, p.136.
[109] Job listing, *San Francisco Chronicle*, November 30, 2003, p.150.
[110] Job listing, *San Francisco Chronicle*, May 9, 1964, p.22.
[111] "Badt to Move," *San Francisco Chronicle*, May 17, 1960, p.43.
[112] Job listing, *San Francisco Examiner*, January 8, 1965, p.38.
[113] Advertisement, *San Francisco Chronicle*, November 24, 1974, p.111.
[114] Job listing, *San Mateo Times*, September 8, 1977, p.22.
[115] *Official Export Guide*, 1993, p. 12, https://www.google.com/books/edition/California_Services_Register/PEYcAQAAMAAJ?hl=en&gbpv=1&bsq=%22182%20beacon%22, accessed October 1, 2021.
[116] Job listing, *San Francisco Chronicle*, February 12, 1992, p.60.
[117] Job listing, *San Francisco Examiner*, March 6, 1992, p.86.
[118] Job listing, *San Francisco Chronicle*, April 18, 1995, p.41.
[119] Google Street view, October 2007.
[120] Job listing, *San Francisco Chronicle*, January 7, 2007, p.75.
[121] "Plant Closure: Major Supplier to the Semiconductor Industry – Ultra Clean Technology," *Markets Insider*, November 25, 2019, https://markets.businessinsider.com/news/stocks/plant-closure-major-supplier-to-the-semiconductor-industry-ultra-clean-technology-1028714239, accessed October 22, 2021.
[122] "RCA Breaks Ground in S.S.F.," *San Mateo Times*, August 4, 1959, p. 3.
[123] Advertisement, *San Francisco Chronicle*, June 15, 1986, p. 117, col. 2.
[124] Advertisement, *San Francisco Chronicle*, August 27, 1987, p. 56, col. 1.
[125] Advertisement, *San Francisco Chronicle*, February 12, 1992, p. 60, col. 8.
[126] Job listing, *San Francisco Examiner*, March 6, 1992, p.86.

service provider, from ca. 1994[127] to 1995[128]; Health South Physical Therapy from ca. 2000[129] to ca. 2006;[130] and U.S. Healthworks, Inc. from ca. 2007[131] to ca. 2019.[132] The building is currently vacant.

5. 508 South Airport Boulevard

The building located at 508 South Airport Boulevard was constructed in 1961 for the S.K. Wellman Co. (a manufacturer of brakes and brake parts) to house its Northern California and Western Nevada sales and distribution facilities.[133] It is unknown how long the company remained at this address. After S.K. Wellman and Co. vacated the property, a series of air cargo forwarding and cargo handling companies occupied portions of the building. The building was occupied by Air-Sea Forwards, Inc. ca. 1975, [134] Trux Transport ca. 1980,[135] Usaha Express Corporation from ca. 1985 to ca. 1988,[136] Osgood Trading, Inc. ca. 1991,[137] and Kingston Contracting, Inc. ca. 2009. The building is presently occupied by Oscartek, a food display case manufacturer and retailer.

C. SFO in the Jet Age

What is commonly referred to as the Jet Age is a period in the history of aviation—as well as social history—characterized by the development of aircraft powered by turbine engines. In his book *Airlines of the Jet Age: A History*, author R.E.G. Davies explains that there have been three distinct Jet Ages. The First Jet Age lasted from 1952 to 1969 and correlates to the advent of early, multi-engine jet aircraft such as the Boeing 707. The Second Jet Age lasted from 1970 to 1999 and correlates to the arrival of wider-bodied jet aircraft such as the Boeing 747 and the first Airbus service as well as the Concorde. The Third Jet Age began in 2000 and continues to the present and was ushered in by the double-decker Airbus A380 with significantly greater passenger capacity than earlier models of aircraft.[138]

---

127 Advertisement, *San Francisco Chronicle*, March 28, 1994, p. 32.
128 Times Mirror Press, *California Services Register*, 1995, p. 404, https://www.google.com/books/edition/California_Services_Register/QewdAQAAMAAJ?hl=en&gbpv=1&bsq=%22192%20beacon%22, accessed October 1, 2021.
129 American Marketing Association, *International Member and Marketing Services Guide*, 2000, p. 178, https://www.google.com/books/edition/The_American_Marketing_Association_Inter/JHkrAQAAMAAJ?hl=en&gbpv=1&bsq=192%20beacon%20street, accessed October 1, 2021.
130 California Department of Transportation, *Post Earthquake Investigation Team Manual,* 2006, p. 48, https://www.google.com/books/edition/Post_Earthquake_Investigation_Team_PEQIT/UozLPDHoAc0C?hl=en&gbpv=1&bsq=%22192%20beacon%20street%22, accessed October 1, 2021.
131 Google Street View, October 2007, https://www.google.com/maps/place/192+Beacon+St,+South+San+Francisco,+CA+94080/@37.6396943,-122.4022497,3a,75y,171.7h,82.32t/data=!3m6!1e1!3m4!1sR1neh9QxgkJV9KXY4YEuXw!2e0!7i3328!8i1664!4m5!3m4!1s0x808f79cb5a4a1efb:0x188c3ac2008915d9!8m2!3d37.6394383!4d-122.4023486, accessed October 20, 2021.
132 Google Street View, March 2019, https://www.google.com/maps/place/192+Beacon+St,+South+San+Francisco,+CA+94080/@37.6396943,-122.4022497,3a,75y,171.7h,82.32t/data=!3m7!1e1!3m5!1sR1neh9QxgkJV9KXY4YEuXw!2e0!5s20190301T000000!7i3328!8i1664!4m5!3m4!1s0x808f79cb5a4a1efb:0x188c3ac2008915d9!8m2!3d37.6394383!4d-122.4023486, accessed October 20, 2021.
133 "New SSF Plant Begun," *San Mateo Times*, April 10, 1961, p.10.
134 *Cargo Airlift*, Vol. 65, 1975, p. 22, https://www.google.com/books/edition/Cargo_Airlift/c6kiAQAAMAAJ?hl=en&gbpv=1&bsq=%22512%20s%20airport%22, accessed October 1, 2021.
135 *Constructor,* Vol. 62, 1980, n.p., https://www.google.com/books/edition/Constructor/NScqAQAAIAAJ?hl=en&gbpv=1&bsq=%22508%20s%20airport%22, accessed October 1, 2021.
136 *Tempo,* Vol. 15, 1985, p. 78, https://www.google.com/books/edition/Tempo/fMYTAQAAMAAJ?hl=en&gbpv=1&bsq=%22512%20south%20airport%22, accessed October 1, 2021.
137 Times Mirror Press, *California Services Register,* Vol. 6, 1991, p. 545, https://www.google.com/books/edition/California_Services_Register/O0YcAQAAMAAJ?hl=en&gbpv=1&bsq=%22508%20s%20airport%22, accessed October 1, 2021.
138 R.E.G. Davies, *Airlines of the Jet Age: A History* (Washington, D.C.: Smithsonian Institution Scholarly Press, 2016), Preface (n.p.).

Numerous newspaper articles in the mid-1950s heralded the coming of the Jet Age at SFO with great enthusiasm, as well as some apprehension, about the changes it would require. The following account is from a 1956 *San Francisco News* article:

> Two years ago the jet age was not upon us; in fact, it appeared a decade away.
>
> Then, early in 1955, the Air Force released the Boeing Airline Co. to build commercial jetliners. Douglas Aircraft Corp. jumped into the competition with the DC-8 jetliner. Six months later, Convair made it a triumvirate with the 880 "Golden Arrow."
>
> Today, the three firms hold well over a billion dollars in orders for jet equipment. San Francisco will see the giant 575 mph planes in less than three years.
>
> Additionally, when the [Old Central] terminal opened, traffic projections based on the estimates of the best aviation brains in the land indicated the in and out passenger total at the airport would reach the five-million figure in 1965.
>
> Revised estimates show the five million mark may be reached in 1959, and one million more will be added each year through the 1960s. […]
>
> Preparation must be made not only for the greater passenger traffic and for jet planes, but also for handling correspondingly high increases in air mail, air express and freight volume. […]
>
> Proposed expansion and improvement of the airport under the [Proposition B] bond issue is in four classifications:
>
> - Improvements to landing area—estimated cost $6,274,000. This includes: reconstruct portion of runway pavement to accommodate jets; extend instrument landing runways and main north-south runways for jet operations by increasing them from 8,770 feet to 9,500 feet; construct high-speed taxiways; purchase 760 acres for runway extensions;
> - Improvements to aircraft maintenance base areas—estimated cost $4,769,000. This includes: Development of circulation roads, including fill, drainage, surfacing and utilities; extend taxiways to west field area; preliminary development of maintenance base areas by filling land, paving, providing sewage plant and utilities;
> - Improvements to the Terminal "City"—estimated cost $12,957,000. This includes: Construction of air cargo facilities; purchase 5.5 acres of land for terminal area; additions to terminal building to improve baggage handling, provide additional public areas, more ticket counter, office and baggage space and facilities, install escalators between ground floor and lobby floor, and install canopy across driveway;
> - Complete Concourse B; building Concourses E, F, and G; construct secondary terminal building to serve Concourses E, F, and G; provide acoustical ceiling, new flooring, moving sidewalks and minor alterations for Concourses C, D, and B;
> - Develop heliport facilities; construct additions to Air Mail building; construct aircraft loading apron for Concourses F and G; build fire house and buy new firefighting [*sic*] equipment; pave parking area three for accommodation of 1500 cars, and construct road and prepare additional parking space for commercial area;
> - Improvements to executive aircraft area and miscellaneous improvements—estimated cost one million dollars.[139]

The larger, heavier jet aircraft, which carried more passengers than earlier aircraft types, necessitated a number of physical improvements not only at SFO but at other major airports around the United States. The primary physical features needed were longer runways due to the longer take-off requirements; wider taxiways to maneuver the larger planes (both of which need to be constructed with thicker concrete bases for the heavier planes); moveable passenger boarding bridges to connect the planes to the gates; terminals that allowed for faster loading and unloading for the larger number of passengers (as well as quicker turnarounds between flights); larger terminals to handle the increased passenger loads; modern airport avionics and enhanced lighting; as well as larger hangars to maintain the longer and wider aircraft, many of which no longer fit within existing hangars designed for older and smaller aircraft.

[139] "San Francisco Meets Challenge," *San Francisco News*, October 15, 1956, p. 14.

The need for enhanced ground improvements to accommodate the jet at the airport was echoed by Trans World Airlines (TWA) in its March 1957 newsletter, *Skyliner*, which stated that,

> The upheaval that's bound to come with the advent of the jets needn't run wild. The U.S. has two or three years to prepare for the jets' entry into regular commercial flying. The airlines are hoping that the airports, the control systems, the terminals, and the whole method of getting passengers and their baggage into and out of airliners can be prepared so they will at least begin to cope with the jets' demands. Since the airlines are putting billions of dollars into the new planes, they're determined to do all they can to see that their investment isn't wasted through lack of preparation on the ground. […]
>
> Whether the airlines can meet the terms of the loans they have negotiated for their jet transports depends on all that follows—on whether airports can be enlarged fast enough to handle the heavier loads and more frequent trips of the new planes, on whether air traffic control can be improved fast enough for them to get full service out of the jets, and on whether there'll be sufficient passengers to fill the big new planes.[140]

SFO made all of these changes to accommodate commercial jet aircraft beginning in the mid-1950s, including the construction of the Central and South terminals (completed in 1954 and 1963, respectively, and both later extensively demolished and renovated); new jetways connected to pinwheel-shaped gates or "rotundas" at the terminal areas (first at the South Terminal and subsequently at the Central Terminal); lengthened, strengthened, and widened runways and taxiways; enhanced ground equipment; as well as new or enlarged maintenance hangars and service centers for TWA, United Airlines, and American Airlines. This extensive campaign of physical improvements at SFO was necessary to support the increased passenger load brought about by jet travel.

SFO's new International Terminal opened in 2000, and its construction resulted in the demolition of earlier Jet Age buildings that were part of the United Airlines Service Center, which contained a hangar designed by Skidmore, Owings & Merrill, a cafeteria and parking lot for United Airlines employees, a flight kitchen, a washing facility for aircraft, and a boiler plant.[141] The International Terminal was designed to have capacity and functionality for "super jumbo jet aircraft." The first scheduled Airbus A380 flight to SFO, which was operated by Lufthansa, arrived in 2011 from the Frankfurt Airport in Germany, and a seasonal daily service has continued since that time. [142] This aircraft accommodates up to 509 passengers.

D. Large Hub Airports in California

SFO is classified by federal law as a large hub airport, meaning that it is a primary commercial service airport that accounts for at least one percent of total enplanements (i.e., passenger boardings) in the United States.[143] Of the 27 commercial service airports in California, three are large hub airports, six are medium hub airports, four are small hub airports, nine are non-hub primary airports, and five are non-primary airports. The three large hub airports in California are SFO, Los Angeles International Airport (LAX), and San Diego International Airport (SAN). In terms of numbers of enplanements nationwide during the 2019 calendar year, LAX ranked second with 42,939,104 enplanements, SFO ranked seventh with 27,779,230 enplanements, and SAN ranked 24th with 12,648,692 enplanements.[144]

---

[140] TWA, "Jets Bring About Need for Improved Ground Facilities and New Plan of Financing," *Skyliner (Trans World Airlines Weekly Employee Publication)*, Vol. 20, No. 10 (March 7, 1957), p. 3.
[141] "United Expands at Mills Field," *San Mateo Times*, February 6, 1957, p. 17.
[142] Lufthansa, "Lufthansa to Introduce First-Ever A380 Service to San Francisco" (press release), January 26, 2011, https://www.lufthansa.com/mediapool/pdf/69/media_931369.pdf, accessed November 16, 2020.
[143] 49 United States Code § 40102 [Title 49, Transportation; Subtitle VII: Aviation Programs; Part A, Air Commerce and Safety; Subpart I, General], http://uscode.house.gov/view.xhtml?path=/prelim@title49/subtitle7&edition=prelim, accessed November 16, 2020.
[144] U.S. Department of Transportation, Federal Aviation Administration, "Enplanements at All Commercial Service Airports (by Rank)," https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/?year=all, accessed October 9, 2020.

All three large hub airports came into existence in the early 1920s. While all were constructed adjacent to bodies of water, the land that was developed for SFO was manmade bay fill. The runway layouts of the three airports vary widely due to differing local terrain and prevailing winds. The primary runway must be oriented towards the direction of the prevailing wind.[145] SAN has a single runway that is located north of the two passenger terminal buildings and measures 9,401 feet in length and 200 feet in width. LAX has four parallel runways that are oriented east-west. One pair of runways is located on both the north and south sides of the central complex of nine terminal buildings. The runways range in length from 8,926 to 12,091 feet and in width from 150 to 200 feet. SFO has four runways arranged in two pairs of parallel runways that intersect at a 90-degree angle. The runways range in length from 7,650 to 11,870 feet, and all measure 200 feet in width. The parallel runways are separated by only 750 feet and do not meet FAA design standards of 4,300 lateral feet of separation runway centerline-to-centerline for independent dual arrivals.[146]

E. Wastewater Infrastructure at SFO

The Mel Leong Treatment Plant, which was first constructed in 1970 and has expanded since that time, treats both sanitary sewage and industrial wastewater generated by SFO. Brief overviews of both types of wastewater systems at SFO are presented below.

1. Sanitary Sewer System

The Airport's first sewage treatment plant was constructed in 1955, immediately to the east of the United Airlines Maintenance Operations Center (Contract No. A-175; see **Figure 40**).[147] Prior to that time, there were four sewage pumping plants in operation at the Airport. An additional sewage pumping plant was constructed with the treatment plant, and two additional sewage pumping plants were planned for future construction.[148] In 1994, under Contract No. 3368, the sewage treatment plant was demolished.

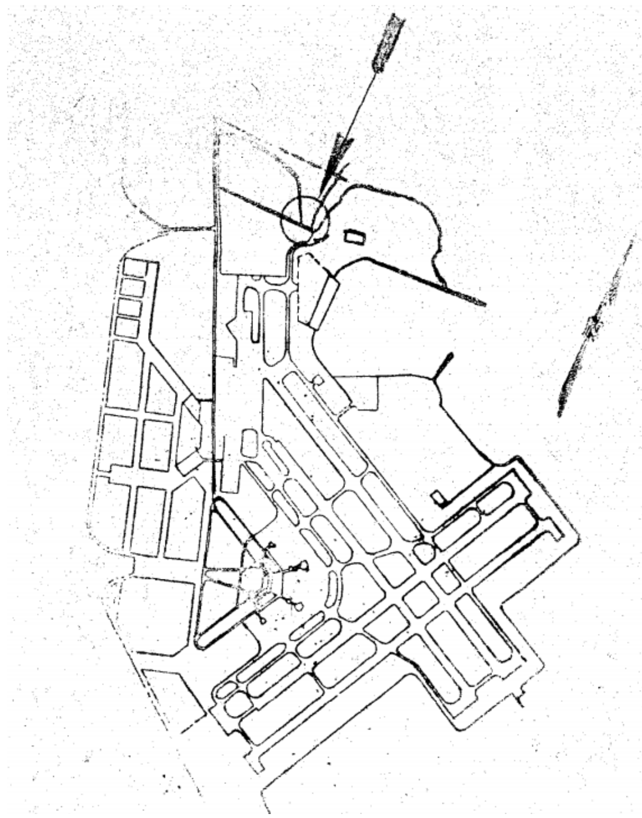
The following inventory of the Airport's extant sanitary sewer system is an excerpt from the Airport's 2016 *Draft Final Airport Development Plan*.

> Sanitary sewage at SFO is collected and treated on-site at the Sanitary Waste Treatment Plant (SWTP) located in the north field area at the Mel Leong Treatment Plant. As a result of the low, flat elevation throughout SFO, the sanitary system uses lift and pump stations to reach the treatment facility.
>
> The SFO sanitary treatment facility (or water quality control treatment plant) is located directly adjacent to the industrial waste treatment facility. The Mel Leong Treatment Plant treats and discharges both the sanitary and industrial treatment processes. The sanitary treatment uses sequencing batch reactors to treat up to 4.4 [million gallons per day (MGD)] at peak flows. The solids are separated and the dried sludge is removed and hauled to a landfill. A portion of treated effluent is used as reclaimed water. The remaining effluent is pumped to the North Bayside System Unit, where the effluent is combined with effluent from surrounding municipalities for dechlorination and deepwater discharge into [San Francisco] Bay.

---

[145] U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5300-13A, Airport Design, https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentNumber/150_5300-13A, September 28, 2012.
[146] San Francisco International Airport, "Weather and Operations at SFO: A Primer for the Media," January 2010, http://media.flysfo.com/media/sfo/media/weather-operations-primer_0.pdf, accessed September 17, 2017.
[147] In the 1953 "Sewerage System General Plan" included in the architectural drawings for Contract No. A-175, there was another sewage treatment plant functioning on the airport property: the Millbrae Sewage Treatment Plant, which was in the same location as the present-day Millbrae Water Pollution Control Plant (400 E. Millbrae Avenue). The Millbrae Sewage Treatment Plant does not appear to have been associated with the airport's wastewater infrastructure, and it is not within the airport's current boundary.
[148] City and County of San Francisco Public Utilities Commission, Utilities Engineering Bureau, "San Francisco Airport Sewerage System General Plan" (December 1953), Contract No. A-175, drawing CA-10877.

As a result of settlement and aging infrastructure, groundwater infiltrates into the sanitary system. The brackish water cannot be removed through the existing system and renders the reclaimed water unusable for many applications. To eliminate infiltration, the existing infrastructure will need to be reexamined and replaced as necessary.[149]



The plant is identified by the arrow.

SOURCE: City and County of San Francisco Public Utilities Commission, *San Francisco International Airport, Sewage Treatment Plant, Utilities Plan* (architectural drawings, April 1955, drawing CA-11545).

Shoreline Protection Program HRE Part 1

Figure 40
Location of the First Sewage Treatment Plant, 1955

2. Industrial Waste System

The following inventory of the Airport's industrial waste system is an excerpt from the Airport's 2016 *Draft Final Airport Development Plan*.

> Industrial waste is collected and treated on-site at the [Industrial Wastewater Treatment Plant (IWTP)] located in the north field area at the Mel Leong Treatment [Plant]. Industrial waste is collected and conveyed to the IWTP through a network of gravity and pressure pipes. Industrial waste is generated mainly by aircraft maintenance, car washing, wash racks, and other general cleaning required throughout the Airport.
>
> SFO has been producing and using recycled water at the Airport for irrigation, as well as washdown in and around the Mel Leong Treatment Plant. [150] In addition, SFO has a recycled water truck fill station at the Mel Leong Treatment Plant, which is used to control dust and for street sweeping. The anticipated capacity of recycled water at the Industrial Wastewater Treatment Plant will be approximately 1.0 MGD for use in nonpotable applications, such as fixture flushing and landscape irrigation.

[149] San Francisco International Airport, *Draft Final Airport Development Plan*, September 2016, p. 3-112, https://www.flysfo.com/sites/default/files/default/about/Chapter_3_Inventory_Draft_Final.pdf, accessed September 29, 2020.

[150] Washdown is the process of cleaning or washing a surface for appearance, sanitation, or removal of contamination.

With a goal of expanding its recycled water program, SFO management began the master planning process and the final report, SFO Recycled Water Master Plan, was completed in December 2014 by Kennedy/Jenks Consultants. Although an underground supply is not currently provided from the Mel Leong Treatment Plant to the Airport, SFO management has included the near term phase of the Recycled Water Master Plan within the Airport Capital Improvement Program. In addition, new facilities being constructed have been designed to accommodate both a potable and a recycled water connection. The facility would be connected to recycled water when it comes online.

In addition to the industrial waste sources, the "first flush" stormwater from the site is retained, diverted, and pumped at a controlled rate to the IWTP to prevent pollutants from entering San Francisco Bay. Additional information on the first flush is provided in the discussion of stormwater infrastructure [below].

The United Airlines [Maintenance Operation Center (MOC)] has its own industrial waste treatment plant that discharges to the SFO IWTP for secondary treatment prior to discharge into the Bay.

The design peak capacity of the IWTP is 1.65 MGD. Currently, the plant is limited to 50 percent to 60 percent of peak capacity because of long-term buildup and maintenance issues. A capital project has been initiated to restore the IWTP to its design peak capacity of 1.65 MGD.

A portion of the effluent is retained and used by SFO as reclaimed water. The remainder of the effluent is combined with the sanitary waste effluent and discharged to the North Bayside System Unit in South San Francisco, where the effluent is combined with effluent from surrounding municipalities for dechlorination and deepwater discharge into the Bay.[151]

3. Mel Leong

Melvin "Mel" Leong (1936–2005) was a longtime SFO employee from the 1950s to the 1990s. He was hired by the San Francisco Public Utilities Commission around 1959 while he studied civil engineering at UC Berkeley and was later promoted to junior engineer. Leong served as SFO's first Environmental Control Officer (a position he held for over 30 years) and supervised the construction of both the sanitary and industrial waste treatment facilities. He also designed the utility systems that serve the Terminal Area and replaced the Airport's 1920s-era facilities, directed the environmental remediation under the Airport's master plan, and modernized the airport-wide utility system in the late 1990s to prepare for the next century. Following his retirement in 1997, Leong was a consultant for the third major phase of construction at the water treatment plant ca. 2002–05 that included the SBR basins.[152, 153, 154]

Leong passed away on June 16, 2005. In September 2005, the Airport Commission adopted Resolution No. 05-0170, which renamed the water treatment facility the Mel Leong Treatment Plant. He was lauded as "the original Airport environmentalist [who] had a great commitment to the environment and made sure that the Airport made a positive commitment as well."[155]

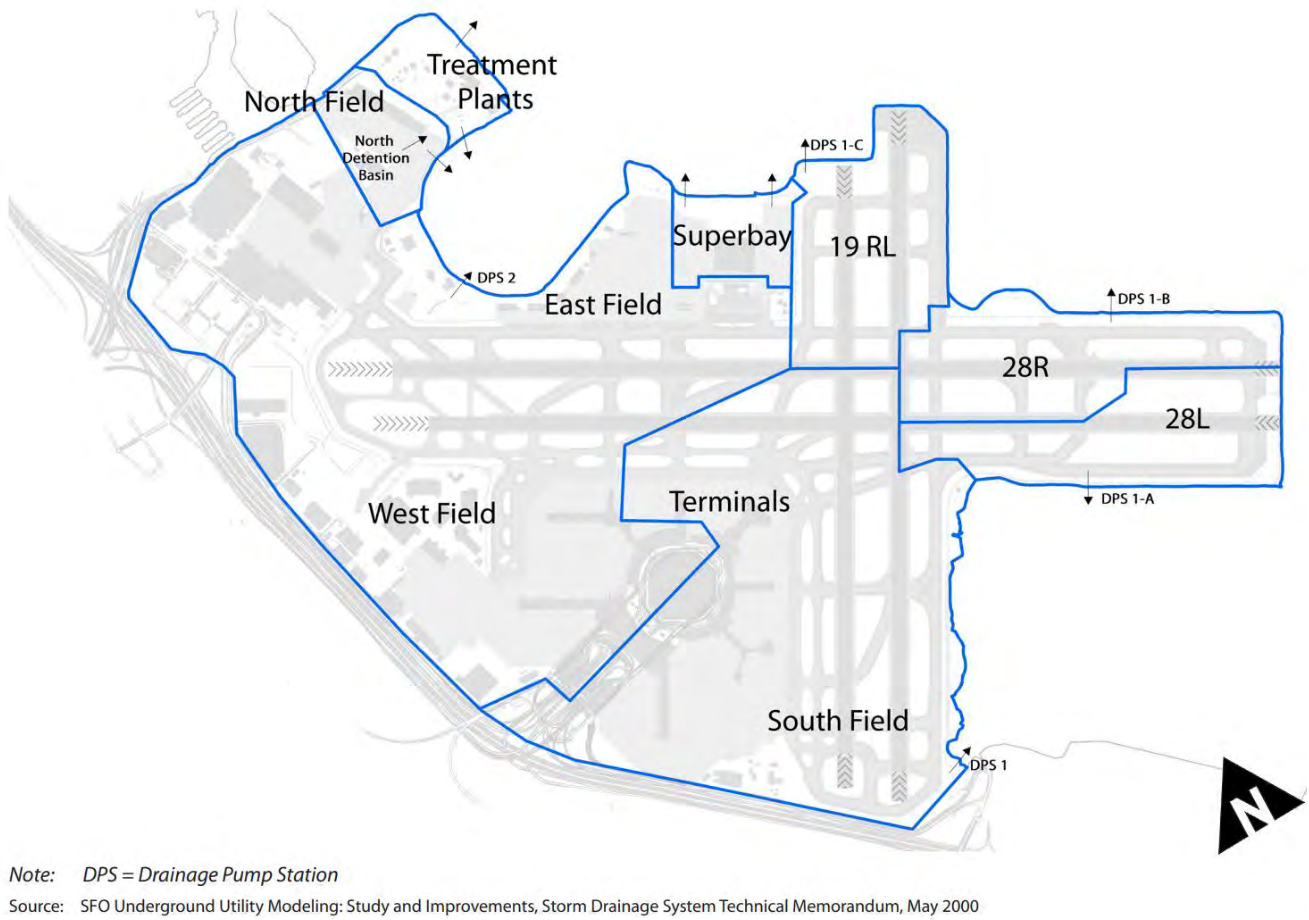
[151] San Francisco International Airport, *Draft Final Airport Development Plan*, September 2016, p. 3-113, https://www.flysfo.com/sites/default/files/default/about/Chapter_3_Inventory_Draft_Final.pdf, accessed September 29, 2020.
[152] "Melvin M. Leong" (obituary), *San Francisco Chronicle*, June 19, 2005.
[153] San Francisco Airport Commission, Meeting minutes, June 3, 1997, pp. 3-4, https://www.flysfo.com/sites/default/files/default/download/about/commission/agenda/pdf/minutes/M060397.pdf, accessed September 29, 2020.
[154] San Francisco Airport Commission, Meeting minutes, September 20, 2005, p. 6, https://www.flysfo.com/sites/default/files/default/download/about/commission/agenda/pdf/minutes/M092005.pdf, accessed September 29, 2020.
[155] Ibid.

F. Stormwater Infrastructure at SFO

The following inventory of the Airport's stormwater drainage system is an excerpt from the Airport's 2016 *Draft Final Airport Development Plan*.

> The SFO basin area is approximately 2,100 acres in size and is divided into eight separate sub-basins, as shown on [**Figure 41**]. The majority of the basin area is impervious. The limited pervious areas are mainly located airside between the runways and taxiways.
>
> Stormwater from both the airside and landside areas is collected through a series of inlets and collection pipes. The collection pipes vary in size and materials, such as vitrified clay, cast iron, steel, or ductile pipe. The majority of the conveyance for the system is gravity; however, 19 major pump stations are included in the stormwater system.
>
> The elevation of SFO is low and flat, with an average site elevation about 2.5 feet above the mean high tide elevation of San Francisco Bay. This requires that stormwater is discharged to the outfall locations via a stormwater pump station. With sea level rise projected, SFO is working to raise the stormwater outfall pipes to maintain a positive discharge to the Bay. These outfall modifications are being incorporated into ongoing system upgrades and are not listed as a separate capital project.
>
> The first flush of a rainfall event carries a higher concentration of pollutant loading in the runoff from the impervious areas of each basin. Four detention basins divert the first flush of a rainfall event to the [IWTP]. One detention facility is located in each of the following basins: North Field Cargo Basin, East Field Basin, West Field Basin, and South Field Basin.
>
> Similar to the sanitary system, the stormwater system has multiple leaks and points of infiltration resulting from settlement and age. SFO management has implemented a capital project to inventory the pipe networks, identify leaks, and prioritize the required repairs.[156]

[156] San Francisco International Airport, *Draft Final Airport Development Plan*, September 2016, p. 3-111, https://www.flysfo.com/sites/default/files/default/about/Chapter_3_Inventory_Draft_Final.pdf, accessed September 29, 2020.



SOURCE: SFO, *Draft Final Airport Development Plan*, September 2016.

Shoreline Protection Program HRE Part 1

Figure 41
Diagram of Stormwater Drainage System, Identifying Drainage Sub-Basins and Pump Stations

G. Industrial Development in South San Francisco

During the mid- to late-19th century, the area now known as South San Francisco was used primarily as cattle grazing land. Landowner Gustavus Swift formed the South San Francisco Land and Improvement Co., which aimed to establish a town, attract workers, and align other industries to support his Western Meat Co. packing plant located at Point San Bruno. Swift promoted the area as friendly to industry at a time when San Francisco was actively relocating factories and manufacturing plants to the southern edges of the city.[157] These efforts coincided with construction by the Southern Pacific Railroad of the Bayshore Railway Cutoff between San Francisco and San Jose between 1904 and 1907. This improved rail access along with increased demand for construction materials after the 1906 earthquake led to the establishment of steel mills along the waterfront in South San Francisco, where the shipping and ship building industries also flourished.[158] Consequently, the City

[157] Joseph Blum, "South San Francisco: The Making of an Industrial City," *California History,* vol. 62, no. 2, 1984, pp. 119-134.
[158] City of South San Francisco, *South San Francisco General Plan*, 1999, 1-3, 1-6, https://www.ssf.net/home/showpublisheddocument/478/636318496957770000, accessed October 15, 2021.

of South San Francisco was incorporated in 1908. By 1910, the area that is today east of U.S. 101 was known as "the factory district."[159]

As described above, the Mills Field Municipal Airport of San Francisco opened in 1927. The Bayshore Highway opened in 1929 as a six-lane thoroughfare connecting downtown San Francisco, cities and towns in San Mateo and Santa Clara counties, and ultimately San Jose. The segment through South San Francisco is known today as Airport Boulevard.[160] Between World Wars I and II, marine and military industries began to populate the waterfront portions of South San Francisco. Industrial growth on the bay side of U.S. 101 expanded into freight, light manufacturing, and airport-related fields.

Population growth was slow but steady until the mid-1940s. Like the rest of the bay area, a general population and industry boom occurred in South San Francisco during the 1950s and 1960s, growing from 6,659 people in 1940 to 38,762 in 1960.[161] The 17-acre Airport Boulevard Industrial Tract (bounded by the Plot 16D construction staging area on the south, U.S. 101 on the west, the San Bruno Canal on the north, and South Airport Boulevard on the east) was platted in 1955 and subdivided in 1957, and became the city's first industrial park.[162,163] In the mid-1960s, approximately 600 acres of tidal land adjacent to the Oyster Point Marina were reclaimed. This area was developed as the city's first comprehensively planned industrial park to feature consistent architectural and landscape design and ample parking.[164]

Over the subsequent decades, many heavy industries in South San Francisco were replaced by research and development, technology, biotechnology, warehousing, manufacturing, and real estate development companies.[165]

1. Development of the Airport Boulevard Industrial Tract

The Airport Boulevard Industrial Tract was the first industrial park in South San Francisco. Its creation is attributed in large part to Louis Poletti (1916–2013), a prominent industrial realtor, who played a major role in developing the tract. The following excerpt from Poletti's obituary describes his contributions:

> *Lou was a man who singly did more to transform the hills and tidelands of Northern San Mateo County into centers of dynamic industries…There are so many major projects that he was involved with, it is difficult to pick out any one, but what started it all was his development of 17 acres of unusable utility land located between South Airport Boulevard and Highway 101. Lou was able to turn this swamp land into the first and only industrial park in town…Lou was a leader of the South Airport Industrial Park Project, also known as Beacon Street. He was responsible for the development of 55 acres by Utah Construction Company, which had tremendous bearing on the progress that the City of South San Francisco has made since.*[166]

---

[159] "South San Francisco Neighborhood Story Map," City of South San Francisco, https://www.arcgis.com/apps/MapJournal/index.html?appid=14ff07b61b384e3087bcb4eeb33bbc4f, accessed October 15, 2021.
[160] Jacquelyne Kious, "Bayshore Highway," https://www.ssf.net/home/showpublisheddocument/5442/636466152001730000, accessed October 15, 2021.
[161] "City of South San Francisco, San Mateo County," Bay Area Census, www.bayareacensus.ca.gov/cities/SouthSanFrancisco.htm, accessed October 15, 2021.
[162] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 44, Page 1," 1955, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[163] San Mateo County, "Subdivision Map: Airport Blvd Industrial Tract, Volume 47, Page 5," 1957, https://gis.smcgov.org/Html5Viewer/?viewer=raster, accessed September 30, 2021.
[164] City of South San Francisco, *South San Francisco General Plan*, 1999, 1-11, https://www.ssf.net/home/showpublisheddocument/478/636318496957770000, accessed October 15, 2021.
[165] Ibid.
[166] "Louis John Poletti" (obituary), *San Francisco Chronicle,* August 12, 2013, p. C3.

The *San Mateo Times* reported that Poletti also incorporated "innovation[s] designed to add charm to industry" in order for the industrial park to "be made as attractive and desirable as residential areas." One such innovation was planting palm trees in front of the buildings.[167] (These are no longer extant.) At least nine manufacturing and distributing facilities were constructed by the end of 1958, including the following:

- Thompson Aircraft Tire Co. (160 Beacon Street);
- H.D. Lee Co.;
- A.S. Aloe Inc.;
- Pioneer Motor Bearing Co.;
- American Chesterfield Inc.;
- Associated Construction and Engineering Co.;
- New Method Fur Co.; and
- Raybestos-Manhattan Co. (168 Beacon Street).[168]

By 1961 this list expanded to include the following tenants:

- P.L. Badt Co. (182 Beacon Street);[169]
- RCA (192 Beacon Street);[170]
- S.K. Wellman Co. (508 South Airport Boulevard);[171]
- Van Heusen Shirts; and
- Tennifax Corp.[172]

A review of historic aerial photographs confirms that the tract was completely developed by 1965.

The early businesses in the industrial park represented a cross section of the types of industrial support companies that evolved from World War II military contracts and technological developments. Thompson Aircraft Tire Co. began as Thompson Tire Co. but changed its focus and its name in 1947 to reflect the growing need of industry specialization.[173,174] Both Raybestos-Manhattan Co. and S.K. Wellman Co. significantly expanded operations in the post-World War II period to become leaders in automotive and equipment brakes and friction technologies. Raybestos-Manhattan Co. went on to construct at least two other buildings in the industrial park at 130 Beacon Street and 179–187 Utah Way.

After the initial period of growth, the Airport Boulevard Industrial Tract attracted other tenants who would take advantage of the proximity to the Airport and the expanding regional highway system. One of Odwalla's early regional distribution centers and warehouses was located in the industrial park, first at 192 Beacon Street and later at 182 Beacon Street. Customs and shipping companies were drawn to the easy transportation access. These

[167] "Palms for S.S.F. Industry," *San Mateo Times,* April 9, 1958, p. 17.
[168] "Raybestos to Build in South City," *San Mateo Times,* August 26, 1958, p. 19.
[169] "Badt to Move," *San Francisco Chronicle*, May 17, 1960, p.43.
[170] "RCA Breaks Ground in SSF," *San Mateo Times,* August 4, 1959, p.23.
[171] "New SSF Plant Begun," *San Mateo Times*, April 10, 1961, p.10.
[172] Ibid.
[173] Business notes, *San Francisco Chronicle,* April 21, 1946, p.19.
[174] "Seiberling Dealership," *San Francisco Chronicle*, October 12, 1947, p. 33.

included Gateway Freight Services, Cargo Service Center, GM Miller and Co. International, Tricor America, Air-Sea Forwarders (ASF), and Usaha Express Corp.

2. Thompson Aircraft Tire Co. (160 Beacon Street)

Thompson Aircraft Tire Co. was founded in 1932 by Walter Schlichtmann as Thompson Tire Co.[175] After World War II, Schlichtmann refocused his company on aircraft, industrial, and military tire retreading based on technology he developed during the rubber shortages of World War II, and the name was changed to Thompson Aircraft Tire.[176] By the time the company moved to 160 Beacon Street in 1958, it was known as a leader in the field and possibly the only such firm specializing in aircraft tire retreading in the world. The company eventually built plants in Miami and Belgium.[177] The company was acquired by Banner Industries in 1972 and became a wholly-owned subsidiary of that company.[178]

160 Beacon Street was constructed in 1958 for Thompson Aircraft Tire Co. The building construction was estimated to cost $400,000 with an additional $600,000 investment in new equipment and supplies, and it replaced Thompson's earlier facility at 601 Minnesota Street in San Francisco. The building was constructed by Herrero Brothers and structural engineers Simpson and Stratta.[179] Accounts from the time describe the buildings as having a "modern, attractive design to meet [the] high standards of the industrial park" and a "special interior layout [to] make the new plant the most efficient of its type in the country."[180] Thompson Aircraft Tire Co. continued to operate at 160 Beacon Street until ca. 1993–1996.[181]

3. Raybestos-Manhattan Co. (168 Beacon Street)

Raybestos-Manhattan Co. was a national company with sales, distribution, and regional administrative offices located across the country. The company was founded in 1902 in Bridgeport, Connecticut, as the A.H. Raymond Co. and manufactured asbestos-based automotive brake pads.[182] After merging with the Manhattan Rubber Co. in 1929, the new company was named the Raybestos-Manhattan Co.[183] As the dangers of asbestos became more widely known, the company was sued in multiple civil lawsuits and declared bankruptcy in 1998.[184]

168 Beacon Street was constructed in 1958 for Raybestos-Manhattan Co., a "leading manufacturer of industrial rubber products, mechanical packings, asbestos textiles, friction materials for brake linking and clutch facings for both original and replacement equipment."[185] It was intended to serve as the company's San Francisco sales district headquarters, replacing a former location at 131 Mission Street in San Francisco.[186] At the time of its construction, the building was given the address of 170 Beacon Street. Within 10 years, Raybestos-Manhattan

[175] "Giant Tires Get New Lease on Life in World's Largest Retreading Mold," *San Francisco Chronicle,* October 12, 1952, p.28.
[176] *San Francisco Chronicle,* October 12, 1947, p.33.
[177] "Thompson Tire European Plant," *San Francisco Chronicle,* November 4, 1967, p.40.
[178] *San Francisco Chronicle,* April 27, 1972, p.56.
[179] "Aircraft Tire Firm Breaks Ground in SSF," *San Mateo Times,* May 22, 1958, p.32.
[180] Ibid.
[181] Job listing, *San Francisco Chronicle,* March 28, 1993, p.88; Job listing, *San Francisco Chronicle,* October 20, 1996, p.114.
[182] CTPost, "Raymark Timeline," https://www.ctpost.com/local/article/Raymark-timeline-2242269.php, accessed October 21, 2021.
[183] Ibid.
[184] "United States Bankruptcy Court for the Eastern District of Pennsylvania: Raymark Industries, Inc.," August 17, 1999, https://www.paeb.uscourts.gov/sites/paeb/files/opinions/raymark.15.pdf, accessed October 21, 2021.
[185] "Raybestos to Build in South City," *San Mateo Times,* August 26, 1958, p.19.
[186] Ibid.

Co. had expanded to two more buildings in the area: a distribution center at 130 Beacon Street (extant) and a corporate distribution center at Harbor Way and Utah Avenue (status unknown).[187]

4. RCA (192 Beacon Street)

The Radio Corporation of America (RCA) was established in 1919 when General Electric purchased and reorganized the Marconi Wireless Telegraph Co. of America.[188] For the first 20 years of its existence, the company focused on broadcast radio, building a series of stations, distribution networks, and content that was broadcast for a radio audience. In 1939, the company presented an all-electric, black-and-white television system at the New York World's Fair, and mass production began immediately. RCA's first color televisions were produced in 1954. The building located at 192 Beacon Street was one of over 150 service centers in the United States at that time that were dedicated to the repair and servicing of RCA-branded televisions and electronics.

Throughout the 1950s and 1960s, RCA expanded its electronics business through a series of scientific and commercial innovations including satellites and rockets to support the space race. The company later introduced color video cassettes (1972), color video discs (1981), and the widescreen television (1990). Today, RCA continues to manufacture a wide range of consumer electronics, household appliances, and entertainment devices.

The building located at 192 Beacon Street was constructed in 1959 for RCA Service Co., a service center for RCA televisions and electronics.[189] It was notable as "one of the largest branches in RCA's nationwide network of 150 service centers."[190]

5. Odwalla (192 and 182 Beacon Street)

Odwalla was founded in 1980 in Santa Cruz, California by musicians Bonnie Bassett, Gerry Percy, and Greg Steltenpohl.[191] The company originally sold its product to local restaurants. They incorporated in 1985 and began a period of regional expansion, which included expansion into the San Francisco Bay Area and establishment of a regional distribution warehouse at 192 Beacon Street.[192] In 1993, Odwalla went public with a valuation of $3.9 million and constructed a new production facility in Dinuba, California.[193] In 1995, Odwalla moved its company headquarters to Half Moon Bay, California. The company then began acquiring small juice companies across the country and moved into national distribution. Following a 1996 E. Coli outbreak associated with their apple juice that resulted in the death of a child, the company lost nearly 90 percent of its value. Eventually they regained market share and were purchased by the Coca-Cola Co. in 2001. The brand was retired by Coca-Cola in 2020.

---

[187] "Raybestos Plans New Plant," *San Mateo Times*, September 26, 1968, p.29.
[188] RCA.com, "Our Legacy," https://www.rca.com/us_en/our-legacy-266-us-en, accessed October 20. 2021.
[189] "RCA Breaks Ground in S.S.F.," *San Mateo Times,* August 4, 1959, p.23.
[190] Ibid.
[191] Grocery.com, "Odwalla, Inc.," https://www.grocery.com/odwalla-inc/, accessed October 20, 2021.
[192] Ibid.
[193] "Odwalla's History: Problems Amid Success in Half Moon Bay," *San Jose Mercury News*, June 12, 2013, https://www.mercurynews.com/2013/06/12/odwallas-history-problems-amid-success-in-half-moon-bay/, accessed October 20, 2021.

6. S.K. Wellman Co. (508 South Airport Boulevard)

The building located at 508 South Airport Boulevard was constructed in 1961 for the S.K. Wellman Co. to house the company's Northern California and Western Nevada sales and distribution facilities.[194] Like several of its neighbors, the S.K. Wellman Co. specialized in the manufacture and distribution of brakes and industrial parts. Construction of the building reportedly costs $200,000.[195] S.K. Wellman was acquired by the American Brake Shoe Co. (Abex) two years later in 1963. The acquisition spurred a long anti-trust investigation that culminated in 1971 with the sale of Abex's Wellman Division to Brush Beryllium.[196] The combined company then changed its name to Brush Wellman.[197]

H. Architecture and Engineering Firms

Research identified the architects and/or engineers responsible for the designs of two subject buildings. Brief histories of these firms are presented below.

1. Architects

Kitchen & Hunt Architects (Building 918)

Partners Robert S. Kitchen, FAIA (1912–2007), and Frank B. Hunt, FAIA (1915–97), directed their San Francisco-based architecture, landscape architecture, and planning firm from 1948 to 1973. In addition to the first major phase of the Mel Leong Treatment Plant at SFO, Kitchen & Hunt designed the extant Truckee Meadows Water Reclamation Facility (originally known as the Reno-Sparks Joint Water Pollution Control Plant) in Reno, Nevada (1967, designed in consultation with Kennedy Engineers)[198] and the extant Sanitary District No. 5 Treatment Plant in Tiburon, California (1962).[199] Some of the firm's notable projects include the Olympic Ice Arena at Squaw Valley, California, a collaboration with Corlett & Spackman Architects that won a 1960 AIA First Honor Award (1958–60, demolished); multiple buildings on the UC Davis campus (Regan Residence Hall, Shields Library Addition, Landscaping Management Field Headquarters) and UC Berkeley campus (Bio-Radiological Lab Building at the Lawrence Radiation Lab); and the West Oakland, South Hayward, Union City, Fremont, and North Berkeley stations in the Bay Area Rapid Transit (BART) system (all completed in the late 1960s and early 1970s, all extant).[200] Kitchen's 2007 obituary also lists "the SFO United Air Lines building" among the firm's completed projects, but archival research did not confirm an association with any specific building.[201]

---

194 "New SSF Plant Begun," *San Mateo Times,* April 10, 1961, p.10.
195 Ibid.
196 "Automotive Repair Industry: Hearings before the Subcommittee on Antitrust and monopoly of the Committee on the Judiciary, United States Senate, ninety-first congress, second session, part 5 Appendix (pages 1819 - 3006)" 1971, https://books.google.com/books?id=Ya_ypvNFNoEC&pg=PA2697&lpg=PA2697&dq=abex+wellman&source=bl&ots=Lwre80jPcQ&sig=ACfU3U0oKCsG1dX0ks_6A050veMNVc5tQ&hl=en&sa=X&ved=2ahUKEwj39dOUqdzzAhWBFjQIHZb8DbAQ6AF6BAgWEAM#v=onepage&q=abex%20wellman&f=false, accessed October 21, 2021.
197 Funding Universe.com, "Brush Engineered Materials, Inc. History," http://www.fundinguniverse.com/company-histories/brush-engineered-materials-inc-history/, accessed October 21, 2021.
198 Mark Hulbert, California Department of Parks and Recreation (DPR) Primary Record for Berkeley Central Medical Building (3031 Telegraph Avenue, Berkeley, CA), October 2019. Appended to City of Berkeley Landmarks Preservation Commission Staff Report Re: 3031 Telegraph Avenue, November 5, 2020, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_LPC/2020-11-05_Item%209_LPC_SR_DR_3031%20Telegraph_with%20attachments.pdf, accessed November 10, 2020.
199 Susan Dinkelspiel Cerny, *An Architectural Guidebook to San Francisco and the Bay Area* (Salt Lake City, UT: Gibbs Smith, Publisher, 2007), p. 468.
200 Ibid., p. 501.
201 "Robert S. Kitchen" (obituary), *San Francisco Chronicle*, June 15, 2007.

The firm also designed many residences.[202] One early residence in Santa Cruz was featured in the 1949 exhibition at the San Francisco Museum of Art titled "Domestic Architecture of the San Francisco Bay Region." Kitchen & Hunt were the architects, and Robert Kitchen was the landscape architect. According to the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, "the list of participating architects and landscape architects reads as a who's who of Second Bay Tradition architects."[203] This is the only mention of Kitchen & Hunt in the context statement, and neither man is identified as a master.

In June 1973, the partnership dissolved. Hunt continued the corporate practice of Kitchen & Hunt Architects under the name Hunt & Co. Architects, and Kitchen established his own practice in San Francisco.[204] By 1982, Hunt had begun a professional affiliation with Kennedy/Jenks Engineers, for which he served as a board member and vice president.[205]

2. Engineers

Kennedy Engineers (Older Portion of Building 922)

Kennedy Engineers was founded in San Francisco in 1919 by Clyde C. Kennedy. Kennedy Engineers became a well-known civil and sanitary engineering firm and established offices in Los Angeles, Tacoma, Salt Lake City, and Washington, D.C., during the 1940s and 1950s, constructing numerous water treatment plants and water supply systems throughout the western United States. Direction of the company passed from Kennedy to his son, Richard R. Kennedy, and then to his grandson, David D. Kennedy in 1979. In 1980, Kennedy Engineers merged with the sanitary and civil engineering firm Jenks & Harrison to form Kennedy/Jenks Engineers. Today that firm is known as Kennedy/Jenks Consultants and operates 29 offices in the United States.[206] Since 2010, Kennedy/Jenks Consultants has completed more than 3,700 wastewater treatment projects.[207]

---

202 Ibid.
203 San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, January 2011, p. 115.
204 "Realty Notes," *San Francisco Examiner*, June 17, 1973, Real Estate Section, p. D.
205 "Newsmakers," *Berkeley Gazette*, April 8, 1982, p. 20.
206 Kennedy Jenks, "Office Locations," https://www.kennedyjenks.com/about-kj/office-locations/, accessed November 10, 2020.
207 Kennedy Jenks, "Wastewater Treatment," https://www.kennedyjenks.com/markets/water/wastewater-engineering/, accessed November 10, 2020.

INTENTIONALLY BLANK

CHAPTER VIII
Evaluation of Historic Status

The following section provides an evaluation of historic significance for age-eligible structures and buildings located within 100 feet of Reaches 1 through 15 based on the site surveys and research and follows California Register Criteria 1 through 4. The following section includes evaluations as individual resources (either as standalone resources or as a property type[208]) and as potential contributors to a potential historic district for the following buildings and structures:

- Outfall E010;
- Building 918/Mel Leong Treatment Plant, Sanitary Waste Process Administration;
- Building 922/Mel Leong Treatment Plant, SBR Sanitary Process;
- Seaplane ramp;
- Outfall E004;
- SDPS-1C and Outfall E007;
- SDPS-1B and Outfall E006;
- SDPS-1A and Outfall E005;
- Building 1080/Field Lighting Building No. 2.; and
- The existing shoreline protection features.

As discussed in Chapter IV, Project Description, in order to address landside flood protection, Reach 16 may be required to form a continuous, closed flood protection system. However, landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae. As such, Reach 16 will be analyzed at a programmatic level.

A. Property Type: Storm Drain Pump Stations and Outfalls

Six historic-age outfalls and four associated storm drain pump stations (SDPS) are located within 100 feet of the project site, including staging areas. Because they are functionally related components of SFO's stormwater infrastructure and have common physical attributes, they have been evaluated collectively as a property type. These include:

- Outfall E010 (1970)
- Outfall E004 (1950)
- SDPS-1C and Outfall E007 (1982)

[208] The National Park Service defines a property type as "a grouping of individual properties characterized by common physical and/or associative attributes [such as] style, structural type, size, scale, proportions, design, architectural details, method of construction, ornamentation, spatial arrangement or plan, materials, workmanship, artistry, and environmental relationships." National Park Service, *Preservation Bulletin 16B: How to Complete the National Register Multiple Property Documentation Form*, 1999, 14.

- SDPS-1B and Outfall E006 (1983)
- SDPS-1A and Outfall E005 (1983)

1. Criterion 1 (Events)

Research does not indicate that the outfalls and associated pump stations, which are common components of SFO's stormwater infrastructure, are associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The range of construction dates reflects the ongoing and systematic land reclamation activities at SFO during the 20th century. The stormwater infrastructure is not associated with the essential aviation function (i.e., the operation and use of aircraft) of SFO. For this reason, the outfalls and associated pump stations do not appear to be eligible for listing under California Register Criterion 1.

2. Criterion 2 (People)

Research does not indicate that the pump stations or outfalls are associated with the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) No individual person or persons are directly associated with the structures. For this reason, the outfalls and associated pump stations do not appear to be eligible for listing under California Register Criterion 2.

3. Criterion 3 (Design/Construction)

The outfalls and associated pump stations are components of SFO's stormwater infrastructure, which has been expanded and modernized over the 20th and 21st centuries. The individual components and the stormwater system itself were engineered to collect water from the airfield, transport it to the Mel Leong Treatment Plant, and safely dispose of the treated water into the bay. As purely utilitarian components of a larger network that are routinely repaired to maintain functionality, the outfalls and pump stations do not appear to embody the distinctive characteristics of a type, period, region, or method of construction; represent the work of a master; or possess high artistic value. For these reasons, the outfalls and associated pump stations do not appear to be eligible for listing under California Register Criterion 3.

4. Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. An archeological sensitivity analysis (ASA) is outside the scope of this evaluation. The outfalls and associated pump stations do not represent a local construction type that would yield important information regarding the prehistory or history of SFO. Therefore, they do not appear to be eligible for listing under California Register Criterion 4.

B. Building 918/Mel Leong Treatment Plant, Sanitary Waste Process Administration

Year constructed: ca. 1969–70

Architect: Kitchen & Hunt Architects

1. Criterion 1 (Events)

Research does not indicate that Building 918 is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Along with Building 922 (discussed below), a headworks, and two digester tanks, these extant buildings and structures were constructed ca. 1969–70 as SFO's second sanitary waste treatment plant. (The first plant was constructed in 1955 and demolished in 1994.) The plant was later enlarged to include industrial waste treatment facilities, and periodic upgrades and expansions have allowed the facility to continue to operate efficiently. As the hub of SFO's wastewater infrastructure, the Mel Leong Treatment Plant (which includes Building 918) does not have an important association with the essential aviation function (i.e., the operation and use of aircraft) of SFO. For these reasons, Building 918 does not appear to be individually eligible for listing under California Register Criterion 1.

2. Criterion 2 (People)

Research does not indicate that Building 918 is associated with the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) No individual person or persons are directly associated with Building 918, which was constructed ca. 1969–70 as the administration and operations building for SFO's second sanitary waste treatment plant. (The first plant was constructed in 1955 and demolished in 1994.) It was enlarged to include industrial waste treatment facilities in the 1970s, and the combined wastewater treatment plant was renamed the Mel Leong Treatment Plant in 2005. The plant's eponym, Mel Leong, was SFO's first and longtime Environmental Control Officer. In addition to supervising the construction of both the sanitary and industrial waste treatment facilities, Leong played important roles in several other major infrastructure upgrades at SFO. Individually, Building 918 is not closely associated with Leong's productive life, and is one example of his many professional contributions to the development of SFO. For these reasons, Building 918 does not appear to be individually eligible for listing under California Register Criterion 2.

3. Criterion 3 (Design/Construction)

Building 918 does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. Research indicates that the building has continually functioned as an administration and operations building for sanitary water treatment since its construction ca. 1969–70. The steel-frame building is utilitarian in nature and does not exhibit or embody distinctive characteristics of a particular architectural style or period. Kitchen & Hunt Architects originally designed the building; despite some alterations, the building closely resembles its original design. Archival research determined that the firm was involved with the design of two water treatment plants (including the one at SFO), and it was better known for its designs of residential, educational, and recreational architecture in northern California. Building 918 does not appear to be representative of Kitchen & Hunt's work, and does not possess high artistic values. For these reasons, Building 918 does not appear to be individually eligible for listing under California Register Criterion 3.

4. Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. An ASA is outside the scope of this evaluation. Building 918 does not represent a local construction type that would yield important information regarding the prehistory or history of SFO. Therefore, it does not appear to be eligible for listing under California Register Criterion 4.

C. Building 922/Mel Leong Treatment Plant, SBR Sanitary Process

Years constructed: ca. 1969–70 (first phase); ca. 2002–05 (expansion)

Engineers: Kennedy Engineers (first phase); CH2M HILL in association with Ocampo-Esta Corp., Michael Willis & Associates, and KPA Consulting Engineers Inc. (SBR process expansion)

1. Criterion 1 (Events)

Research does not indicate that Building 922 is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Along with Building 918 (discussed above), a headworks, and two digester tanks, these extant buildings and structures were constructed ca. 1969–70 as SFO's second sanitary waste treatment plant. (The first plant was constructed in 1955 and demolished in 1994.) The plant was later enlarged to include industrial waste treatment facilities, and periodic upgrades and expansions have allowed the facility to continue to operate efficiently. As the hub of SFO's wastewater infrastructure, the Mel Leong Treatment Plant (which includes Building 922) does not have an important association with the essential aviation function (i.e., the operation and use of aircraft) of SFO. For these reasons, Building 922 does not appear to be individually eligible for listing under California Register Criterion 1.

2. Criterion 2 (People)

Research does not indicate that Building 922 is associated with the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) No individual person or persons are directly associated with Building 922, which was originally constructed ca. 1969–70 as SFO's second sanitary waste treatment plant. (The first plant was constructed in 1955 and demolished in 1994.) The building was partially demolished and significantly enlarged ca. 2002–05. The combined sanitary and industrial wastewater treatment plant was renamed the Mel Leong Treatment Plant in 2005. The plant's eponym, Mel Leong, was SFO's first and longtime Environmental Control Officer. In addition to supervising the construction of both the sanitary and industrial waste treatment facilities, Leong played important roles in several other major infrastructure upgrades at SFO. Individually, Building 922 is not closely associated with Leong's productive life, and it is an altered example of his many professional contributions to the development of SFO. For these reasons, Building 922 does not appear to be individually eligible for listing under California Register Criterion 2.

3. Criterion 3 (Design/Construction)

Building 922 does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. It has continually functioned as a sanitary water treatment facility since its construction ca. 1969–70. The reinforced concrete structure is utilitarian in nature and does not exhibit or embody distinctive characteristics of a particular architectural style or period. The original ca. 1969–70 portion of Building 922 was designed by Kennedy Engineers, a precursor of the prominent present-day engineering firm Kennedy/Jenks Consultants. Although Kennedy Engineers was a well-known civil and sanitary engineering firm in its day (1919–80), research does not indicate that Building 922 is representative of the firm's work or expressive of a particular phase in the firm's history. The two sludge beds that made up approximately one-third of the original portion of Building 922 were demolished and replaced with the SBR process facility portion of Building 922 ca. 2002–05. This more recent expansion was the product of a team of engineers and designers led by CH2M HILL, an American international technical professional services firm that was acquired by Jacobs Engineering Group in 2017. With more than 20,000 employees and $5.24 billion in revenue in 2016,[209] archival research does not suggest that Building 922 was one of CH2M HILL's important 21st-century projects. Furthermore, Building 922 does not express aesthetic ideals or design concepts more fully than similar property types commonly found outside of SFO, and it therefore does not possess high artistic values. For these reasons, Building 922 does not appear to be individually eligible for listing under California Register Criterion 3.

4. Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. An ASA is outside the scope of this evaluation. Building 922 does not represent a local construction type that would yield important information regarding the prehistory or history of SFO. Therefore, it does not appear to be eligible for listing under California Register Criterion 4.

D. Seaplane Ramp

Year constructed: ca. 1944

Architect/Engineer: Unknown

1. Criterion 1 (Events)

Research does not indicate that the seaplane ramp is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Between 1932 and 1942, the Airport grew from 220 acres to 2,245 acres through land acquisition and reclamation, and many shoreline improvements realized during these decades are attributed to the WPA. It was on this reclaimed land north of the dredged Seaplane Harbor that Pan Am's Pacific-Alaska Division was constructed, which operated a fleet of "flying boat" fixed-wing aircraft. From 1944 to April 1946 (the date of the final flying boat flight to arrive at SFO), the seaplane ramp served the purely utilitarian function of moving amphibious aircraft between water and land. After that time, however, archival research suggests that the seaplane ramp became obsolete due to the transition from amphibious aircraft to land-based aircraft. For these reasons, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 1.

2. Criterion 2 (People)

Research does not indicate that the seaplane ramp is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the structure, which functioned historically as a component of the Airport's shoreline infrastructure specifically for the use of Pan Am. For this reason, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 2.

[209] CH2M HILL Companies, Ltd., "Form 10-K for the Fiscal Year Ended December 30, 2016," https://www.sec.gov/Archives/edgar/data/777491/000155837017001430/chm-20161230x10k.htm, accessed November 3, 2020.

3. Criterion 3 (Design/Construction)

The seaplane ramp is a utilitarian structure designed to be purely functional and not represent any architectural style. It does not embody the distinctive characteristics of a type, period, region, or method of construction; represent the work of a master; or possess high artistic values. For these reasons, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 3.

4. Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. An ASA is outside the scope of this evaluation. The seaplane ramp does not represent a local construction type that would yield important information regarding the prehistory or history of SFO. Therefore, it does not appear to be eligible for listing under California Register Criterion 4.

E. Building 1080/Field Lighting Building No. 2

Years constructed: 1987; 2010 (addition)

Architect/Engineer: Unknown

1. Criterion 1 (Events)

Research does not indicate that Building 1080 is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Along with Building 1071/Field Lighting Building No. 1,[210] these two buildings provide electricity to light the airfield, including runway and taxiway lighting. Field lighting buildings are utilitarian components of the airfield infrastructure at SFO and are commonly found at other large-hub airports. Whereas power to the lights is generated from Building 1080, the lights are actually controlled from the air traffic control tower, which is located between Terminals 1 and 2 and was constructed between 2012 and 2016. As a utilitarian component of the airfield infrastructure, Building 1080 does not have an important association with the essential aviation function (i.e., the operation and use of aircraft) of SFO. For this reason, Building 1080 does not appear to be individually eligible for listing under California Register Criterion 1.

2. Criterion 2 (People)

Research does not indicate that Building 1080 is associated with the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) No individuals are directly associated with the building, which has powered the airfield lighting since its construction 1987. For this reason, Building 1080 does not appear to be individually eligible for listing under California Register Criterion 2.

3. Criterion 3 (Design/Construction)

Building 1080 does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. The original portion of the building (1987) is essentially a box constructed of concrete masonry units and capped with a flat roof, and the curved roof of the pre-engineered addition (2010) provides some visual

[210] According to historic aerial photographs, Building 1071/Field Lighting Building No. 1, was constructed ca. 1990–93.

interest. However, the building is utilitarian in nature, is located on the perimeter of the airfield, and was not designed to serve the essential aviation function (i.e., the operation and use of aircraft) at SFO. It therefore does not possess high artistic values. Research did not identify the architect or engineer of Building 1080, and it is not believed to be the work of a master. For these reasons, Building 1080 does not appear to be individually eligible for listing under California Register Criterion 3.

4. Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. An ASA is outside the scope of this evaluation. Building 1080 does not represent a local construction type that would yield important information regarding the prehistory or history of SFO. Therefore, it does not appear to be eligible for listing under California Register Criterion 4.

F. Reach 16

Reach 16 may or may not be required to form a continuous, closed flood protection system. If it is determined that Reach 16 would need to be constructed in the future, it is currently anticipated that Reach 16 would extend southwest from where Reach 1 connects with South Airport Boulevard around the western perimeter of Airport property, east of U.S. 101. The reach would continue southeast along North McDonnell Road and South McDonnell Road and would connect to the western end of Reach 15. Reach 16 would likely consist of a low concrete wall with a maximum height of 2 feet and a series of deployable barriers and raised roads located on Airport property. However, the exact alignment of Reach 16 is not currently known. As such, this analysis considers a 150-foot buffer to account for different possible alignments of the reach in order to identify buildings and structures located within the vicinity of the reach.

As shown in **Table 2**, 19 buildings and structures are located within 150 feet of Reach 16. Four buildings previously have been determined ineligible for listing in the California Register, and concurrence of ineligibility of three other buildings has been acknowledged by the planning department. None of the other buildings and structures have been previously evaluated. With the exception of Building 800A, none currently meet (in 2021) the 45-year age criterion. However, because it is anticipated that Reach 16 would consist of a low concrete wall with a maximum height of 2 feet, construction of the reach would not result in a direct or indirect adverse impact on Building 800A. As the timing of Reach 16 construction is not currently known, it is unknown whether or not buildings and structures that have not previously been evaluated would become age-eligible by full build-out of Reach 16. Therefore, at such time that Reach 16 may be constructed, it would need to be determined if any of the highlighted buildings in Table 2 would meet the 45-year age criterion, thereby necessitating further evaluation of the building or structure at that time.

Table 2 Buildings and Structures within 150 Feet of Reach 16

Building No.	Building Name	Year Constructed	Previously Evaluated for the California Register or National Register?	Note
800A	Building 800A, United Airlines Maintenance Operations Center	Ca. 1946–1968	No	N/A
795	Long-term parking garage no. 1	1994	No	May become age eligible by the full build-out of Reach 16
—	Long-term parking garage no. 2	2018	No	May become age eligible by the full build-out of Reach 16
779	Rental car center AirTrain station	1998	No	May become age eligible by the full build-out of Reach 16
780	Rental car center	1998	No	May become age eligible by the full build-out of Reach 16
782	Rental car center	1998	No	May become age eligible by the full build-out of Reach 16
730	Cargo building	1971	Yes	Determined ineligible under the RADP[a]
710	Cargo building/office	1968	Yes	Determined ineligible under the RADP[a]
692	Sheet metal shop	1974	Yes	Determined ineligible under the RADP[a]
679	AirTrain maintenance and storage facility	1999	No	May become age eligible by the full build-out of Reach 16
676	Jason Yuen Architectural Building	1967	Yes	May become age eligible by the full build-out of Reach 16
677	West Field Road AirTrain station	2003	No	May become age eligible by the full build-out of Reach 16
612	Northwest Airlines cargo building	1969	Yes	The planning department has acknowledged that it concurs with the findings in the West Field Cargo Cultural Resources Survey Report[c] that identified the building as ineligible for listing in the California Register.
606	American Airlines cargo building	1967	Yes	The planning department has acknowledged that it concurs with the findings in the West Field Cargo Cultural Resources Survey Report[c] that identified the building as ineligible for listing in the California Register.
602	Swissport cargo building	1969	Yes	The planning department has acknowledged that it concurs with the findings in the West Field Cargo Cultural Resources Survey Report[c] that identified the building as ineligible for listing in the California Register.
585	United Airlines cargo building	1966	Yes	Determined ineligible under the RADP[a]
588	BART substation	Ca. 2002	No	BART did not begin operating at SFO until 2003
12	Hotel	2019	No	Would not be age eligible by the full build-out of Reach 16
—	Emergency response/fire	2019	No	Would not be age eligible by the full build-out of Reach 16

SOURCE: SFO, 2020; ESA, 2021.

NOTES:

General: The highlighted rows indicate the buildings and structures that have not been evaluated and may meet the 45-year age criterion by full build-out of Reach 16.

a. Preservation Team Review Form, Various Properties at San Francisco International Airport, June 7, 2019.

b. SFO Engineering Administration Building – Building 676 Cultural Resources Survey Report, September 2020.

c. West Field Cargo Redevelopment Project Cultural Resources Survey Report, April 2021.

G. Properties Located Adjacent to Plot 16D Construction Staging Area

1. 160 Beacon Street

Year constructed: 1958

Architect/Engineer: Simpson and Stratta (structural engineers)

Criterion 1 (Events)

Research does not indicate that 160 Beacon Street is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The building was constructed in 1958 for Thompson Aircraft Tire Co. to house offices and tire retreading equipment. Industrial and military tires, including those on airplanes, undergo extreme heat and frictional stress and are expensive to replace, and tire retreading provides a cost-effective means to extend the usable life of tires. While Thompson Aircraft Tire Co. was a leader in the field of aircraft tire retreading, research does not indicate that there are any important associations between 160 Beacon Street and innovations that advanced the industry. Research also does not indicate that the tire retreading industry was historically important in local, regional, or statewide development trends. For this reason, 160 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Walter Henry Schlichtmann (1899–1959) was the founder and long-term president of Thompson Aircraft Tire Co. Under his direction, the company developed the retreading technology and methodologies that resulting in the success of the company following World War II. However, research does not indicate that Schlichtmann was a historically significant figure. While he was noted as a contributor to the war effort through advancements in tire retreading technology, the company did not occupy 160 Beacon Street until 1958 and is not associated with wartime efforts by the company or Schlichtmann. Additionally, Schlichtmann died within months of the company moving to 160 Beacon Street. Therefore, research does not support an association between 160 Beacon Street and the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) For this reason, the building does not appear to be individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

160 Beacon Street does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. The building is utilitarian in nature, consisting of a large volume of interior space that can be utilized for a variety of purposes. While newspaper accounts from 1958 at the time of construction note that the interior had a special layout for efficiency, it is currently devoid of any specialized interior features that can be attributed to aircraft tire retreading or associated laboratory research in support of that use, and therefore does not possess high artistic values. Research does not indicate that Simson and Stratta structural engineers are masters in their field. For these reasons, 160 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. 160 Beacon Street was constructed on engineered fill deposited in the mid-1950s on land that was reclaimed from San Francisco Bay. Therefore, any information potential at the site is highly unlikely. It does not appear to be eligible for listing under California Register Criterion 4.

2. 168 Beacon Street

Year constructed: 1958

Architect/Engineer: Associated Construction and Engineering

Criterion 1 (Events)

Research does not indicate that 168 Beacon Street is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The building was constructed in 1958 for the Raybestos-Manhattan Co. as a regional sales headquarters. At the time, the Raybestos-Manhattan Co. was well established throughout the United States. While the company was a leader in the field of industrial brakes and parts, research does not indicate that there are any important associations between 168 Beacon Street and innovations that advanced the industry. The building served a utilitarian support function as a regional administrative office. No other subsequent tenants are associated with historically important events or local, regional, or statewide development trends. For this reason, 168 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research did not identify associations between 168 Beacon Street and persons or entities of historical importance. While the building was constructed by a well-known national company, the building did not play a significant role in the development of the Raybestos-Manhattan, Co. Therefore, research does not support an association between 168 Beacon Street and the lives of persons or entities important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) For this reason, 168 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

The Raybestos-Manhattan Co. constructed the building located at 168 Beacon Street in 1958 and a distribution center located at 130 Beacon Street between 1958 and 1968. The two buildings share similar minimalist architectural features such as pent roofs covered with standing seam metal. However, the building is utilitarian in nature, consisting of a large volume of interior space that can be utilized for a variety of purposes. 168 Beacon Street does not appear to embody the distinctive characteristics of a type, period, region, or method of construction, and therefore does not possess high artistic values. Research does not indicate that Associated

Construction and Engineering is a master in its field.[211] For these reasons, 168 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. 168 Beacon Street was constructed on engineered fill deposited in the mid-1950s on land that was reclaimed from San Francisco Bay. Therefore, any information potential at the site is highly unlikely. It does not appear to be eligible for listing under California Register Criterion 4.

3. 182 Beacon Street

Year constructed: 1960

Architect/Engineer: Unknown

Criterion 1 (Events)

Research does not indicate that 182 Beacon Street is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The building was constructed in 1960 for the P.L. Badt Co. as an office and warehouse to store automobile service station fixtures and equipment. Research does not indicate that there are any important associations between 182 Beacon Street and historically important events or trends in local, regional, or statewide development trends. The building served as a utilitarian light-industrial facility that was adaptable to a wide range of businesses and purposes. For this reason, 160 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research did not identify associations between 182 Beacon Street and persons or entities of historical importance. The building is associated with a number of local, regional, and national companies but did not play a significant role in the development of the P.L. Badt Co., Unitog Uniforms, Tricor America, Odwalla, or Ultra Clean Technology. Therefore, research does not support an association between 182 Beacon Street and the lives of persons or entities important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) For this reason, the building does not appear to be individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

182 Beacon Street does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. The building is utilitarian in nature, consisting of a large volume of interior space that can be utilized for a variety of purposes. For this reason, it does not possess high artistic values. The building is not attributed to a specific architect or engineer and does not appear to represent the work of a master. For these

[211] Associated Construction and Engineering Company was located at 127 Beacon Street, South San Francisco in 1967. "National Directory of Architectural, Engineering and Consulting Firms with Certified Fallout Shelter Analyst," 1967, p.117, https://books.google.com/books?id=22hNAAAAYAAJ&pg=PA117&lpg=A117&dq=associated+construction+and+engineering+south+san+francisco&source=bl&ots=d3FzjNb8kp&sig=ACfU3U1J68zkG7wVBQgwaRNbxk9TMpgqAQ&hl=en&sa=X&ved=2ahUKEwieqo3j1dzzAhXrDzQIHXu8D6QQ6AF6BAgCEAM#v=onepage&q=associated%20construction%20and%20engineering%20south%20san%20francisco&f=false.

reasons, 182 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. 182 Beacon Street was constructed on engineered fill deposited in the mid-1950s on land that was reclaimed from San Francisco Bay. Therefore, any information potential at the site is highly unlikely. It does not appear to be eligible for listing under California Register Criterion 4.

4. 192 Beacon Street

Years constructed: 1959

Architect/Engineer: Unknown, Harvis Construction Co. (Contractors)

Criterion 1 (Events)

Research does not indicate that 192 Beacon Street is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The building has been occupied by several businesses, most notably by the RCA Service Co. for 28 years. While RCA was a pioneer in the communication and electronics industries, the subject building was not associated with any technological innovations that made the company successful. Rather, it was one of at least 150 such service centers in the United States. The building was a utilitarian support center for RCA-branded televisions and electronics. For this reason, 192 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 1

Criterion 2 (People)

The building located at 192 Beacon Street is associated with two well-known commercial brands: RCA and Odwalla. Originally constructed in 1959 as one of 150 service centers specializing in the repair of RCA electronics, this association lasted until ca. 1987. While the association with RCA lasted 28 years, the building was one of many similar franchises. Research did not identify any historically significant events, innovations, or other developments with regards to the building's association with RCA. The building was occupied by Odwalla from 1987 to 1992, which were formative years in the company's growth from a local juice supplier to a regional distributor. As a warehouse and distribution center, the building served a supporting role in the growth of the company and does not appear to have played an important role in the expansion of the company from a local to a regional business. Since the building was used for routine activities associated with the ordinary development of RCA and later Odwalla, the associations between 192 Beacon Street and these companies are not historically significant. Additionally, research did not identify any associations with the lives of persons important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) Therefore, 192 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

192 Beacon Street does not appear to embody the distinctive characteristics of a type, period, region, or method of construction. The building is utilitarian in nature, consisting of a large volume of interior space that can be

utilized for a variety of purposes. The design is not associated with a known architect or engineer, and it is largely devoid of architectural detailing. For these reasons, 192 Beacon Street does not appear to be individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. 192 Beacon Street was constructed on engineered fill deposited in the mid-1950s on land that was reclaimed from San Francisco Bay. Therefore, any information potential at the site is highly unlikely. It does not appear to be eligible for listing under California Register Criterion 4.

5. 508 South Airport Boulevard

Year constructed: 1961

Architect/Engineer: Unknown

Criterion 1 (Events)

Research does not indicate that 508 South Airport Boulevard is associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. It was constructed in 1961 for the S.K. Wellman Co. to house offices and serve as a regional distribution center. By 1961, S.K. Wellman was an established company with multiple offices, manufacturing facilities, and distribution centers. Research does not indicate that there are any important associations between 508 South Airport Boulevard and innovations that advanced the industry. Moreover, the company was associated with the building for only two years before being acquired by the American Brake Shoe Co. Subsequent tenants are likewise not associated with historically important events or local, regional, or statewide development trends. For this reason, 508 South Airport Boulevard does not appear to be individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research did not identify associations between 508 South Airport Boulevard and persons or entities of historical importance. While the building was constructed by a national company, the building did not play a significant role in the development of the S.K. Wellman Co. and was associated with the company for only two years. Therefore, research does not support an association between 508 South Airport Boulevard and the lives of persons or entities important to local, California, or national history. (Architects and/or engineers are discussed under Criterion 3.) For this reason, the building does not appear to be individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

Metal panel cladding was recently installed over the stucco façade of 508 South Airport Boulevard, creating the appearance of a two-story building. The building is utilitarian in nature and modern in appearance, does not embody the distinctive characteristics of a type, period, region, or method of construction, and does not possess high artistic values. Research does not indicate that the design is associated with a master architect or engineer.

For these reasons, 508 South Airport Boulevard does not appear to be individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. 508 South Airport Boulevard was constructed on engineered fill deposited in the mid-1950s on land that was reclaimed from San Francisco Bay. Therefore, any information potential at the site is highly unlikely. It does not appear to be eligible for listing under California Register Criterion 4.

H. Historic District Considerations

The following section includes an analysis of potential historic districts through identification of cohesive or significant patterns for the building and structures identified in Table 1.

1. U.S. Coast Guard Air Station San Francisco Historic District

There is one known historic district located within the Airport on property owned by the federal government. In 1998, Carey & Co. prepared a cultural resources survey that identified the U.S. Coast Guard Air Station as a historic district that is significantly associated with the U.S. Coast Guard and with World War II search and rescue operations. It is also significant as one of the first U.S. Coast Guard air stations constructed on the Pacific Coast (see Chapter III, Current Historic Status). The air station is listed in the San Mateo County BERD with a status code of 2S2, signifying that it was evaluated as an individual property, determined eligible for listing in the National Register by consensus through the Section 106 process, and is listed in the California Register.[212] Each of the contributing buildings and structures is listed in the San Francisco County BERD, and each is noted as a contributor to a multi-component resource determined eligible for listing in the National Register by consensus through the Section 106 process and is listed in the California Register.[213]

As part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station according to current professional standards for continued eligibility for listing in the California Register (Appendix A).[214] Based on a site survey, archival research, and analysis, none of the extant historic-age buildings and structures that comprise the U.S. Coast Guard Air Station appear to be individually eligible for listing in the California Register under any criteria. However, the air station appears eligible as a historic district under Criteria 1 and 3 and would be considered a historical resource for the purposes of CEQA. Under Criterion 1, it is significant at the regional level for its association with the early history of the U.S. Coast Guard's presence on the Pacific Coast, as it was the third air station commissioned (1940) after those in Port Angeles (1935) and San Diego (1937). It is also significant as the first U.S. Coast Guard air station on the Pacific Coast constructed during wartime and in operation when the United States entered World War II in December 1941, since which time the U.S. Coast Guard Air Station has continuously manned search and rescue missions. Under Criterion 3, the U.S. Coast Guard Air Station is significant as a collection of buildings that embody the distinctive characteristics of the Streamline Moderne Style constructed during World War II and continue to reflect the original design. The three contributing buildings are Buildings A/1019A (main hangar; primary significance), B/1019B (administration; primary significance), and G (utility/storage; secondary significance). The period of significance is 1939–1945, which

[212] California Office of Historic Preservation. Built Environment Resource Directory (BERD) for San Mateo County, March 2020.
[213] Ibid.
[214] California Public Resources Code Section 5024.1(g)(4).

reflects the construction (ca. 1939–41) and commission (1940) of the air station and includes the construction of the three contributing buildings.

None of the buildings and structures evaluated in this HRE appear to be historically, architecturally, or functionally related to the U.S. Coast Guard Air Station. As such, none of the subject buildings or structures contribute to the eligible U.S. Coast Guard Air Station San Francisco Historic District.

2. Mel Leong Treatment Plant

Buildings 918 and 922, constructed ca. 1969–70, are some of the oldest components of SFO's sanitary wastewater treatment facility, which, along with the industrial wastewater treatment facility, is known today as the Mel Leong Treatment Plant. The extant sanitary wastewater treatment facility (composed of Buildings 918 and 922, a headworks, and two digester tanks) was the second constructed at SFO: the first plant was constructed in 1955 and demolished in 1994. The adjacent industrial wastewater treatment facility was constructed in the late 1970s and early 1980s, and the sanitary treatment facility was expanded in the early 2000s, replacing a portion of the original Building 922. The Mel Leong Treatment Plant expanded to the west side of Clearwater Drive in the 2000s. Over time, the plant has been enlarged and modernized to remain functional and maintain its efficiency. The 2016 *Draft Final Airport Development Plan* notes that the industrial wastewater treatment facility has reached the end of its design life, and a variety of upgrades are planned or already completed.[215]

The Mel Leong Treatment Plant functions to serve SFO. It does not serve neighboring communities, nor is it a component of a regional wastewater treatment system. Because of these limits, the plant is not associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States (Criterion 1). As discussed above, the plant's eponym, Mel Leong, was involved in many important and large-scale projects during his lengthy career as SFO's first Environmental Control Officer. The plant is an altered example of Leong's many professional contributions to the development of SFO, and it does not appear to be significantly associated with his productive life (Criterion 2). The plant is composed of buildings and structures erected from ca. 1969–70 to 2010 and designed to be utilitarian in nature as opposed to embodying the distinctive characteristics of a type, period, region, or method of construction (Criterion 3). The plant would not yield important information regarding the prehistory or history of SFO (Criterion 4), and an ASA is outside the scope of this evaluation. For these reasons, the Mel Leong Treatment Plant does not appear to be eligible for listing as a historic district in the California Register under any criteria.

3. Potential Historic District that Includes the Age-Eligible Buildings and Structures in the SPP Boundary

Based on the architectural descriptions provided above and documentation of the physical development of SFO, the subject buildings and structures do not together form a discontiguous historic district. None appear to be significantly related in terms of architectural design, function, or historical development. As such, none of the subject buildings or structures contribute to a potential historic district.

[215] San Francisco International Airport, *Draft Final Airport Development Plan*, September 2016, p. 3-116, https://www.flysfo.com/sites/default/files/default/about/Chapter_3_Inventory_Draft_Final.pdf, accessed September 29, 2020.

4. Potential Historic District that Includes the Airport Boulevard Industrial Tract

Based on the architectural descriptions provided above and documentation of the physical development of Airport Boulevard Industrial Tract, the subject buildings and structures do not together form a historic district. Each was designed for utility out of standard building materials. No cohesive design or use unites the grouping of buildings. None of the buildings appear to be related in terms of architectural design, function, or historical development. As such, none of the subject buildings or structures contribute to a potential historic district.

I. Existing Shoreline Protection Features

As described in Chapter V, Property and Building Descriptions, and Chapter VII, Historic Context, the existing shoreline protection features are the result of manmade fill activities undertaken between 1927 and 1972. These protection features include a combination of concrete walls, sheet pile walls, concrete debris, armor rocks, sandbags, K-rails, tidal flats, embankment walls/dikes, and earthen and vegetated berms. The existing shoreline protection features for each reach typically include varying combinations of these systems that were installed, repaired, and/or replaced during different periods of the Airport's expansion and operation.

The existing shoreline protection features exclusively serve the Airport and are unrelated to other shoreline infrastructure to the north and south of the Airport, and together do not form a continuous shoreline constructed during a specific period of the Airport's history. For these reasons, SFO's existing shoreline protection features are not associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States (Criterion 1). Archival research does not indicate that the existing shoreline protection features are associated with the lives of persons important to local, California, or national history (Criterion B). The existing shoreline protection features also do not represent a comprehensively designed system of shoreline protection. Rather, the various components were designed, constructed, repaired, and/or replaced in an unsystematic manner over the course of several decades. As such, the shoreline protection features do not embody the distinctive characteristics of a type, period, region, or method of construction or represent the work of a master or possess high artistic values (Criterion C). For these reasons, the existing shoreline protection features do not appear to be eligible for listing either individually or as a historic district in the California Register under any criteria. An ASA is outside of the scope of this evaluation.

CHAPTER IX
Integrity

In addition to being eligible for listing under at least one of the four California Register significance criteria (1 through 4), a property must also retain sufficient integrity to convey its historical significance in order to be considered a historical resource. The California Register defines integrity as the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. A property is examined for seven aspects that together comprise integrity. These aspects, which are based on the National Register criteria for evaluation, are location, design, setting, materials, workmanship, feeling, and association.

As discussed above, because none of the subject buildings or structures appear to be individually significant under any California Register criteria, either as standalone resources or as property types, or contributors to known or potential historic districts, a discussion of integrity is not necessary.[216]

[216] As part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station San Francisco in 2020, a portion of which is located within the project site (see Figure 6, p. 22), and found that it appears eligible as a historic district under California Register Criteria 1 and 3 and therefore would be considered a historical resource for the purposes of CEQA. The complete evaluation is included as Appendix A and is only summarized in this HRE.

INTENTIONALLY BLANK

CHAPTER X
Conclusion

Based on a site survey, archival research, and analysis, ESA finds the age-eligible buildings and structures located within 100 feet of the SPP project site, including staging areas, ineligible for individual listing in the California Register. These buildings and structures also do not appear to contribute to any known or potential historic districts. As such, none of the buildings or structures evaluated in this HRE would be considered historical resources for the purposes of CEQA.[217]

[217] As part of the SPP project, ESA re-evaluated the U.S. Coast Guard Air Station San Francisco in 2020, a portion of which is located within the project site (see Figure 6, p. 22), and found that it appears eligible as a historic district under California Register Criteria 1 and 3 and therefore would be considered a historical resource for the purposes of CEQA. The complete evaluation is included as Appendix A and is only summarized in this HRE.

INTENTIONALLY BLANK

CHAPTER XI
Sources

A. Publications

1. Newspapers and Journals

"$4,000,000 Runway Next Development at Airport," *San Francisco Chronicle*, July 8, 1948, p. 9.

Advertisements, *San Francisco Chronicle*, 1946–2004.

"Aircraft Tire Firm Breaks Ground in SSF," *San Mateo Times*, May 22, 1958, p. 32.

Aviation Week, Including Space Technology, Vol. 69, Part 2, 1958, https://www.google.com/books/edition/Aviation_Week_Including_Space_Technology/2oVKAQAAIAAJ?hl=en&gbpv=1&bsq=%22160+beacon+street,+south+san+francisco%22&dq=%22160+beacon+street,+south+san+francisco%22&printsec=frontcover, accessed October 1, 2021.

"Badt to Move," *San Francisco Chronicle*, May 17, 1960, p.43.

"Big Jet-Age Airport Play Okayed Here," *San Francisco Chronicle*, February 4, 1959, pp. 1, 4.

Blum, Joseph, "South San Francisco: The Making of an Industrial City," *California History*, vol. 62, no. 2, 1984, pp. 119-134.

Cargo Airlift, Vol. 65, 1975, https://www.google.com/books/edition/Cargo_Airlift/c6kiAQAAMAAJ?hl=en&gbpv=1&bsq=%22512%20s%20airport%22, accessed October 1, 2021.

Constructor, Vol. 62, 1980, https://www.google.com/books/edition/Constructor/NScqAQAAIAAJ?hl=en&gbpv=1&bsq=%22508%20s%20airport%22, accessed October 1, 2021.

Frederickson, Abby Jane, "From a Mud Hole by the Bay to San Francisco's Airport, Part 1," *The Boutique & Villager* (Hillsborough Weekly Newspaper), April 16, 1974, p. B1. Quoted in David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991.

"Giant Tires Get New Lease on Life in World's Largest Retreading Mold," *San Francisco Chronicle*, October 12, 1952, p. 28.

Golding, George, "OK Millions for Airport Improvement," *The Times* (San Mateo), October 16, 1968, p. 26.

Job listings, *San Francisco Chronicle*, 1964–2007.

"Louis John Poletti" (obituary), *San Francisco Chronicle*, August 12, 2013, p. C3.

"Melvin M. Leong" (obituary), *San Francisco Chronicle*, June 19, 2005.

"New SSF Plant Begun," *San Mateo Times*, April 10, 1961, p.10.

"Newsmakers," *Berkeley Gazette*, April 8, 1982, p. 20.

"Odwalla's History: Problems Amid Success in Half Moon Bay," *San Jose Mercury News*, June 12, 2013, https://www.mercurynews.com/2013/06/12/odwallas-history-problems-amid-success-in-half-moon-bay/, accessed October 20, 2021.

"Palms for S.S.F. Industry," *San Mateo Times*, April 9, 1958, p. 17.

"Raybestos to Build in South City," *San Mateo Times*, August 26, 1958, p. 19.

"Raybestos Plans New Plant," *San Mateo Times*, September 26, 1968, p.29.

"RCA Breaks Ground in SSF," *San Mateo Times*, August 4, 1959, p.23.

"Realty Notes," *San Francisco Examiner*, June 17, 1973, Real Estate Section, p. D.

"Robert S. Kitchen" (obituary), *San Francisco Chronicle*, June 15, 2007.

"San Francisco's Airport of the Future," *San Francisco Chronicle*, March 26, 1943, p. 26.

"San Francisco Meets Challenge," *San Francisco News*, October 15, 1956, p. 14.

"Seiberling Dealership," *San Francisco Chronicle*, October 12, 1947, p. 33.

Tempo, Vol. 15, 1985, https://www.google.com/books/edition/Tempo/fMYTAQAAMAAJ?hl=en&gbpv=1&bsq=%22512%20south%20airport%22, accessed October 1, 2021.

"Thompson Tire Breaks Ground," *San Mateo Times*, May 7, 1958, p. 19.

"Thompson Tire European Plant," *San Francisco Chronicle*, November 4, 1967, p.40.

TWA, "Jets Bring About Need for Improved Ground Facilities and New Plan of Financing," *Skyliner (Trans World Airlines Weekly Employee Publication)*, Vol. 20, No. 10, March 7, 1957, p. 3.

"United Expands at Mills Field," *San Mateo Times*, February 6, 1957, p. 17.

2. Books

Davies, R.E.G., *Airlines of the Jet Age: A History*, Washington, D.C.: Smithsonian Institution Scholarly Press, 2016.

Dinkelspiel Cerny, Susan, *An Architectural Guidebook to San Francisco and the Bay Area*, Salt Lake City, UT: Gibbs Smith, Publisher, 2007.

Hill, John H., et al., *SFO: A Pictorial History of the Airport*, San Francisco: San Francisco Airport Commission, 2000.

3. Reports

Alessandro Baccari & Associates, *San Francisco International Airport: A Socioeconomic View*, 1975. Quoted in David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991.

Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

City and County of San Francisco, *Journal of Proceedings Board of Supervisors*, Vol. 37, No. 4, January 26, 1942, San Francisco, SF: A.F. Heuer, 1942.

City and County of San Francisco Airport Commission, *San Francisco International Airport Terminal Area Master Plan*, 1985, in the collection of the SFO Museum, Accession No. 2002.133.010.

Consoer, Townsend & Associates, *Pilot Plant Study for the Treatment of Industrial Waste Vol. 1*, prepared for the San Francisco Airports Commission, April 1977.

David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991.

ESA, *Final Historical Resources Report Final Historical Resources Report: Information Regarding the Eligibility of Properties at San Francisco International Airport for Inclusion on the National Register of Historic Places or the California Register of Historic Resources*, December 2000, Addendum (by ESA/Carey & Co.), 2001.

———, *Final Historic Resources Evaluation Part 1 for the Recommended Airport Development Plan, San Francisco International Airport*, prepared for the San Francisco Planning Department, June 2018.

Healy, Clyde E., *San Francisco Improved: Report of Clyde E. Healy, Assistant City Engineer, City of San Francisco and Coordinator of W.P.A. Projects, Period October 10, 1935, to August 31, 1939*, San Francisco, CA: s.n., 1939.

National Park Service, *Preservation Bulletin 16B: How to Complete the National Register Multiple Property Documentation Form*, 1999.

San Francisco Planning Department, "Availability of Notice of Preparation of Environmental Impact Report and Notice of Public Scoping Meeting," November 25, 2020.

———, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, January 2011.

URS, *Historic Architecture Survey Report for the Runway Safety Area Program at San Francisco International Airport*, June 2011.

B. Unpublished

California Office of Historic Preservation, *Built Environment Resource Directory for San Francisco County*, March 2020.

———, *Built Environment Resource Directory for San Mateo County*, March 2020.

Castro, Art (SFO), Email to David Kim (SFO), September 2, 2020.

Fielding, Sam (Senior Planner at the City of Millbrae), telephone discussion with Johanna Kahn (ESA), March 29, 2018.

Kim, David (SFO), Email to Eryn Brennan (ESA), August 19, 2020.

San Francisco Department of Building Inspection, Records Management Division, telephone discussion with Johanna Kahn (ESA), May 22, 2018.

San Francisco International Airport, Various SFO design and construction drawings and related documents, accessed October 2020.

San Francisco Public Library History Room, "SF Airports, San Francisco International—History" (clipping file).

SFO Museum, Miscellaneous reports, documents, and photographs, accessed 2020.

Sullivan, Tara (San Francisco Planning Department), Memorandum to Irene Nishimura (San Francisco Planning Department), April 20, 2011, on file at the San Francisco Planning Department as part of Case File No. 2010.0755E.

Yee, Colton (SFO), Email to David Kim (SFO), August 19, 2020.

C. Internet

American Marketing Association, *International Member and Marketing Services Guide*, 2000, https://www.google.com/books/edition/The_American_Marketing_Association_Inter/JHkrAQAAMAAJ?hl=en&gbpv=1&bsq=192%20beacon%20street, accessed October 1, 2021.

Amoroso Construction, "SFO Waste Water Treatment Plant," https://www.sjamoroso.com/project-sfo-waste-water-treatment-plant-13.htm, accessed September 29, 2020.

Apex Testing Laboratories, "Mel Leong Treatment Plant Rehabilitation," https://apextestinglabs.com/portfolio/us-gas-company-7/, accessed September 29, 2020.

BASS Electric, "Endorsements," http://www.basselectric.net/endorsements/, accessed July 30, 2020 [https://web.archive.org/web/20200730101412/http://www.basselectric.net/endorsements/].

Bay Area Census, "City of South San Francisco, San Mateo County," www.bayareacensus.ca.gov/cities/SouthSanFrancisco.htm, accessed October 15, 2021.

California Department of Transportation, *Post Earthquake Investigation Team Manual*, 2006, https://www.google.com/books/edition/Post_Earthquake_Investigation_Team_PEQIT/UozLPDHoAc0C?hl=en&gbpv=1&bsq=%22192%20beacon%20street%22, accessed October 1, 2021.

California State Military Museum, "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," http://www.militarymuseum.org, accessed March 19, 2018.

CH2M HILL Companies, Ltd., "Form 10-K for the Fiscal Year Ended December 30, 2016," https://www.sec.gov/Archives/edgar/data/777491/000155837017001430/chm-20161230x10k.htm, accessed November 3, 2020.

City and County of San Francisco Airports Commission, *San Francisco International Airport Expansion Program: Modernization and Replacement Phase*, April 1977, https://archive.org/details/sanfranciscointe3197sanf/page/n17/mode/2up, accessed September 29, 2020.

City of Berkeley Landmarks Preservation Commission, Staff Report Re: 3031 Telegraph Avenue, November 5, 2020, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_LPC/2020-11-05_Item%209_LPC_SR_DR_3031%20Telegraph_with%20attachments.pdf, accessed November 10, 2020.

City of South San Francisco, *South San Francisco General Plan*, 1999, https://www.ssf.net/home/showpublisheddocument/478/636318496957770000, accessed October 15, 2021.

———, *South San Francisco Neighborhood Story Map*, https://www.arcgis.com/apps/MapJournal/index.html?appid=14ff07b61b384e3087bcb4eeb33bbc4f, accessed October 15, 2021.

———, *Permits*, https://permits.ssf.net, accessed October 1, 2021.

———, *South San Francisco Historic Preservation*, http://www.ssf.net/departments/economic-community-development/planning-division/historic-preservation, accessed March 19, 2018.

CTPost, "Raymark Timeline," https://www.ctpost.com/local/article/Raymark-timeline-2242269.php, accessed October 21, 2021.

Dyett & Bhatia, *Environmental Resources and Conservation Element of the San Bruno General Plan*, March 2009, https://www.sanbruno.ca.gov/civicax/filebank/blobdload.aspx?BlobID=24019, accessed March 19, 2018.

Funding Universe.com, "Brush Engineered Materials, Inc. History," http://www.fundinguniverse.com/company-histories/brush-engineered-materials-inc-history/, accessed October 21, 2021.

Grocery.com, "Odwalla, Inc.," https://www.grocery.com/odwalla-inc/, accessed October 20, 2021.

Kennedy Jenks, "Office Locations," https://www.kennedyjenks.com/about-kj/office-locations/, accessed November 10, 2020.

———, "Wastewater Treatment," https://www.kennedyjenks.com/markets/water/wastewater-engineering/, accessed November 10, 2020.

Kious, Jacquelyne, "Bayshore Highway," City of South San Francisco, https://www.ssf.net/home/showpublisheddocument/5442/636466152001730000, accessed October 15, 2021.

Landrum & Brown, *San Francisco International Airport Expansion Program: Environmental Impact Assessment Report*, Vol. 1, 1975, https://archive.org/details/sanfranciscointe1975land/page/n137/mode/2up, accessed September 29, 2020.

Lufthansa, "Lufthansa to Introduce First-Ever A380 Service to San Francisco" (press release), January 26, 2011, https://www.lufthansa.com/mediapool/pdf/69/media_931369.pdf, accessed March 6, 2018.

Markets Insider, "Plant Closure: Major Supplier to the Semiconductor Industry – Ultra Clean Technology," November 25, 2019, https://markets.businessinsider.com/news/stocks/plant-closure-major-supplier-to-the-semiconductor-industry-ultra-clean-technology-1028714239, accessed October 22, 2021.

Michael Tauber Architecture, "SF Int. Airport Waste Water Treatment Plant," http://www.michaeltauberarchitecture.com/944612688034, accessed September 29, 2020.

"National Directory of Architectural, Engineering and Consulting Firms with Certified Fallout Shelter Analyst," 1967, p. 117, https://books.google.com/books?id=22hNAAAAYAAJ&pg=PA117&lpg=A117&dq=associated+construction+and+engineering+south+san+francisco&source=bl&ots=d3FzjNb8kp&sig=ACfU3U1J68zkG7wVBQgwaRNbxk9TMpgqAQ&hl=en&sa=X&ved=2ahUKEwieqo3j1dzzAhXrDzQIHXu8D6QQ6AF6BAgCEAM#v=onepage&q=associated%20construction%20and%20engineering%20south%20san%20francisco&f=false.

Official Export Guide, 1993, https://www.google.com/books/edition/California_Services_Register/PEYcAQAAMAAJ?hl=en&gbpv=1&bsq=%22182%20beacon%22, accessed October 1, 2021.

Pacific Coast Architecture Database, "Kitchen and Hunt, Architects (Partnership)," http://pcad.lib.washington.edu/firm/4122/, accessed November 3, 2020.

PBS&J, *Burlingame Downtown Specific Plan Initial Study/Mitigated Negative Declaration*, May 2010, pp. 218–222, https://www.burlingame.org/document_center/Planning/General%20and%20Specific%20Plans/Draft%20Initial%20Study%20Mitigated%20Negative%20Declaration.pdf, accessed March 19, 2018.

PMA Consultants, "Mel Leong Industrial Waste Treatment Plant, San Francisco," https://pmaconsultants.com/projects/mel-leong-industrial-waste-treatment-plant/, accessed September 29, 2020.

Quality Erectors and Construction, Inc., "Mel Leong Treatment Plant," https://www.qec-inc.com/project/3/mel-leong-treatment-plant, accessed September 29, 2020.

RCA.com, "Our Legacy," https://www.rca.com/us_en/our-legacy-266-us-en, accessed on October 20, 2021.

San Francisco Airport Commission, Meeting minutes, June 3, 1997, https://www.flysfo.com/sites/default/files/default/download/about/commission/agenda/pdf/minutes/M060397.pdf, accessed September 29, 2020.

———, Meeting minutes, September 20, 2005, https://www.flysfo.com/sites/default/files/default/download/about/commission/agenda/pdf/minutes/M092005.pdf, accessed September 29, 2020.

———, *San Francisco International Airport Expansion Program*, 1973, https://cors.archive.org/details/sanfranciscointe1973sanf, accessed August 21, 2017.

———, "Special Advisory Committee to Consider and Recommend Action on the Nomination of Edwin M. Lee for Naming or Dedication at the San Francisco International Airport" (meeting minutes), October 16, 2018, https://www.flysfo.com/sites/default/files/media/sfo/about-sfo/commission/101618_SAC_Minutes.pdf, accessed September 29, 2020.

San Francisco International Airport, "Airport's Wastewater Treatment Plant Expansion Approved" (press release), July 23, 2002, https://media.flysfo.com/SF-02-44.pdf, accessed September 29, 2020.

———, *Draft Final Airport Development Plan*, September 2016, https://www.flysfo.com/sites/default/files/default/about/Chapter_3_Inventory_Draft_Final.pdf, accessed September 29, 2020.

———, "Pan American Airways Moves Its Pacific-Alaska Division to San Francisco Airport," https://www.flysfo.com/content/pan-american-airways-moves-its-pacific-alaska-division-san-francisco-airport, accessed November 3, 2020.

———, "Weather and Operations at SFO: A Primer for the Media," January 2010, http://media.flysfo.com/media/sfo/media/weather-operations-primer_0.pdf, accessed August 17, 2017.

San Mateo County, Property Maps Portal, https://gis.smcgov.org, accessed September 30, 2021.

Schembri Construction, "SFO – Field Lighting," http://www.schembri.com/sfo-field-lighting#!/page/461834/sfo-field-lighting, accessed September 29, 2020.

SFO Museum, *China Clipper*, San Francisco, CA: San Francisco International Airport, 2013, https://issuu.com/sfomuseum/docs/china_clipper/6, accessed November 3, 2020.

Times Mirror Press, *California Services Register*, Vol. 6, 1991, https://www.google.com/books/edition/California_Services_Register/O0YcAQAAMAAJ?hl=en&gbpv=1&bsq=%22508%20s%20airport%22, accessed October 1, 2021.

———, *California Services Register*, 1995, https://www.google.com/books/edition/California_Services_Register/QewdAQAAMAAJ?hl=en&gbpv=1&bsq=%22192%20beacon%22, accessed October 1, 2021.

"United States Bankruptcy Court for the Eastern District of Pennsylvania: Raymark Industries, Inc.," August 17, 1999, https://www.paeb.uscourts.gov/sites/paeb/files/opinions/raymark.15.pdf, accessed October 21, 2021.

United States Code, http://uscode.house.gov/, accessed September 17, 2017.

U.S. Department of Transportation, Federal Aviation Administration, "Advisory Circular 150/5300-13A, Airport Design," September 28, 2012. https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentNumber/150_5300-13A, accessed January 18, 2018.

———, "Enplanements at All Commercial Service Airports (by Rank)," 2020, https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/?year=all, accessed October 9, 2020.

U.S. Senate, "Automotive Repair Industry: Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, ninety-first congress, second session, part 5 Appendix (pages 1819–3006)," 1971, https://books.google.com/books?id= Ya_ypvNFNoEC&pg=PA2697&lpg=PA2697&dq=abex+wellman&source=bl&ots=Lwre80jPcQ&sig=ACfU3U0oKCsG1dX0ks_6A050veMNVc5tQ&hl=en&sa=X&ved=2ahUKEwj39dOUqdzzAhWBFjQIHZb8DbAQ6AF6BAgWEAM#v=onepage&q=abex%20wellman&f=false, accessed October 21, 2021.

U.S. Small Business Administration, *International Trade, State and Local Resource Directory: California*, 1988, https://www.google.com/books/edition/International_Trade_State_and_Local_Reso/kYlVgbWXxiQC?hl=en&gbpv=1&bsq=%22168%20beacon%20street%22, accessed October 1, 2021.

APPENDIX A

Re-evaluation of U.S. Coast Guard Air Station San Francisco for Eligibility for Listing in the California Register of Historical Resources (ESA, 2021)

ESA

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900 phone
415.896.0332 fax

esassoc.com

Re-evaluation of U.S. Coast Guard Air Station San Francisco for Eligibility for Listing in the California Register of Historical Resources

Introduction

This memorandum provides an evaluation of the potential historic significance of U.S. Coast Guard Air Station San Francisco (U.S. Coast Guard Air Station) per the California Register of Historical Resources (California Register) criteria. The property was evaluated in 1998, at which time it was determined eligible for listing as a historic district in the National Register of Historic Places (National Register) and subsequently listed in the California Register.[1] Per California Public Resources Code Section 5024.1(g)(4), "If the survey is five or more years old at the time of its nomination for inclusion in the California Register, the survey is updated to identify historical resources which have become eligible or ineligible due to changed circumstances or further documentation and those which have been demolished or altered in a manner that substantially diminishes the significance of the resource." The 1998 evaluation is 23 years old, and the historic district is being re-evaluated pursuant to current professional standards for continued eligibility for listing in the California Register.

Johanna Kahn, M.Ar.H., an architectural historian, is the author of this report. Becky Urbano, M.S., a senior architectural historian, and Eryn Brennan, M.Ar.H., M.U.E.P, an architectural historian and urban planner, provided senior review. The author and reviewers of this report meet the Secretary of the Interior's Professional Qualification Standards for architectural history.

Summary of Previous Findings

In 1998, a cultural resources survey identified the U.S. Coast Guard Air Station as a historic district eligible for listing in the National Register.[2] It was identified as eligible under National Register Criterion A for its association with the development of San Francisco International Airport (SFO) and as one of the first three U.S. Coast Guard air stations on the Pacific Coast, as well as for its association with the development of the U.S. Coast

---

1 California Code of Regulations, Title 14, Chapter 11.5, § 4851, Historical Resources Eligible for Listing in the California Register of Historical Resources, *https://govt.westlaw.com/calregs/Document/IFF8DB730D48511DEBC02831C6D6C108E?viewType=FullText &originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)*, accessed November 16, 2020.

2 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

Guard and World War II search and rescue operations. The U.S. Coast Guard Air Station was also identified as eligible under National Register Criterion C as a distinguishable entity whose components may lack individual distinction. The period of significance of the U.S. Coast Guard Air Station San Francisco Historic District was identified as 1941–1947.[3] The State Historic Preservation Officer (SHPO) concurred with these findings and issued a determination of eligibility on October 19, 1998.[4]

An inventory of the buildings and structures that were identified in the 1998 report is shown in **Table 1**. The six contributing buildings and structures included: the main hangar (Building A/1019A, extant), the administration building (Building B/1019B, extant), a warehouse (Building F, demolished), a utility/fuel repair/storage building (Building G, extant), living quarters (Building H, demolished), and the seaplane ramp (extant). The four non-contributing buildings included the former Stonerock Barracks (Building C/1019C, extant), the paint/gardener shop (Building D, extant), the pump house/storage (Building E, extant), and the utility/sewage pump house (Building J, extant). A pyrotechnic storage building (Building I, demolished) was not evaluated.

TABLE 1
1998 U.S. COAST GUARD AIR STATION SAN FRANCISCO INVENTORY

U.S. COAST GUARD Building Identifier	SFO Building Identifier	Building/Structure Name	Year(s) Constructed	Contributor to NR-eligible historic district	Extant
A	1019A	Main hangar	Ca. 1939–1941	Yes	Yes
B	1019B	Administration	Ca. 1939–1941	Yes	Yes
C	1019C	Stonerock Barracks	Ca. 1968–1970	No	Yes
D		Paint/gardener shop	1990	No	Yes
E		Pump house/storage	1960	No	Yes
F		Warehouse/ recreation	Ca. 1941–1944	Yes	No; demolished in 2005
G		Utility/fuel/repair/ storage building	Ca. 1944	Yes	Yes
H		Bachelor officer quarters	Ca. 1942–1947	Yes	No; demolished in 2007
I		Pyrotechnic storage	1990	Not evaluated	No; demolished after 1998
J		Utility/sewage pump house	Ca. 1944–1950	No	Yes
N/A		Seaplane ramp	1941	Yes	Yes

SOURCE: Carey & Co., 1998

Updated Inventory

An updated inventory of buildings and structures located within the U.S. Coast Guard Air Station property is shown in **Table 2**. The inventory is based on a field survey conducted on September 1, 2020, and data provided by the U.S. Coast Guard Civil Engineering Unit (CEU) Oakland in October 2020. Buildings demolished since 1998 are highlighted in gray. All extant buildings and structures are identified in **Figure 1**, p. 5.

3 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

4 California State Parks Office of Historic Preservation. "Determination of Eligibility for Air Station San Francisco, San Mateo County" (DOE 38-98-0018-9999 re: USCG980828A). To Susan L. Boyle, United States Coast Guard, October 19, 1998.

TABLE 2
2020 U.S. COAST GUARD AIR STATION SAN FRANCISCO INVENTORY

U.S. Coast Guard Building Identifier	SFO Building Identifier	Building/ Structure Name	Year(s) Constructed	Contributor to NR-eligible historic district (1998)	Contributor to NR-eligible historic district (2020 re-evaluation)	Individually eligible
A	1019A	Main hangar	1939–1940	Yes	Yes	No; not historically or architecturally significant
B	1019B	Administration	1939–1940	Yes	Yes	No; not historically or architecturally significant
C	1019C	Port Security Unit 312 (formerly Stonerock Barracks)	Ca. 1968–1970	No	No	No; not historically or architecturally significant
D		Paint/gardener shop	1990	No	No	No; not age-eligible
E		Pump house/storage	1960	No	No	No; not historically or architecturally significant
F		Warehouse/ recreation	Ca. 1944–1946	Yes	No; demolished in 2005	N/A
G		Utility/fuel/ repair/storage building	Ca. 1944	Yes	Yes	No; not historically or architecturally significant
H		Bachelor officer quarters	Ca. 1942–1947	Yes	No; demolished in 2007	N/A
I		Pyrotechnic storage	1990	Not evaluated	No; demolished after 1998	N/A
J		Utility/sewage pump house	Ca. 1944–1950	No	No	No; not historically or architecturally significant
N/A		Seaplane ramp	1941	Yes	No; appears to have been reconstructed and lengthened and does not retain integrity	No; not historically or architecturally significant
	S-13	Guard shack at main gate on North Access Rd.	1992	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
	1019F	Port Security Unit boat storage	2005	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
	1019G	Public works building	2005	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Fuel tanks	Ca. 1989–1993	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Temporary hangar	2012	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Fuel dispensing hydrant 1	Ca. 1990	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Fuel dispensing hydrant 2	Ca. 1990	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Helicopter fueling/ washdown ramp 1	Ca. 1990	N/A	No; outside period of significance and not age-eligible	No; not age-eligible

U.S. Coast Guard Building Identifier	SFO Building Identifier	Building/ Structure Name	Year(s) Constructed	Contributor to NR-eligible historic district (1998)	Contributor to NR-eligible historic district (2020 re-evaluation)	Individually eligible
		Helicopter fueling/ washdown ramp 2	Ca. 1990	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		BBQ shelter	2012	N/A	No; outside period of significance and not age-eligible	No; not age-eligible
		Gazebo	2011	N/A	No; outside period of significance and not age-eligible	No; not age-eligible

SOURCES: Carey & Co., 1998; ESA, 2020; U.S. Coast Guard CEU Oakland, 2020; SFO, 2020

Regulatory Setting

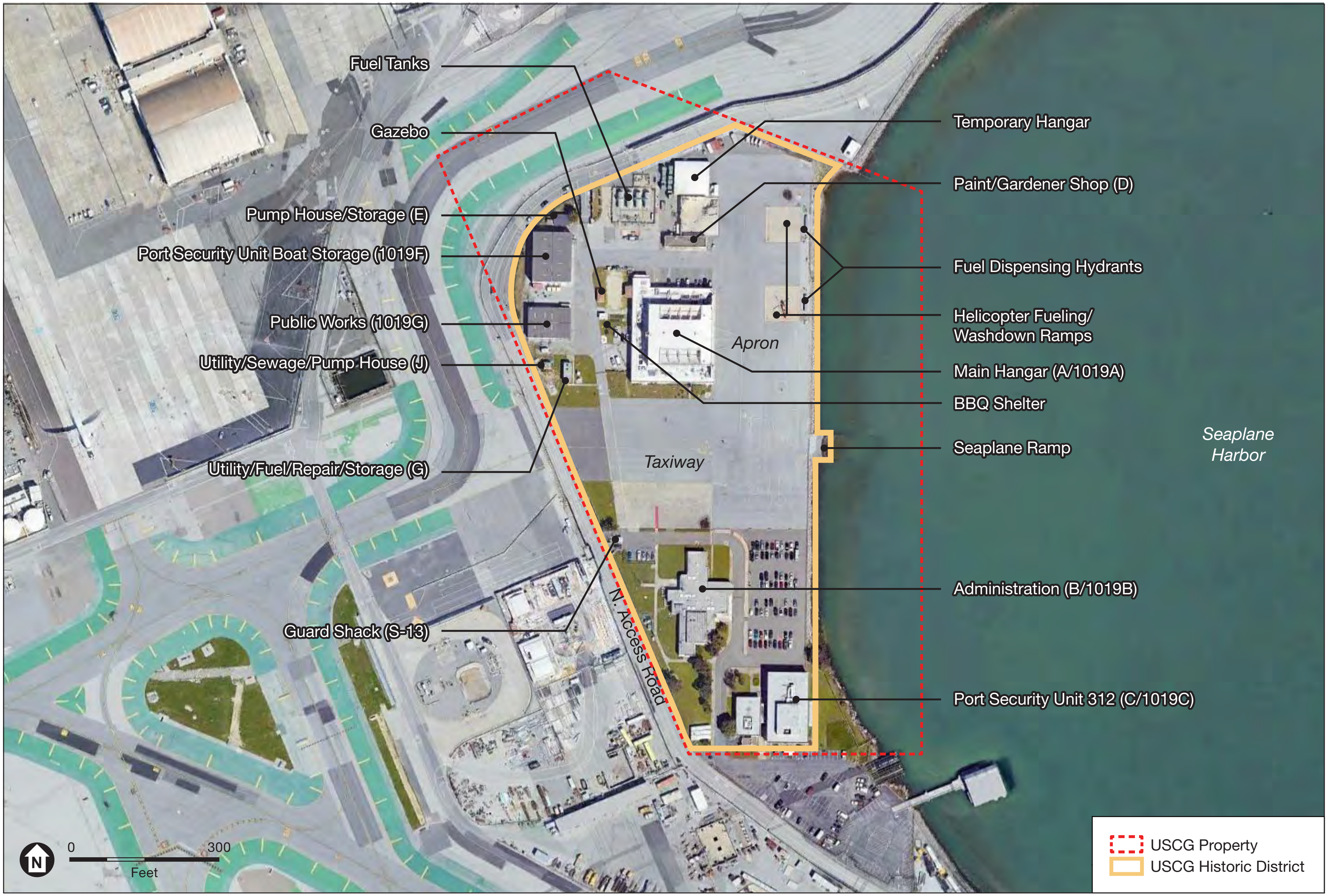
California Register of Historical Resources

The California Register is an authoritative guide to significant architectural, archaeological, and historic resources in the State of California. Resources can be listed in the California Register through a number of methods. California Historical Landmarks and/or National Register-eligible properties (both listed and formal determinations of eligibility) are automatically listed. Properties can also be nominated to the California Register by local governments, private organizations, or citizens. This includes properties identified in historic resource surveys with status codes of 1 through 5[5] and resources designated as local landmarks or listed by a city or county ordinance. A building or structure identified in the California Office of Historic Preservation's (OHP) Built Environment Resource Directory (BERD) with a California Historical Resource Status Code rating of 1 or 2 (on or determined eligible for the National Register) is also considered to be listed on the California Register. Properties of local significance that have been designated under a local preservation ordinance (i.e., local landmarks), or that have been identified in a local historical resources survey, may also be eligible for listing in the California Register.

The evaluative criteria used by the California Register for determining eligibility are closely based on those developed for use by the National Park Service for the National Register. In order to be eligible for listing in the California Register a property must demonstrate significance under one or more of the following criteria:

- **Criterion 1 (Event):** Resources that are associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States.
- **Criterion 2 (People):** Resources that are associated with the lives of persons important to local, California, or national history.

[5] California Historical Resource Status Codes 1 through 5 include: (1) Properties listed in the National Register or the California Register; (2) Properties determined eligible for listing in the National Register or the California Register; (3) Appears eligible for National Register or California Register through survey evaluation; (4) Appears eligible for National Register or California Register though other evaluation; and (5) Properties recognized as historically significant by local government.



SOURCE: Google Earth Pro, 2020; ESA, 2020

Figure 1
Existing Facilities at U.S. Coast Guard Air Station San Francisco

- **Criterion 3 (Design/Construction):** Resources that embody the distinctive characteristics of a type, period, region, or method of construction or represent the work of a master or possess high artistic values.
- **Criterion 4 (Information Potential):** Resources or sites that have yielded, or have the potential to yield information important to the prehistory or history of the local area, California, or the nation.

In addition to being eligible for listing under at least one of the four California Register significance criteria, a property must also retain sufficient integrity to convey its historical significance in order to be considered a historical resource. The California Register defines integrity as the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. A property is examined for seven aspects that together comprise integrity. These aspects, which are based on the National Register criteria for evaluation, are location, design, setting, materials, workmanship, feeling, and association.

Property and Building Descriptions

The following provides a description of U.S. Coast Guard Air Station's setting and exterior architectural descriptions of the buildings and structures identified in Table 2, p. 3.[6] Construction chronologies and known alterations to the extant buildings and structures are also discussed below.

Setting

The U.S. Coast Guard Air Station was constructed on 20.53 acres of the former San Francisco Municipal Airport that was donated by the City and County of San Francisco (the City) to the federal government in 1939 for the purpose of establishing a U.S. Coast Guard Air Station. The previously identified historic district is located entirely within the boundary of the federally owned U.S. Coast Guard Air Station within the larger SFO property, as shown in Figure 1, p. 5. The public entrance to the air station is from North Access Road, a short distance northwest of Building B/1019B, and a secondary/private access point from North Access Road is located between Building E and the fuel tanks. The U.S. Coast Guard Air Station's taxiway is connected to the Airport's system of runways; this same configuration existed during World War II when the air station was newly constructed. The U.S. Coast Guard Air Station appears to have been constructed as a clearly identifiable collection of buildings and structures independent from and unrelated to the Airport and within a clearly defined boundary that corresponds to the current property boundary.

The shoreline along the U.S. Coast Guard Air Station fronts Seaplane Harbor. According to a 2018 report documenting the conditions of the shoreline around SFO, "The fronting slope of the shoreline is steep and layered with large armor rocks and concrete debris. […] The crest of the slope is formed by a small concrete curb on the edge of the U.S. Coast Guard property […]. A decommissioned [seaplane] ramp is present part way through creating a 50-foot-wide gap in the concrete curb."[7]

---

6 None of the buildings and structures at U.S. Coast Guard Air Station San Francisco include publicly accessible interior spaces (i.e., interiors that are intended to be used by the general public). For this reason, no interior spaces are described or documented herein.

7 Telamon Engineering Consultants, Inc. and AECOM, San Francisco International Airport Shoreline Protection Program Conceptual Design Development Report Vol. 1, March 30, 2018, 26–27.

Architectural Descriptions

1. Building A/1019A, Main Hangar

Building A/1019A is a large aircraft hangar that measures approximately 32,300 square feet. It is one story in height and contains a high-ceiling main volume surrounded on the north, west, and south sides by a low-ceiling volume that contains shops and offices (**Figure 2** and **Figure 3**). The reinforced concrete walls, which are clad in smooth stucco, are supported by concrete piles, and the building is capped by a steel-truss roof. The primary (east) façade features sliding metal doors that provide access for the aircraft from the adjacent apron. Each of the six metal panel doors includes 20 fixed lites. The façade terminates in a curved parapet with a sign reading "United States Coast Guard."

SOURCE: SFO, 2020

Figure 2
Building A/1019A, View Facing Southwest

SOURCE: SFO, 2020.

Figure 3
Building A/1019A, View Facing Northeast

The north, west, and south façades all feature multi-lite, aluminum-sash windows with multi-lite clerestory windows above. Painted signage on the north façade reads "Fly Coast Guard," and signage on the south façade reads "Guardians of the Golden Gate." Dimensional signage on the west façade reads "Coast Guard."

Construction Chronology and Alterations

Construction of Building A/1019A began in 1939, when it was announced that "a contract was let by the Treasury Department in the amount of $513,000 for the construction of facilities at the site. […] Modernistic lines will be followed in the architectural designs" prepared by the U.S. Coast Guard Civil Engineering Office in San Francisco.[8,9] It was one of the first buildings constructed on the U.S. Coast Guard Air Station property, along with an administration/barracks building (Building B/1019B) and the seaplane ramp.[10] A review of historic photographs confirms that the original fenestration pattern on the first floor of the east and west façades was altered at an unknown date, the shape of the parapet on the east façade was changed at an unknown date after 1963, and the original large "Coast Guard" label painted on the roof was removed by 1956 (**Figure 4** and **Figure 5**). According to the 1998 evaluation, "[alterations include] significant spatial and structural upgrades in both 1983–84 and 1985–86 when new offices were added, and the replacement of original steel windows with aluminum sash."[11]

SOURCE: SFO Museum, Twitter post, November 15, 2018, 3:08 p.m., http://twitter.com/SFOMuseum

Figure 4
Building A/1019A, View Facing Northwest, ca. 1940

---

8 San Francisco Public Utilities Commission, Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939, 187.

9 "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April–July 1945), 34.

10 San Francisco Public Utilities Commission, Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939, 187.

11 Carey & Co., California Department of Parks and Recreation (DPR) Primary Record for Building A (P-38-004091). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

SOURCE: SFO, 2020

Figure 5
Building A/1019A, View Facing Northwest

Known alterations to Building A/1019A completed before 1998 are summarized in **Table 3**. Alterations completed since 1998, including those that are currently in progress or currently approved, are summarized in **Table 4**.[12]

TABLE 3
KNOWN ALTERATIONS TO BUILDING A/1019A COMPLETED BEFORE 1998

Date (if known)	Description of Work
Ca. 1945–56	Original "Coast Guard" label painted on the roof removed
Ca. 1963–98	Shape of the parapet on the east façade was changed
1983–84	"Significant spatial and structural upgrades […] when new offices were added"
1985–86	"Significant spatial and structural upgrades [including] the replacement of original steel windows with aluminum sash"
Unknown	Original fenestration pattern on the first floor of the east and west façades was altered

SOURCES: Carey & Co., 1998; ESA, 2020

[12] This does not include electrical, HVAC, or other utility repairs/upgrades.

TABLE 4
ALTERATIONS TO BUILDING A/1019A SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
1998	Fire alarm replacement	197564	Completed
1999	Exterior paint/repair	11-O2493	Completed
2001	Hangar door hardware rehabilitation/replacement	11-O8129	Completed
2001	Repair open windows	11-O01152	Completed
2003	Hangar interior space rehabilitation	197419	Completed
2003	Roof repair	197350	Completed
2004	Seismic retrofit of main hangar	11-O04110	Completed
2005	Repairs to hangar doors	11-O05048	Completed
2006	Repair hangar doors	11-O02103	Completed
2008	Replace metal security doors	630082	Completed
2008	Replace hangar staircase	556214	Completed
2009	Unspecified construction modifications	3633612, 3649827	Completed
2011	Seismic retrofit/roofing repairs	660600	Completed
2011	Resurface hangar roof	598065 (associated with 660600)	Completed
2011	Seismic retrofit. Note	4028914	Completed
2016	Reconfigure locker/shower room	6197022	Completed
2021	Repair hangar roof	9967576	Approved, not yet started
2021	Hangar lighting retrofit	10072748	Approved, not yet started

SOURCE: U.S. Coast Guard CEU Oakland, 2020

2. Building B/1019B, Administration Building

Building B/1019B is a one-story, 12,890-square-foot building with an irregular footprint (**Figure 6** and **Figure 7**). It is of concrete construction, clad in smooth stucco, and capped by a series of flat roofs with metal coping at the roofline. Typical fenestration includes fixed and awning aluminum-sash windows, sometimes configured as ribbon windows; fixed porthole windows on the east wing; and pairs of glazed, metal-frame doors at the primary (northwest) and secondary (east) entrances. The east entrance originally functioned as the primary entrance and is marked by a long, curved awning supported by metal columns.

SOURCE: SFO, 2020

NOTE: The primary entrance is located near the center of the photograph.

Figure 6
Building B/1019B, View Facing Southeast

SOURCE: SFO, 2020

NOTE: This was the original primary entrance and is now a secondary entrance.

Figure 7
Building B/1019B, View Facing Southwest

Construction Chronology and Alterations

Construction of Building B/1019B began in 1939, when it was announced that "a contract was let by the Treasury Department in the amount of $513,000 for the construction of facilities at the site. […] Modernistic lines will be followed in the architectural designs" prepared by the U.S. Coast Guard Civil Engineering Office in San Francisco.[13,14] It was one of the first buildings constructed on the U.S. Coast Guard Air Station property, along with the main hangar (Building A/1019A) and the seaplane ramp.[15] According to the 1998 evaluation, "Alterations to the building include the replacement of all windows; the removal of the spiral staircase [that was originally located at

13 San Francisco Public Utilities Commission, Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939, 187.

14 "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April–July 1945), 34.

15 San Francisco Public Utilities Commission, Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939, 187.

the entry on the east façade], observation deck [with a railing accessible by the spiral staircase] and radio tower [that was located on the roof]; and the change of entry from the east to the west side of the building,"[16] A review of historic photographs confirms that an addition was constructed at the southwest corner of the building in 1999, and a pedestrian door was added to the south façade at an unknown date (**Figure 8** and **Figure 9**).

SOURCE: *Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939*, 186.

Figure 8
East façade of Building B/1019B, 1940

SOURCE: SFO, 2020

Figure 9
East façade of Building B/1019B, View Facing Northwest

Known alterations to Building B/1019B completed before 1998 are summarized in **Table 5**. Alterations completed since 1998, including those that are currently in progress or currently approved, are summarized in **Table 6**.[17]

[16] Carey & Co., California Department of Parks and Recreation (DPR) Primary Record for Building B (P-38-004092). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

[17] This does not include electrical, HVAC, or other utility repairs/upgrades.

TABLE 5
KNOWN ALTERATIONS TO BUILDING B/1019B COMPLETED BEFORE 1998

Date (if known)	Description of Work
Unknown	Replacement of all windows
Unknown	Removal of the spiral staircase that was originally located at the entry on the east façade, observation deck with a railing accessible by the spiral staircase and radio tower that was located on the roof
Unknown	Change of entry from the east to the west side of the building
Unknown	Pedestrian door was added to the south façade (observed)

SOURCES: Carey & Co., 1998; ESA, 2020

TABLE 6
ALTERATIONS TO BUILDING B/1019B SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
1999	Addition of 2 berthing spaces; exterior paint and repair	11-O05268	Completed
2006	ADA accessibility upgrades	11-O8976	Completed
2008	Repair to interior structural columns	649158	Completed
2010	Structural and concrete repairs and boiler replacement	2307520	Completed
2016	Replace damaged windows and frames resulting from helicopter crash near administration building	7501675	Completed
2016	Roof management program	6345115	Completed
2020	Replace windows	11874078	In progress

SOURCE: U.S. Coast Guard CEU Oakland, 2020

3. Building C/1019C, Port Security Unit 312 (Formerly Stonerock Barracks)

Building C/1019C, the former Stonerock Barracks, is composed of two discreet buildings that are connected by a glazed passageway (**Figure 10** through **Figure 12**). Pairs of glazed, metal-frame doors on the north and south sides of the glazed passageway serve as the primary entrance to both buildings. The one-story, 3,750-square-foot former mess hall and the two-story, 23,700-square-foot former barracks building are of reinforced concrete post-and-beam construction and clad in precast concrete panels with a pebble dash finish. Both are capped by a flat roof with parapets around the perimeter and mechanical enclosures. The former mess hall features floor-to-ceiling windows on the north façade. A two-story projecting bay on the east façade of the barracks contains a secondary entrance composed of a pair of glazed, aluminum-frame doors flanked by fixed and operable metal-frame windows.

SOURCE: SFO, 2020
NOTE: This is currently the primary entrance.

Figure 10
North Façade of Building C/1019C, View Facing Southeast

SOURCE: SFO, 2020

Figure 11
South and East Façades of Building C/1019C, View Facing Northwest

SOURCE: SFO, 2020

Figure 12
South Façade of Building C/1019C, View Facing North

Construction Chronology and Alterations

Building C/1019C was constructed ca. 1968–70 as a barracks for U.S. Coast Guard personnel.[18] One archival source suggests that the building was designed by the San Francisco architectural firm of Rockrise & Watson; however, no citation is listed, and further research did not confirm this.[19] Building C/1019C was vacant from the mid-1980s until at least 1998 due to asbestos contamination and the decreased number of personnel manning the U.S. Coast Guard Air Station during that period.[20] Since November 2006, Port Security Unit (PSU) 312 has occupied the building. PSU 312 was established in August 2005 as a deployable specialized force overseen by the U.S. Coast Guard Pacific Area Command. According to the U.S. Coast Guard, "[PSUs] provide waterborne security and limited land-based protection for shipping lanes and critical port facilities that support United States military and humanitarian relief operations. These specialized deployable units are organized for sustained expeditionary operations."[21]

No known alterations were made to Building C/1019C prior to 1998. Alterations completed since 1998 are summarized in **Table 7**.[22]

---

18 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

19 "Rockrise and Watson, Architects (Partnership)," *Pacific Coast Architecture Database, http://pcad.lib.washington.edu/firm/2072/*, accessed November 3, 2020.

20 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

21 United States Coast Guard Pacific Area, "Coast Guard Port Security Unit 312 To Hold Change-of-Command Ceremony," June 7, 2019, *https://content.govdelivery.com/accounts/USDHSCG/bulletins/240295a*, accessed September 29, 2020.

22 This does not include electrical, HVAC, or other utility repairs/upgrades.

TABLE 7
ALTERATIONS TO BUILDING C/1019C SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2005	Rehabilitate Stonerock Barracks at U.S. Coast Guard Air Station San Francisco for use by the Federal Aviation Administration (FAA) for office space	11-F9007	Completed
2006	Rehabilitate first floor for PSU 312	264369	Completed
2007	Repair exterior lighting; replace broken window panes/non-secure window	650826	Completed
2016	Roof management program	6345116	Completed
2017	Repairs and maintenance; installation of water heater leak sensors; stairway door replacement; repair emergency electrical and fire alarm systems repaired	7807691	Completed
2019	Repair roof drains	10117825	Completed

SOURCE: U.S. COAST GUARDCEU Oakland, 2020

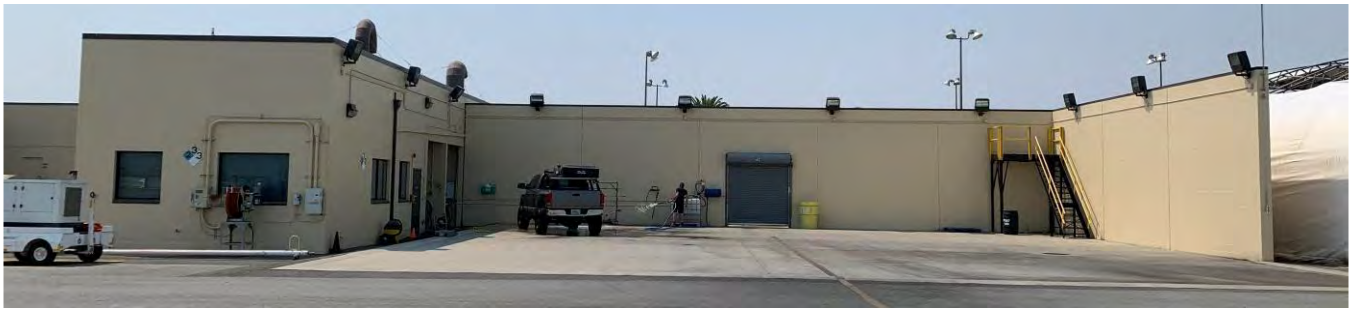
4. Building D, Paint/Gardener Shop

Building D is a one-story, 1,640-square-foot building with a rectangular footprint (**Figure 13** through **Figure 15**). It is of concrete block construction with a concrete foundation and is capped by a flat roof with metal coping at the roofline. The primary (south) façade features three flush metal doors with louvers, a pair of flush metal doors with louvers, and three roll-up vehicular doors. Metal-frame windows are located on the north, east, and west façades. The area surrounding Building D is entirely paved. Immediately north of the building is a paved pad that is bordered by Building D on the south and by concrete walls on the west and north sides.

SOURCE: SFO, 2020

NOTE: This is currently the primary entrance.

Figure 13
South Façade of Building D, View Facing North



SOURCE: SFO, 2020

Figure 14
East Façade of Building D and Adjacent Walled Pad, View Facing West

SOURCE: SFO, 2020

Figure 15
West Façade of Building D, View Facing East

Construction Chronology and Alterations

Building D was constructed in 1990.[23] According to historic aerial photographs, it appears that a walled pad for maintenance was constructed on the north side of the building in 2009. Unspecified roof repairs were made in 2016 as part of the U.S. Coast Guard Air Station's roof management program.[24] No other known or observed alterations have been made to the building since its initial construction. Alterations to Building D completed since 1998 are summarized in **Table 8**.

[23] Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

[24] U.S. Coast Guard CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

TABLE 8
ALTERATIONS TO BUILDING D SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2009	Walled pad for maintenance was constructed on the north side of the building (observed)	—	Completed
2016	Roof management program	6345117	Completed

SOURCES: U.S. COAST GUARDCEU Oakland, 2020; ESA, 2020

5. Building E, Pump House/Storage

Building E is a one-story, 640-square-foot building with a rectangular footprint (**Figure 16** and **Figure 17**). It is of wood-frame construction with a concrete foundation, is clad in painted plywood siding, and is capped by a gabled roof covered with composition roofing. The primary (south) façade features a flush metal door and a roll-up vehicular door. The east and west façades feature multi-lite, industrial-sash windows. A partially glazed flush metal door is located on the south façade, and a flush metal door is located on the east façade. A wood post-and-beam structure is attached to the building's west façade and covers an outdoor storage area.

SOURCE: SFO, 2020

Figure 16
South Façade of Building E, View Facing Northeast

SOURCE: SFO, 2020

Figure 17
East and North Façades of Building E, View Facing Southwest

Construction Chronology and Alterations

Building E was constructed in 1960. Subsequent alterations included "the addition of an attached two-level wood platform structure [on the west side of the building, which was reduced to a single level at an unknown date after 1998].[25] The building was refurbished by Anderson-Pacific Construction Company in 1990."[26] Unspecified roof repairs were made in 2016 as part of the U.S. Coast Guard Air Station's roof management program.[27] Known alterations to Building E are summarized in **Table 9**.

---

25 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

26 Carey & Co., California Department of Parks and Recreation (DPR) Primary Record for Building E (P-38-004095). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

27 USCG CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

TABLE 9
KNOWN ALTERATIONS TO BUILDING E

Award Fiscal Year	Description of Work	Project Number(s)	Status
1990	The building was refurbished by Anderson-Pacific Construction Company	—	Completed
2016	Roof management program	6345118	Completed
Unknown	Addition of an attached two-level wood platform structure [on the west side of the building]	—	Completed
Post-1998	Wood platform on the west side of the building reduced to a single level (observed)	—	Completed

SOURCES: U.S. COAST GUARDCEU Oakland, 2020; Carey & Co., 1998 ESA, 2020

6. Building G, Utility/Fuel/Repair/Storage Building

Building G is a one-story, 504-square-foot building with a rectangular footprint (**Figure 18** and **Figure 19**). It is an intact example of a utilitarian building designed in the Moderne Style. It is of concrete block construction with a raised concrete foundation and is capped by a flat roof with shallow eaves on all sides. The primary (north) façade features a paneled door that is accessed by concrete steps with a metal handrail. The east and west façades feature multi-lite, industrial-sash windows. A partially glazed flush metal door is located on the south façade, and a flush metal door is located on the east façade.

SOURCE: SFO, 2020

Figure 18
East and North Façades of Building G, View Facing Southwest

SOURCE: SFO, 2020

Figure 19
South and West Façades of Building G, View Facing Northeast

Construction Chronology and Alterations

Building G was constructed ca. 1944.[28] Unspecified roof repairs were made in 2016 as part of the U.S. Coast Guard Air Station's roof management program, and unspecified renovations were made in 2005.[29] No other known or observed alterations have been made to the building since 1998. Alterations to Building G completed since 1998 are summarized in **Table 10**.

TABLE 10
ALTERATIONS TO BUILDING G SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2005	Renovated battery shop to come into compliance with local and Coast Guard standards	11-O05018	Completed
2016	Roof management program	6345119	Completed

SOURCE: U.S. COAST GUARDCEU Oakland, 2020

7. Building J, Utility/Sewage/Pump House

Building J is a one-story, 120-square-foot building with a rectangular footprint (**Figure 20** and **Figure 21**). It is an altered example of a utilitarian building designed in the Moderne Style. It is of concrete block construction with a raised concrete foundation and is capped by a flat roof with metal coping at the roofline. The primary (north) façade features a partially glazed metal door that is accessed by concrete steps with metal handrails. The west façade features a multi-lite window with a concrete sill. A metal staircase on the south façade leads to a covered porch that occupies the southeast corner of the building.

[28] Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

[29] U.S. Coast Guard CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

SOURCE: SFO, 2020

Figure 20
East and North Façades of Building J, View Facing West

SOURCE: SFO, 2020

Figure 21
West and South Façades of Building J, View Facing Northeast

Construction Chronology and Alterations

Building J was constructed ca. 1944–50.[30] Based on a review of historic photographs, the southeast corner of the building was modified at an unknown date after 1998. The concrete block walls in that corner were removed and reconstructed in different locations, creating a covered porch. The unpaved ground around the building appears to have been regraded sometime since 1998, as the 1998 architectural description mentions a "four riser concrete staircase," and the extant staircase includes only three risers. It is possible that these alterations were included as part of the unspecified repairs completed in 2017 and 2018. [31] Alterations to Building J completed since 1998 are summarized in **Table 11**.

TABLE 11
ALTERATIONS TO BUILDING J SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2017	Repair pump house	9060109	Completed
2018	Repair pump house	11304826	Completed
Unknown	Regrading around building, reducing the exterior staircase from four to three risers (observed)	—	Completed
Unknown	Reconfiguration of southeast corner of building (observed)	—	Completed

SOURCES: U.S. Coast Guard CEU Oakland, 2020; ESA, 2020

8. Seaplane Ramp

The seaplane ramp is a reinforced concrete structure located at the west end of Seaplane Harbor (**Figure 22 and Figure 23**). The ramp is 50 feet wide and features timber curbs and steel piles on the north and south sides.[32] It is not currently in use, and a metal security fence installed ca. 2004 prevents access to the ramp from the U.S. Coast Guard Air Station's apron. Sandbags stacked on the east side of the fence function as a makeshift flood control feature.

---

30 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

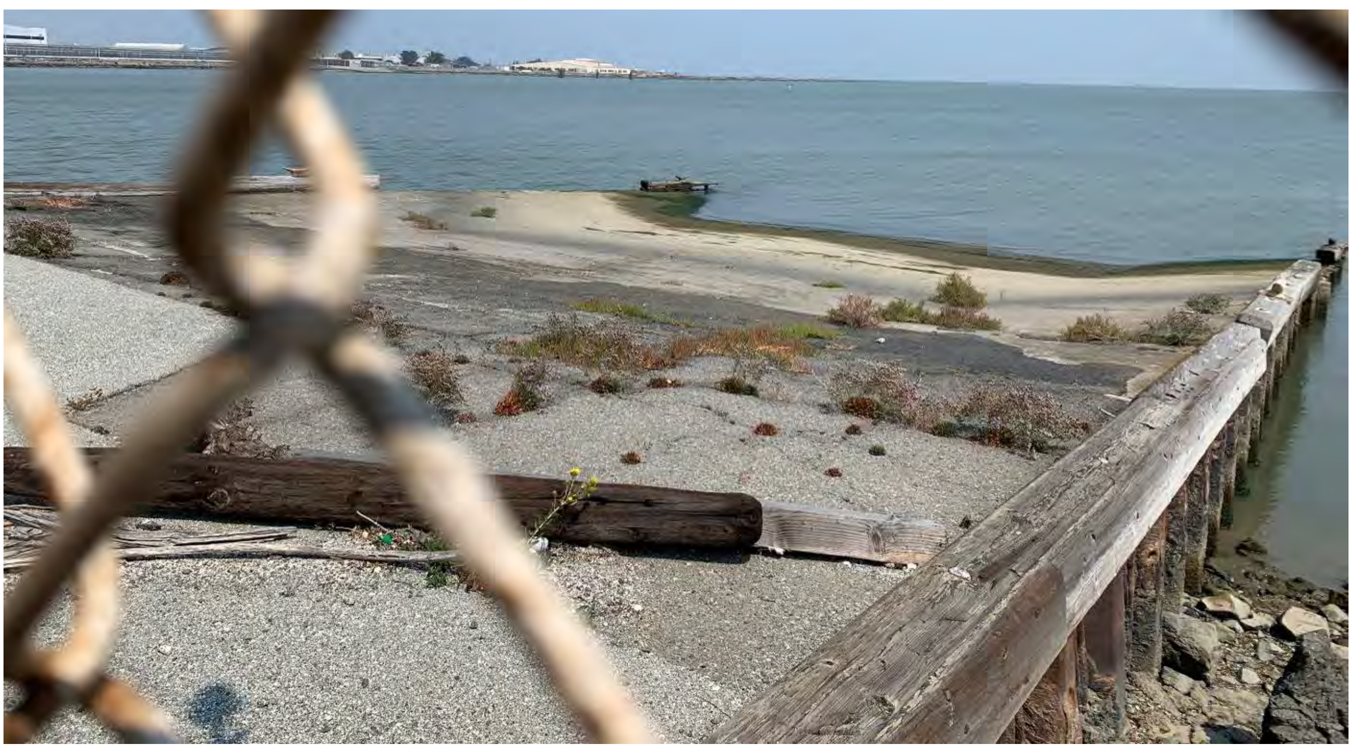
31 USCG CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

32 The U.S. Coast Guard confirmed that the seaplane ramp is supported by individual steel piles. Damage Controlman Chief Petty Officer John R. Travis (U.S. Coast Guard Air Station San Francisco), Email to Johanna Kahn (ESA), June 8, 2021.

=

SOURCE: ESA, 2018

Figure 22
Seaplane Ramp, View Facing Southeast



SOURCE: SFO, 2020

Figure 23
Seaplane Ramp, View Facing Northeast

Construction Chronology and Alterations

When it was constructed in 1941 for use by the U.S. Coast Guard, the seaplane ramp measured 128 feet by 50 feet and had a weight capacity of 50,000 pounds.[33] The inclined surface of the ramp was originally supported by timber piles coated with creosote,[34] and these were replaced with steel piles at an unknown date. As shown in **Figure 24**, the inclined surface was originally an even plane. This was a typical ramp design that is also exhibited in the extant seaplane ramp on the north side of Seaplane Harbor.[35] A review of historic photographs (**Figure 25**) indicates that the inclined surface was reconstructed at an unknown date ca. 1951, after which time it appears to slope up at the sides (a transverse cross section would show the current configuration as a U shape with shallow, outturned sides). Although it currently appears that the ramp has collapsed in the center, a comparison to historic photographs confirms that it has been this way for decades. This reconstruction appears to have predated the reported lengthening of the ramp in 1953.[36]

The seaplane ramp likely remained in use until ca. 1964, by which time the U.S. Coast Guard Air Station retired its entire fleet of seaplanes in favor of landplanes and helicopters.[37,38] The steel sheet pile seawall adjacent to the north and south sides of the seaplane ramp was replaced ca. 1974–76. [39] In the following decades, both the ramp and seawall became severely deteriorated. By 2003, the seawall adjacent to the seaplane ramp was failing, "resulting in the continued deterioration and undermining of the seawall and adjacent concrete/asphalt slabs…The on-going destabilization of the seawall will result in the continued deterioration of paved areas used for aircraft, helicopter, and vehicle parking."[40] As a result, 972 feet of the seawall on both sides of the seaplane ramp was repaired using riprap, damaged asphalt on the apron was replaced, and a chain-link fence was installed along the water side of the U.S. Coast Guard Air Station ca. 2004, effectively separating it from the seaplane ramp.[41]

---

33 "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," *California State Military Museum*, *http://www.militarymuseum.org/cgassf.html*, accessed September 29, 2020.

34 Treasury and Post Office Departments Appropriation Bill, Fiscal Year 1939, *Supplemental Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives, 75th Congress* (Washington, DC: U.S. Government Printing Office, 1938), 845, *https://www.google.com/books/edition/Hearings/zB10H_I3MWkC?hl=en&gbpv=1&bsq=%22seaplane%20ramp%22*, accessed April 29, 2021,

35 See the *Shoreline Protection Program Historic Resource Evaluation Part 1* to which this analysis is appended for more information.

36 "Seaplane Ramp to Be Extended," *San Mateo Times*, June 23, 1953, 8.

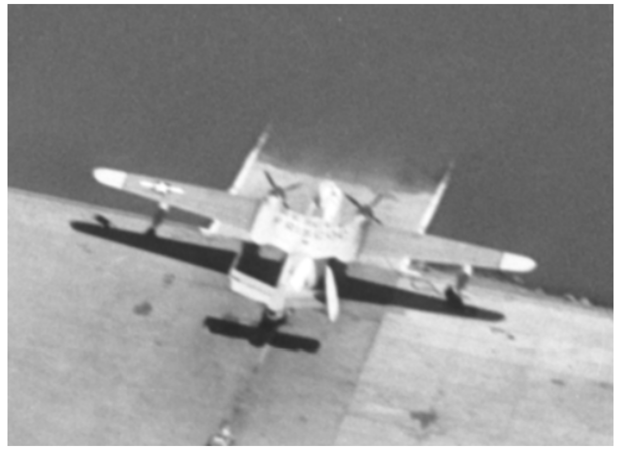
37 Doug Siegfried, "Seaplanes of San Diego Bay," *Coronado Times*, September 27, 2009, *https://coronadotimes.com/news/2009/09/27/seaplanes-of-san-diego-bay-by-cdr-doug-siegfried-usn-ret/*, accessed April 26, 2021.

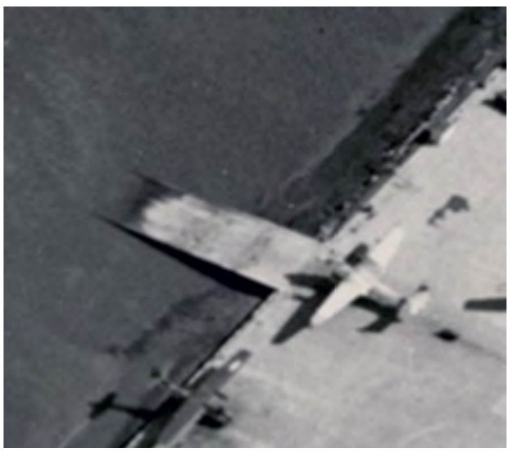
38 Robert B. Workman, Jr., "Seaplanes and Offshore Operations: Rough Seas and Cigars," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/historical-narrative/rough-seas-and-cigars/#:~:text=Large%20seaplane%20open%20sea%20landing,in%201960%20ending%20an%20era*, accessed April 26, 2021.

39 U.S. Coast Guard Civil Engineering Unit Oakland, *Environmental Assessment for the Seawall Repairs at U.S. Coast Guard Air Station San Francisco*, prepared by the Environmental Co. in December 2003, 1-1, on file at SFO.

40 Ibid.

41 Ibid., 2-1; San Francisco Bay Conservation and Development Commission, "Re: Supplemental Listing of Pending Administrative Matters," December 12, 2003.

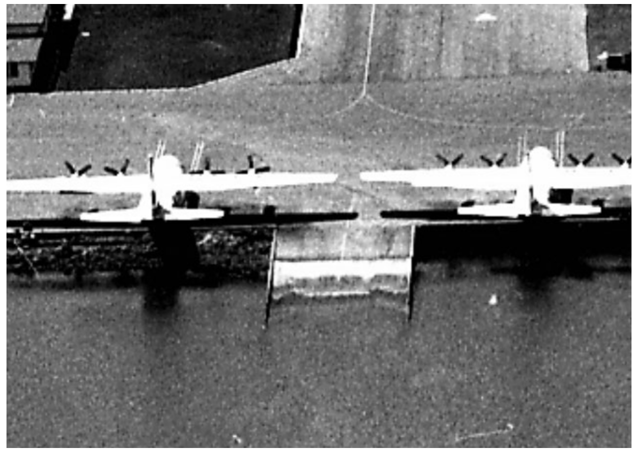


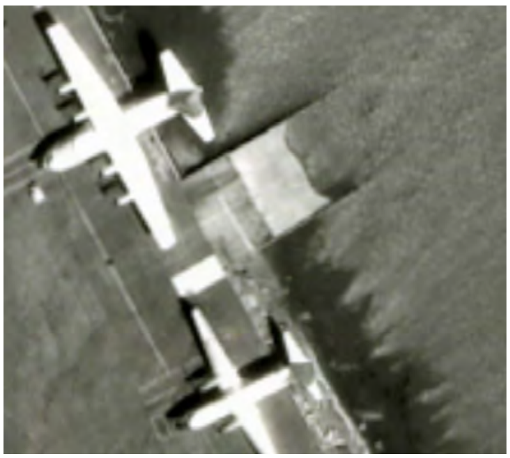


1941 (upper left), ca. 1945 (upper right), 1946 (lower left).

SOURCE: Collection of SFO Museum, Accession Nos. 2014.114.019 (upper left), 2014.077.009 (upper right), 2000.058.1407 (lower left).

Figure 24
Details Views of Seaplane Ramp, 1940s





1951 (upper left), 1963, (upper right) 1973 (lower left).

SOURCE: SFO Museum, Accession Nos. e (upper left), 2011.032.1006 (upper right), 2004.083.013 (lower left).

Figure 25
Detail Views of Seaplane Ramp, 1950s–1970s

Known alterations include sealing the asphalt paving in 1995.[42] It is possible that additional asphalt repairs have occurred over time. The timber curbs were replaced with pressure-treated lumber at an unknown date, and other components may also have been replaced over time. Known alterations to the seaplane ramp are summarized in **Table 12**.

[42] USCG CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

TABLE 12
KNOWN ALTERATIONS TO THE SEAPLANE RAMP

Award Fiscal Year	Description of Work	Project Number(s)	Status
ca. 1951	Inclined surface reconstructed	N/A	Completed
1953	Ramp lengthened	N/A	Presumed completed
1995	Seal asphalt ramp	11-O4074	Completed
ca. 2004	Chain link security fence installed	N/A	Completed
Unknown	Curbs replaced with pressure-treated lumber	N/A	Completed

SOURCES: U.S. COAST GUARD CEU Oakland, 2020; "Seaplane Ramp to Be Extended," *San Mateo Times*, June 23, 1953, 8; San Francisco Bay Conservation and Development Commission, "Re: Supplemental Listing of Pending Administrative Matters," December 12, 2003.

9. Building S-13, Guard Shack

The guard shack is located at the main entrance to the U.S. Coast Guard Air Station and is accessible from North Access Road (**Figure 26** and **Figure 27**). It is one story in height, has a rectangular footprint, is clad in metal siding, and is capped by a flat roof. Although it was constructed in 1992, well after the Streamline Moderne Style was popularized in the 1930s and 1940s, several details reference this style, including the curved walls and eaves and the continuous speed line on the fascia. Single sliding, partially glazed, metal doors are located on the north and south façades, and fixed windows are located on all four façades. All glazing is tinted.

SOURCE: SFO, 2020

Figure 26
South Façade of the Guard Shack, View Facing Northeast

SOURCE: SFO, 2020

Figure 27
North Façade of the Guard Shack, View Facing Southwest

Construction Chronology and Alterations

According to U.S. Coast Guard CEU Oakland, the guard shack was constructed in 1992. Based on a comparison of historic aerial photographs, the current configuration of the main east-west entrance from North Access Road appears to have been constructed between 1968 and 1980, and it is possible that there was an earlier guard shack and/or gate constructed in approximately the same location during this period. There have been no known alterations.

10. Building 1019F, Port Security Unit Boat Storage

Building 1019F is a two-story building with a rectangular footprint and is capped by a flat roof (**Figure 28**). It is of prefabricated metal construction and is clad in textured vertical panels of unknown material (possibly fiber cement). Fenestration includes aluminum-sash sliding windows, partially glazed flush metal pedestrian doors, and three metal roll-up vehicular doors on the east façade. It is similar in design to Building 1019G.

SOURCE: SFO, 2020

Figure 28
South and East Façades of Building 1019F, View Facing Northwest

Construction Chronology and Alterations

Building 1019F was constructed in 2005 on the site formerly occupied by the original Building F (warehouse/recreation building), which was a contributor to the National Register-eligible historic district. Unspecified roof repairs were made in 2016 as part of the U.S. Coast Guard Air Station's roof management program.[43] No other known or observed alterations have been made to the building since its initial construction. Alterations to Building 1019F completed since its construction are summarized in **Table 13**.

TABLE 13
ALTERATIONS TO BUILDING 1019F

Award Fiscal Year	Description of Work	Project Number(s)	Status
2016	Roof management program	6345122	Completed

SOURCE: U.S. COAST GUARDCEU Oakland, 2020

[43] USCG CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station San Francisco from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

11. Building 1019G, Public Works Building

Building 1019G is a one-story building with a rectangular footprint and is capped by a flat roof (**Figure 29**). It is of prefabricated metal construction and is clad in textured vertical panels of unknown material (possibly fiber cement). Fenestration includes aluminum-sash sliding windows, partially glazed flush metal pedestrian doors (both single and pairs), and metal roll-up vehicular doors on the north and south façades. The flat roof extends well beyond the east façade; it is supported by steel columns and creates a large covered area. It is similar in design to Building 1019F.

SOURCE: SFO, 2020

Figure 29
South and East Façades of Building 1019G, View Facing Northwest

Construction Chronology and Alterations

Building 1019G was constructed in 2005 on the site formerly occupied by the original Building F (warehouse/recreation building), which was a contributor to the National Register-eligible historic district. Unspecified roof repairs were made in 2016 as part of the U.S. Coast Guard Air Station's roof management program.[44] No other known or observed alterations have been made to the building since its initial construction. Alterations to Building 1019G completed since its construction are summarized in **Table 14**.

TABLE 14
ALTERATIONS TO BUILDING 1019G

Award Fiscal Year	Description of Work	Project Number(s)	Status
2016	Roof management program	6345119	Completed

SOURCE: U.S. COAST GUARDCEU Oakland, 2020

44 USCG CEU Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station San Francisco from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

12. Fuel Tanks

This structure is composed of four large, metal fuel tanks mounted horizontally on top of a poured-in-place concrete platform (**Figure 30**). Metal ladders and stairs are located on the south side of the concrete platform, and a metal staircase and catwalk spans the north ends of the tanks.

SOURCE: SFO, 2020

Figure 30
South Façade of the Fuel Tanks, View Facing Northeast

Construction Chronology and Alterations

Based on a comparison of historic aerial photographs, the fuel tanks appear to have been constructed between 1989 and 1993. Since that time, there have been periodic inspections, cleanings, and repairs that have required repairing all valves and fittings (2003 and 2008) and relining the interior of the fuel tanks and replacing fuel level sensors (2012). Alterations to the fuel tanks completed since 1998 are summarized in **Table 15**.

TABLE 15
ALTERATIONS TO THE FUEL TANKS SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2003	Fuel farm valve repairs	11-O01042	Completed
2008	Fuel farm piping repair and replace filter elements	656095	Completed
2012	Clean, inspect, reline interior and replace fuel level sensors in all four fuel tanks	3695186, 3695188, 3695189, and 3695190	Completed

SOURCES: U.S. Coast Guard CEU Oakland, 2020; ESA, 2020

13. Temporary Hangar

The temporary hangar is a metal-frame structure with a rectangular footprint (**Figure 31**). It is constructed of eight segmentally arched trusses and is clad in a tensioned fabric that appears to be cut or torn. The east and west sides of the hangar are open to the elements.

SOURCE: SFO, 2020

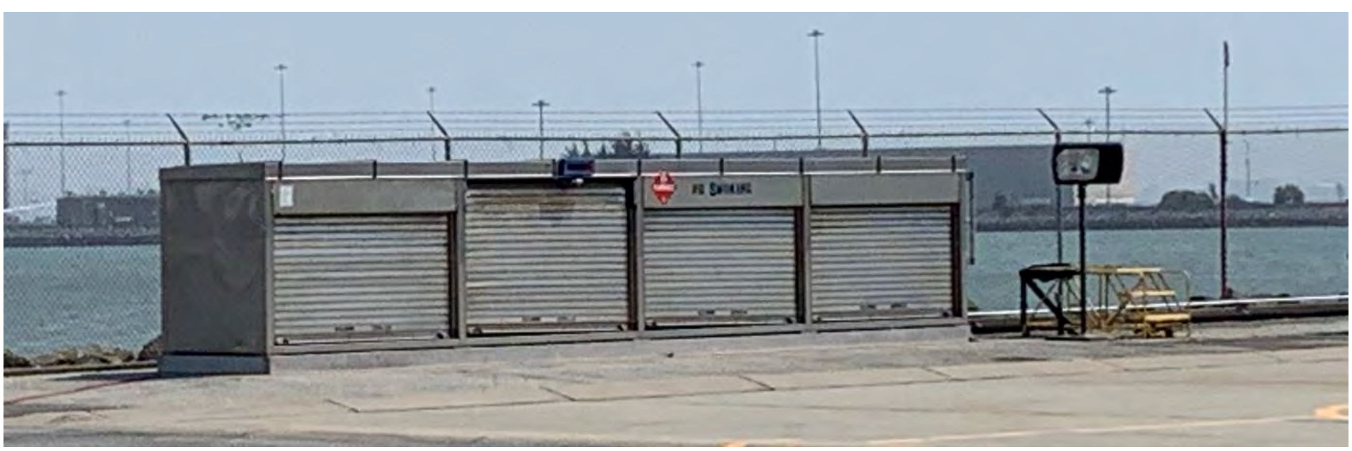
Figure 31
East Façade of the Temporary Hangar, View Facing Southwest

Construction Chronology and Alterations

Based on a comparison of historic aerial photographs, the temporary hangar appears to have been constructed in 2012. There have been no known alterations. The large cut or tear in the fabric is recent (since July 2020).

14. Fuel Dispensing Hydrants 1 and 2

Two nearly identical fuel dispensing hydrants are located east and southeast of Building A/1019A, near the shoreline (**Figure 32**). Both are one story in height, have rectangular footprints, and are clad in metal siding. The primary (west) façades each feature four metal roll-up doors.



SOURCE: SFO, 2020

Figure 32
West Façade of one of the Fuel Dispensing Hydrants, View Facing Southeast

Construction Chronology and Alterations

In 1990, the U.S. Coast Guard granted SFO a permanent taxiway and access road easement over a 2.2-acre site at the northwest corner of the U.S. Coast Guard Air Station property. Creation of this easement necessitated the demolition, relocation, or replacement of several U.S. Coast Guard facilities.[45] The two fuel dispensing hydrants were constructed ca. 1990, and their sites were selected to accommodate the easement. The pit fuel enclosures were replaced in 2013. Alterations to the hydrants completed since 1998, including those that are currently in progress or currently approved, are summarized in **Table 16**.

TABLE 16
ALTERATIONS TO THE FUEL DISPENSING HYDRANTS SINCE 1998

Award Fiscal Year	Description of Work	Project Number(s)	Status
2010	Replace four fuel level sensors	3228907	Completed
2013	Replace north fuel pit enclosure	5617804	Completed
2013	Replace south fuel pit enclosure	5617808	Completed
2014	Replace fuel pit enclosures and electrical boxes	2936863	Completed
2020	Repair aviation fuel system; transfer to south hydrant	13006640	In progress
2020	Repair aviation fuel system; transfer to north hydrant	13006699	In progress

SOURCE: U.S. COAST GUARDCEU Oakland, 2020

15. Helicopter Fueling/Washdown Ramps 1 and 2

Two nearly identical helicopter fueling/washdown ramps are located immediately west of the fuel dispensing hydrants (**Figure 33**). The ramps are paved pads with raised curbs around the perimeters, and they have an imperceptible slope. Ramp 1 (to the north) has one drainage grate in the southwest corner, and the number "1" is painted on the west half of the ramp. Ramp 2 (to the south) has drainage grates in the center and the southwest corner, and the number "2" is painted on the west half of the ramp.

SOURCE: SFO, 2020

Figure 33
One of the Helicopter Fueling/Washdown Ramps (with a Fuel Dispensing Hydrant in the Background), View Facing East

45 Easement deed, October 25, 1990, Real Property Files, Maintenance and Logistics Command Pacific, Alameda, CA. Cited in Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

Construction Chronology and Alterations

In 1990, the U.S. Coast Guard granted SFO a permanent taxiway and access road easement over a 2.2-acre site at the northwest corner of the U.S. Coast Guard Air Station property. Creation of this easement necessitated the demolition, relocation, or replacement of several U.S. Coast Guard facilities.[46] The two helicopter fueling/washdown ramps were constructed ca. 1990, and their sites were selected to accommodate the easement. There have been no known alterations.

16. BBQ Shelter

The BBQ shelter is located immediately west of Building A/1019A (**Figure 34**). It is one story in height, has a rectangular footprint, and is capped by a flat roof covered with corrugated metal roofing. The shelter is a pergola of simple wood post-and-beam construction on cylindrical concrete piers and a flat concrete pad. It contains two BBQs and a countertop with a sink and storage.

SOURCE: SFO, 2020

Figure 34
BBQ Shelter (with Building A/1019A in Background), View Facing Southeast

46 Easement deed, October 25, 1990, Real Property Files, Maintenance and Logistics Command Pacific, Alameda, CA. Cited in Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

Construction Chronology and Alterations

Based on a comparison of historic aerial photographs, the BBQ shelter appears to have been constructed in 2012. There have been no known alterations.

17. Gazebo

The gazebo is located immediately west of Building A/1019A (**Figure 35**). It is one story in height, has a rectangular footprint, and is capped by a hipped roof covered with composition shingles. A small, square monitor is centered on the roof; it has louvered panels on its four sides and is capped by a small hipped roof. The prefabricated gazebo features modest Folk Victorian-inspired details in the wood elements around the building's perimeter. The gazebo rests on a raised wood deck that appears to have been constructed directly on the grass below.

SOURCE: SFO, 2020

Figure 35
Gazebo (with Building A/1019A in Background), View Facing Southeast

Construction Chronology and Alterations

Based on a comparison of historic aerial photographs, the gazebo appears to have been constructed in 2011. There have been no known alterations.

History of U.S. Coast Guard Air Station San Francisco

In April 1937, the U.S. Treasury Department authorized the acquisition by donation (as opposed to purchase) of a site at the San Francisco Municipal Airport to establish U.S. Coast Guard Air Station San Francisco:[47]

> At the present time the Coast Guard has only two air stations on the Pacific coast—one at Port Angeles, Wash., and the other at San Diego, Calif. The airline distance from Port Angeles to San Francisco is 749 statute miles, and from San Diego to San Francisco is 443 statute miles, which distance prevents utilization, for several hundred miles to the northward and southward of the San Francisco Bay region, of the services and protection of the Coast Guard air stations at Port Angeles and San Diego. The establishment of a Coast Guard air station at a strategic point between the two existing stations would provide the Coast Guard with the means of effectively meeting public emergencies requiring the assistance of aircraft and for the prosecution of Coast Guard and customs duties in which aircraft facilities are now engaged along other sections of our coast. The importance and volume of marine and air commerce in the San Francisco Bay region and adjacent territory would suggest the wisdom of affording Coast Guard air service and protection in this area.
>
> The need for the establishment of a Coast Guard air station between San Diego and Port Angeles has been felt by the Coast Guard, and with the view of selecting a suitable site for such a station, if provision be made for its construction, a careful survey was made about a year ago, with the result that the San Francisco Bay region was agreed upon as best serving the requirements of the Coast Guard. A site for this station has been reserved at the San Francisco airport and offered to the Coast Guard. The Coast Guard considers this location ideally situated, provided certain dredging be accomplished to permit the handling of seaplanes.[48]

President Franklin D. Roosevelt signed the bill authorizing construction of the U.S. Coast Guard Air Station on June 15, 1937.[49] Following the approval of a $2,850,000 Airport Bond Fund in December 1937, "A tentative agreement between the Public Utilities Commission and Federal authorities provided that the army would dredge the seaplane channel and harbor, the city paying half the cost, and in return, the Coast Guard would receive title to 20 acres on the harbor."[50] In June 1938, the final $600,000 for construction of the U.S. Coast Guard Air Station was restored by the House Appropriations Committee.[51] On June 5, 1939, San Francisco Mayor Angelo Rossi signed the deed transferring 20 acres of reclaimed land to the Federal government.[52]

The U.S. Coast Guard Civil Engineering Office in San Francisco designed U.S. Coast Guard Air Station San Francisco,[53] and general contractor William Willis, who built U.S. Coast Guard Air Station Port Angeles, was hired to build it. The first buildings to be constructed were the main hangar (Building A/1019A) and barracks (Building B/1019B, currently the administration building), both of which were in operation in June 1940

---

47 The USCG operated under the U.S. Department of the Treasury from its inception in 1790 to 1967, the Department of Transportation from 1967 to 2003, and the Department of Homeland Security from 2003 to the present.

48 "Report No. 665: Coast Guard Air Station, San Francisco Airport, San Francisco, Calif.," *Senate of the United States Committee and Subcommittee Assignments for the 75th Congress*, June 1, 1937, *https://www.google.com/books/edition/Report/jaKD85LvjLcC?hl=en&gbpv=0*, Accessed November 3, 2020.

49 "F.D.R. Signs S.F. Plane Patrol Bill," *San Francisco Chronicle,* June 16, 1937, 34.

50 "Seaplane Base at City Airport Held Doubtful," *San Francisco Chronicle,* December 2, 1937, 6.

51 "S.F. Air Base Fund Approved" *San Francisco Chronicle,* June 8, 1938, 3.

52 "S.F. Deeds Air Base to Coast Guard," *San Francisco Chronicle,* June 6, 1939, 10.

53 "U.S. Coast Guard," *Federal Architect,* Vol. 14, No. 1 (April-July 1945), 34.

(**Figure 36**). Next was the construction of the seaplane ramp for launching and retrieving amphibious aircraft and grading, paving, and landscaping of the property (Figure 36).[54] U.S. Coast Guard Air Station San Francisco was officially commissioned during a ceremony held on November 15, 1940, when it was announced that "Six or seven planes and about 60 men will be based at the field."[55] A public dedication took place on February 15, 1941.[56] When first built, the U.S. Coast Guard Air Station operated exclusively with fixed-wing aircraft, and many, but not all, were seaplanes. The first aircraft complement was one PBY-5 Catalina (two-engine patrol bomber seaplane) and two RD-4 Dolphins (two-seat, two-engine amphibious patrol plane). OS2U-3 Kingfisher aircraft (two-seat, single-engine patrol floatplane) were added in 1942. By 1945, a PB2Y Coronado (10-seat, four-engine amphibious patrol bomber), PB-1G Flying Fortress (four-engine multi-use aircraft (bomber, lifeboat, and observation); not a seaplane), and P4Y-2G Privateers (11-seat, four-engine rescue and reconnaissance aircraft; not a seaplane) were also in use.[57]

On November 2, 1941, President Roosevelt signed an executive order transferring operational command of the U.S. Coast Guard from the Treasury Department to the Navy Department.[58] The United States entered into World War II on December 7, 1941.

Development of the U.S. Coast Guard Air Station continued during the war, and it grew to accommodate over 250 people. A second barracks building (originally known as Building C, demolished ca. 1968) appears in 1943 aerial photographs. An infirmary (originally known as Building D) and a drill building (originally known as Building E) appear on a February 1944 site plan. They were located northwest and immediately north of Building B, respectively, and both were demolished ca. 1968–70. Other support buildings were constructed in the mid-1940s including a warehouse and maintenance shop building (originally known as Building F, constructed ca. 1944–46 and demolished in 2005), a utility/fuel/repair/storage shop (Building G, extant), bachelor officer quarters (originally known as Building H, constructed in 1946 and demolished in 2007), and a sewage pump house (Building J, extant) (**Figure 37**).[59]

Concurrent shoreline improvements included construction in 1943 of a seawall, breakwaters on the northeast and southeast sides of Seaplane Harbor (visible in Figure 37), a pier with two 30-foot launches for U.S. Coast Guard crash and personnel boats (visible in Figure 36 and Figure 37);[60,61] and continued dredging of Seaplane Harbor. The pier remained in use by the U.S. Coast Guard until 1970 and by the Federal Aviation Administration in 1979–80, and it was subsequently demolished in 1988.[62] As a result of fill activities in the late 1940s through the early 1970s, the southeast breakwater was incorporated into the area currently known as the "shark fin" (where Building 1059, the Police Main Training Facility and Shooting Range, is currently located), and the majority of

54 "Coast Guard Air Station Nearer Reality," *San Francisco Chronicle,* May 8, 1940, 32.

55 "11th Cavalry Transferred to Mexican Border," *San Francisco Chronicle,* November 16, 1940, 2.

56 Herb Caen, "Saturday Scrapbook," *San Francisco Chronicle,* February 15, 1941, 13.

57 "1941: Coast Guard Air Station San Francisco Established," United States Coast Guard Aviation History, https://cgaviationhistory.org/1941-coast-guard-air-station-san-francisco-established/, accessed September 29, 2020.

58 "Navy Takes Over the Coast Guard," *San Francisco Chronicle,* November 3, 1941, 1.

59 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 6-8.

60 "Appraisal Report," August 31, 1992, Real Property Files, Maintenance and Logistics Command Pacific, Alameda, CA. Cited in Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 9.

61 Listing for U.S. Coast Guard Air Station San Francisco in 1945 Directory of Airfields, available at "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," *California State Military Museum, http://www.militarymuseum.org/cgassf.html*, accessed September 29, 2020.

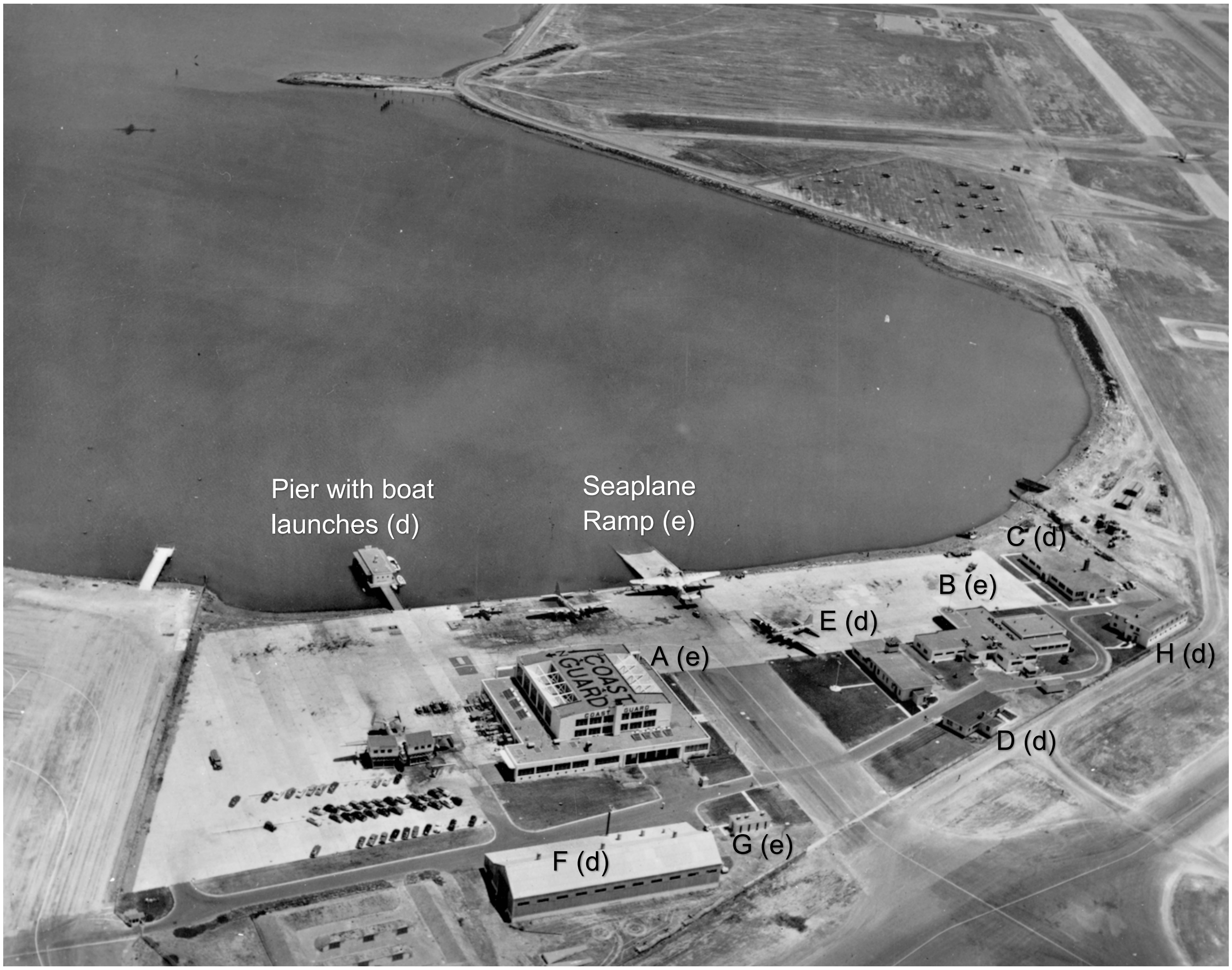
62 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 7.

the northeast breakwater was incorporated into the North Field. The seawall along the east side of the U.S. Coast Guard Air Station was replaced ca. 1974–76 and extensively repaired ca. 2004.[63]

SOURCE: Collection of SFO Museum, Accession No. 2014.114.019

Figure 36
Aerial View Showing Buildings A/1019A (in Background) and B/1019B (in Foreground) and the Seaplane Ramp (at right), 1941

63 Ibid., 2-1; San Francisco Bay Conservation and Development Commission, "Re: Supplemental Listing of Pending Administrative Matters," December 12, 2003.



SOURCE: Collection of SFO Museum, Accession No. 2014.114.015; edited by ESA

NOTE: Note (e) signifies that the building/structure is extant, and Note (d) signifies that it has been demolished.

Figure 37
Aerial View of U.S. Coast Guard Air Station San Francisco Looking Southeast, 1951

In January 1945, the U.S. Army and U.S. Navy published a directory of active airfields, and the U.S. Coast Guard Air Station was included as a separate listing from the San Francisco Municipal Airport. The listing for the U.S. Coast Guard Air Station included various specifications, including the number and types of buildings, radio facilities, and connectivity to nearby roads and railroads (**Figure 38**).[64]

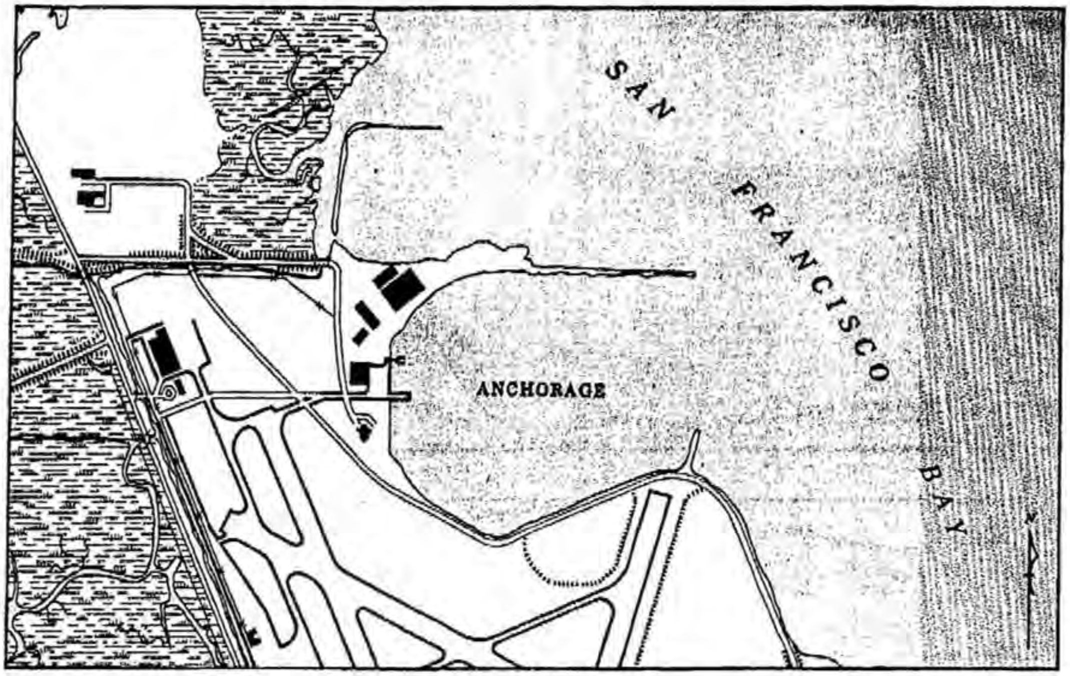
---

[64] Listing for U.S. Coast Guard Air Station San Francisco in 1945 Directory of Airfields, available at "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," *California State Military Museum*, Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, *http://www.militarymuseum.org/cgassf.html*, accessed September 29, 2020.

CALIFORNIA

[redacted]

SAN FRANCISCO COAST GUARD AIR STATION
SAN FRANCISCO



LOCATION:
FROM CITY - 8.0 mi. SSE (air line).
POSITION - Lat. 37°37'57". Long. 122°23'20".
ALTITUDE - 7'.
CITY POPULATION - 634,536.

DESCRIPTION:
TYPE - Navy.
LANDING AND TAKE-OFF AREA -
Location - In San Francisco Bay, NE of station.
Shape - Irregular.
Dimensions (over-all) - Unlimited, in open bay.
Minimum Depth - 10'.
Shelter - Good.
Runways - Over 30,000', all directions.
ANCHORAGE -
Location - Inside of breakwater to E of station.
Minimum Depth - 10'.
Shelter - Good, except from SE winds.
Mooring Buoys - (4) W end of basin; (4) bordering seaplane channel.
Small Boats - (2) 30' launches; 2 crash and 2 personnel boats.
Ramps - (1) 128' x 50', capacity, 50,000 lb., W end of basin; (1) 291' x 100', capacity, 75,000 lb. (under const.), N shore of basin.
Haul-Out Facilities - Marine Railway.
Tender Anchorage - In basin, E of station.
APPROACH HAZARDS - None reported.
MARKINGS - None reported.
LIGHTING - Landing lights (portable).

TRANSPORTATION:
AIRLINES - None reported.
RAILROADS - Atchison, Topeka & Santa Fe; Southern Pacific; Western Pacific; at San Francisco.
Sidings - Capacity, 12 cars, 1.0 mi. from station.
ROADS - U. S. No. 101, 1.2 mi. W; U. S. No. 101 (bypass), 0.2 mi. W; paved.
FACILITIES - Bus and taxi service.

RADIO FACILITIES:
RANGE - None.
TOWER - 269 kcs. and 128.18 mcs. (Cont.).
GND/AIR - None.
INSTRUMENT APPROACH AND LETDOWN PROCEDURE - None.

FACILITIES:
HANGARS - (1) Door size 118' x 27'; (1) door size 157' x 36'.
SHOPS - Major engine repair; major aircraft repair.
GASOLINE -
At Anchorage - 91 and 100 octane; 1 servicing truck.
In Vicinity - None reported.
OIL -
At Anchorage - SAE 30 to 60.
In Vicinity - None reported.
COMMUNICATIONS - Telephone; telegraph; teletype.
PERSONNEL ACCOMMODATIONS (Transient) -
At Anchorage - None reported.
In Vicinity - At San Francisco.

WEATHER (Records from Station at San Francisco):
PREVAILING WIND - W, except Dec., Jan., N; July, Aug., SW.
PRECIPITATION - Av. mo., 0.01" (July) to 4.70" (Jan.); av. yr., 22.01".
TEMPERATURE - Av. min. and max., 50.2° to 62.4°; extremes, 29° to 101°.
FOG - No data.
FACILITIES (At Anchorage) - First-order weather station; CAA weather teletype, 24-hr. operation.

OPERATED BY: Coast Guard.

OWNED BY: U. S. Govt.

SOURCE: California State Military Museum, 2017

Figure 38
Listing for U.S. Coast Guard Air Station San Francisco in 1945 Directory of Airfields

World War II officially ended on September 2, 1945, and control of the U.S. Coast Guard reverted to the Treasury Department on January 1, 1946.[65] The first helicopter, a HO3S-1 Dragonfly, was introduced in 1947, followed by various other helicopter models.[66] In the subsequent years after the war, the usefulness of seaplanes in the Coast Guard and Navy declined. The variety of superior landplanes and helicopters, in combination with the widespread availability of long, paved runways at airports globally, as well as other technological advancements, essentially made seaplanes obsolete for purposes of supporting U.S. Coast Guard operations. In the early 1960s, the Coast Guard retired its entire fleet of seaplanes.[67,68] The Stonerock Barracks (Building C/1019C, extant) replaced the original Building C in 1970 and functioned as bachelor enlisted quarters. It is possible that Building C/1019C was designed by the San Francisco architectural firm of Rockrise & Watson; however, research did not confirm this.[69] Because of asbestos contamination and a reduced number of personnel at the U.S. Coast Guard Air Station, the former Stonerock Barracks was vacant from the mid-1980s until at least 1998.[70]

Beginning in the early 1970s, the significant expansion of SFO necessitated discussions, negotiations, studies, and correspondence regarding two primary issues: relocation and easements. The U.S. Coast Guard investigated the potential benefits of relocating the U.S. Coast Guard Air Station to the former Hamilton Air Force Base near Novato in Marin County. A detailed analysis prepared in 1975 by a graduate student at the Naval Postgraduate School concluded that relocation would result in a significant increase in the distance to the scene of search and rescue operations.[71] U.S. Coast Guard Air Station San Francisco transitioned to a helicopters-only unit in 1978.[72]

Historically, easements allowed non-U.S. Coast Guard aircraft to cross U.S. Coast Guard property to access airport facilities in the North Field. On October 22, 1990, the U.S. Coast Guard granted SFO a permanent taxiway and access road easement over a 2.2-acre site at the northwest corner of the U.S. Coast Guard Air Station property. Creation of this easement necessitated the demolition, relocation, or replacement of several facilities at the expense of the City. The gardener's shop, paint locker, compressed gas storage building, nose hangar foundation, and vehicle hoist were demolished. New facilities added at this time included two fuel dispensing hydrants (extant), two helicopter fueling/washdown ramps (extant), two standpipe risers for fire suppression, a diked fuel storage area, an underground fuel piping and utility conduit, a shop building (Building D, extant), a pyrotechnic storage building (Building I, demolished), fencing, and floodlighting.[73]

---

65 William H. Thiesen, "The Coast Guard's World War II Crucible," *Naval History Magazine* Vol. 30, No. 5 (October 2016), *https://www.usni.org/magazines/naval-history-magazine/2016/october/coast-guards-world-war-ii-crucible*, accessed November 3, 2020.

66 "1941: Coast Guard Air Station San Francisco Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1941-coast-guard-air-station-san-francisco-established/*, accessed September 29, 2020.

67 Doug Siegfried, "Seaplanes of San Diego Bay," *Coronado Times*, September 27, 2009, *https://coronadotimes.com/news/2009/09/27/seaplanes-of-san-diego-bay-by-cdr-doug-siegfried-usn-ret/*, accessed April 26, 2021.

68 Robert B. Workman, Jr., "Seaplanes and Offshore Operations: Rough Seas and Cigars," *United States Coast Guard Aviation History, https://cgaviationhistory.org/historical-narrative/rough-seas-and-cigars/#:~:text=Large%20seaplane%20open%20sea%20landing,in%201960%20ending%20an%20era*, accessed April 26, 2021.

69 "Rockrise and Watson, Architects (Partnership)," *Pacific Coast Architecture Database, http://pcad.lib.washington.edu/firm/2072/*, accessed November 3, 2020.

70 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 7.

71 Jean Andrew Snyder, "The Operational Impact of Relocating Coast Guard Air Station San Francisco to Hamilton Air Force Base," Master's thesis, Naval Postgraduate School, 1975, *https://archive.org/details/operationalimpac00snydpdf/mode/2up?q=hh-52A*.

72 "1941: Coast Guard Air Station San Francisco Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1941-coast-guard-air-station-san-francisco-established/*, accessed September 29, 2020.

73 Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 7.

A second relocation of the U.S. Coast Guard Air Station was proposed in 1995 when SFO offered to finance and construct a new U.S. Coast Guard air station facility. The U.S. Coast Guard ultimately decided that none of the proposed locations met the agency's needs. SFO concurrently withdrew the proposal citing a lack of sufficient funds.[74] Few physical changes have occurred since 2000. Buildings 1019F (Port Security Unit boat storage) and 1019G (public works building) replaced Building F in 2005, a gazebo was constructed in 2011, and a temporary hangar and BBQ shelter were constructed in 2012.

U.S. Coast Guard Air Stations on the Pacific Coast

The U.S. Coast Guard was established when the Revenue Cutter Service (in existence since 1863) merged with the U.S. Life Saving Service (in existence since 1785) in 1915. The U.S. Coast Guard absorbed the U.S. Lighthouse Establishment and Service (in existence since 1779) in 1939, completing the coastal authority that is known today as the U.S. Coast Guard.[75]

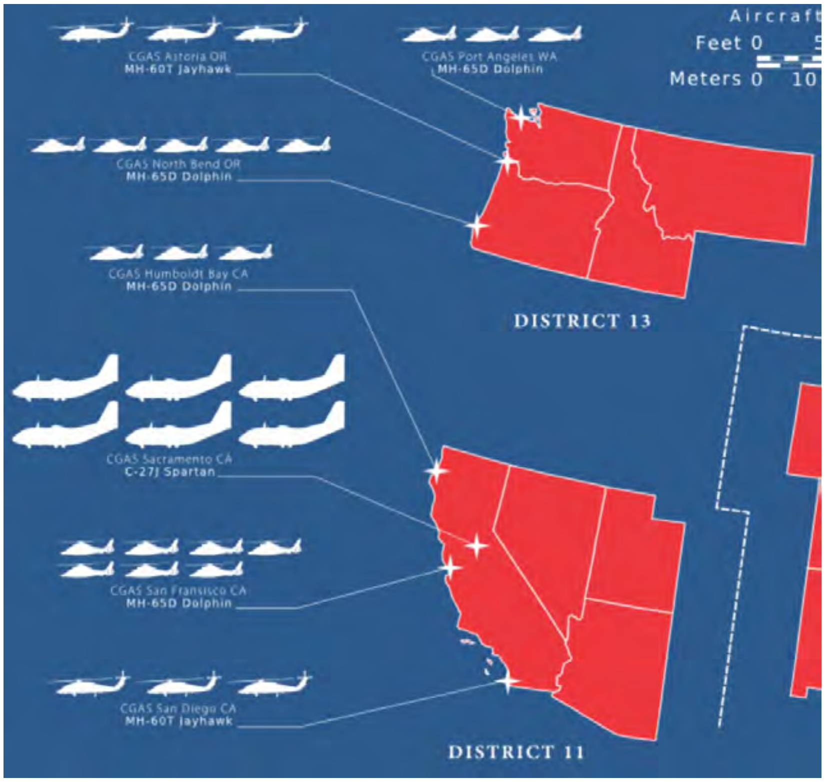
U.S. Coast Guard activities on the west coast fall under the command of U.S. Coast Guard Districts 11 and 13 (**Figure 39**). District 11, which is headquartered at Coast Guard Island in Alameda, California, oversees activities in California, Nevada, Utah, and Arizona and currently operates four air stations: U.S. Coast Guard Air Station San Diego (established in 1937), U.S. Coast Guard Air Station San Francisco (established in 1940), U.S. Coast Guard Air Station Humboldt Bay (established in 1977), and U.S. Coast Guard Air Station Sacramento (established in 1978).[76] District 13, which is headquartered in Seattle, Washington, oversees activities in Washington, Oregon, Idaho, and Montana and currently operates three air stations: U.S. Coast Guard Air Station Port Angeles (established in 1935), U.S. Coast Guard Air Station Astoria (established in 1964), and U.S. Coast Guard Air Station North Bend (established in 1974).

---

74 Ibid., 8.

75 National Park Service, A History of Service: The Origins of the U.S. Coast Guard, *https://www.nps.gov/piro/learn/historyculture/upload/USCGThreeAgencies.pdf*, accessed November 10, 2020.

76 USCG District 12 was disestablished in 1987 and was absorbed in its entirety by District 11. U.S. Department of Transportation / U.S. Coast Guard, *Realignment of Support and Management Functions in the United States Coast Guard,* February 1987, *https://media.defense.gov/2020/Nov/10/2002533026/-1/-1/0/1987_GILBERT_STUDY01-SM.PDF*, accessed November 10, 2020.



SOURCE: CIGeography (https://cigeography.blogspot.com), 2019

Figure 39
Listing of U.S. Coast Guard Air Stations and Aviation Forces in Districts 11 and 13, November 2019

District 11

U.S. Coast Guard Air Station San Diego was established in 1937 as the first U.S. Coast Guard air station in California. It has historically been located immediately south of San Diego International Airport (SAN; formerly known as Lindbergh Field). Twenty-three acres of tideland were deeded to the Federal Government from the City of San Diego in 1935, and land reclamation and construction of the air station began the following year.[77] The earliest buildings and structures were a hangar with a lean-to, mess hall, barracks building, two aircraft aprons, a runway to Lindbergh Field, and a wood seaplane ramp. A major rebuilding campaign was completed between 1972 and 1983.[78] In 1997, U.S. Coast Guard Air Station San Diego was recommended eligible for listing in the National Register, but it is not listed in either the National Register or California Register.[79] As of November 2019, U.S. Coast Guard Air Station San Diego operates three MH-60T Jayhawk helicopters.[80]

---

77 "1937: Coast Guard Air Station San Diego Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1937-coast-guard-air-station-san-diego-established/*, accessed September 29, 2020.

78 "Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Diego," *California State Military Museum*, *http://www.militarymuseum.org/cgassd.html*, accessed September 29, 2020.

79 California Office of Historic Preservation. Built Environment Resource Directory (BERD) for San Diego County, March 2020.

80 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html*, accessed November 3, 2020.

As discussed above, the land that is occupied by U.S. Coast Guard Air Station San Francisco was deeded to the Federal Government in 1939, and the air station was commissioned in November 1940. It was the second U.S. Coast Guard air station constructed in California and the third on the West Coast after the air stations in Port Angeles, Washington, and San Diego, California. As of November 2019, U.S. Coast Guard Air Station San Francisco operates six MH-65D Dolphin helicopters.[81]

U.S. Coast Guard Air Station Los Angeles was established in 1962 as an air detachment from U.S. Coast Guard Air Station San Diego.[82] It was relocated to Los Angeles International Airport (LAX) from 1987 to 2016. The air station officially closed in September 2016, at which time its component units (i.e., regular, reserve, auxiliary, and civilian personnel) were relocated to Naval Station Point Mugu near Oxnard and became a forward operating base (i.e., satellite) of U.S. Coast Guard Air Station San Francisco.[83]

U.S. Coast Guard Air Station Humboldt Bay (originally named U.S. Coast Guard Air Station Arcata) was commissioned in 1977 and is located in McKinleyville, California. Prior to 1977, air coverage was provided by U.S. Coast Guard Air Station San Francisco only during the summer season.[84] As of November 2019, the U.S. Coast Guard Air Station Humboldt Bay operates three MH-65D Dolphin helicopters, which is the same aircraft used by U.S. Coast Guard Air Station San Francisco,[85] and responds to missions along 250 miles of coastline from the Mendocino-Sonoma county line to the California-Oregon border.[86]

U.S. Coast Guard Air Station Sacramento was established in 1978 and is located at McClellan Airfield (formerly McClellan Air Force Base) north of Sacramento, California.[87,88] As of July 2019, it employs 203 active duty and civilian personnel, and operates six HC-27J Spartan medium-range surveillance aircraft, and deploys search-and-rescue resources to the entire west coast of the United States.[89] The former air force base is listed in the National Register and California Register, but the period of significance (1936–41) predates the establishment of U.S. Coast Guard Air Station Sacramento.[90]

81 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html*, accessed November 3, 2020.

82 "1962: Coast Guard Air Station Los Angeles Established," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1962-coast-guard-air-station-los-angeles-established/*, accessed September 29, 2020.

83 Nick Green, "Local Coast Guard Station to Shrink After Air Station Los Angeles at LAX Shuts in 2016," *Daily Breeze,* April 7, 2015, *https://www.dailybreeze.com/2015/04/07/local-coast-guard-station-to-shrink-after-air-station-los-angeles-at-lax-shuts-in-2016/*, accessed November 3, 2020.

84 "1977: Air Station/Group Humboldt Bay, California Commissioned," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1977-air-stationgroup-humboldt-bay-california-commissioned/*, accessed September 29, 2020.

85 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html*, accessed November 3, 2020.

86 "US Coast Guard Station Humboldt Bay," *Report to Base, https://report-to-base.com/branch/coastguard/humboldtbay/*, accessed November 3, 2020.

87 "1978: Coast Guard Air Station Sacramento Established," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1978-coast-guard-air-station-sacramento-established/*, accessed September 29, 2020.

88 "Historic California Posts, Camps Stations and Airfields: McClellan Air Force Base," *California State Military Museum, http://www.militarymuseum.org/McClellan AFB.html*, accessed September 29, 2020.

89 "Coast Guard Air Station Sacramento Welcomes New Commanding Officer," *Coast Guard News,* July 12, 2019, *https://coastguardnews.com/coast-guard-air-station-sacramento-welcomes-new-commanding-officer/2019/07/12/*, accessed November 3, 2020.

90 PAR & Associates, National Register of Historic Places Registration Form for the Sacramento Air Depot Historic District (Reference No. 91001969), August 31, 1998. Listed in the National Register in January 1992.

District 13

U.S. Coast Guard Air Station Port Angeles was the first U.S. Coast Guard air station on the Pacific Coast. It was commissioned in 1935 and has historically been located in Port Angeles, Washington. Due to its geographic location, U.S. Coast Guard Air Station Port Angeles performs search-and-rescue missions both in the water and in the Olympic Mountain Range.[91] In 1996, the administration building and hangar were determined individually eligible for listing in the National Register under Criteria A/C and A, respectively. A period of significance was not identified, and neither building is listed in either the National Register or the Washington Heritage Register. The entire air station was determined not eligible for listing in either register.[92] As of November 2019, the U.S. Coast Guard Air Station Port Angeles operates three MH-65D Dolphin helicopters, which is the same aircraft used by U.S. Coast Guard Air Station San Francisco,[93] and employs approximately 122 active duty, civilian, and auxiliary personnel.[94]

U.S. Coast Guard Air Station Astoria was established in 1964 at the former U.S. Naval Station Tongue Point in Astoria, Oregon. Since 1996, the air station has been located at the Warrenton-Astoria Regional Airport (AST) in Warrenton, Oregon.[95] As of November 2019, U.S. Coast Guard Air Station Astoria operates three MH-60T Jayhawk helicopters.[96] As of June 2003, the unit employed 67 active duty, 24 reserve duty, and one civilian personnel.[97]

U.S. Coast Guard Air Station North Bend was commissioned in 1974 following an increase in search-and-rescue activities along the Oregon coast during the 1960s and 1970s. It is located at the Southwest Oregon Regional Airport in North Bend, Oregon.[98] As of November 2019, U.S. Coast Guard Air Station North Bend operates five MH-65D Dolphin helicopters, which is the same aircraft used by U.S. Coast Guard Air Station San Francisco.[99]

SFO History

The 1998 evaluation concluded that the U.S. Coast Guard Air Station is significantly associated with the development of SFO. However, little historical context was presented, and this conclusion was not substantiated. The following brief history of SFO is provided to establish that the development of SFO was largely independent of the establishment and operation of the U.S. Coast Guard Air Station.

---

91 "1935: Coast Guard Air Station Port Angeles Established," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1935-cgas-port-angeles-established/*, accessed September 29, 2020.

92 Architectural Resources Group, Historic Property Inventory Forms for USCG Group Air Station Port Angeles Hangar (Property ID 3205) and Administration Building (Property ID 3206), October 3, 1996, *www.wisaard.dahp.wa.gov*, accessed November 3, 2020.

93 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html*, accessed November 3, 2020.

94 "Coast Guard Air Station & Sector Field Office Port Angeles," *Report to Base, https://report-to-base.com/branch/coastguard/angeles/#:~:text=Base%20Population,Sector%20Field%20Office%20Port%20Angeles*, accessed November 3, 2020.

95 "1964: Coast Guard Air Station Astoria Oregon Established," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1964-coast-guard-air-station-astoria-oregon-established/*, accessed September 29, 2020

96 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.htm*l, accessed November 3, 2020.

97 U.S. Coast Guard, "Group/Air Station Astoria" (press release), June 3, 2003, *https://www.pacificarea.uscg.mil/Portals/8/District_13/lib/doc/factsheet/sector_columbia_river.pdf*, accessed November 3, 2020.

98 "1974: Air Station North Bend Oregon Established," *United States Coast Guard Aviation History, https://cgaviationhistory.org/1974-air-station-north-bend-oregon-established/*, accessed September 29, 2020.

99 "U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, *https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html*, accessed November 3, 2020.

In March of 1927, San Francisco Supervisors opted to lease 150 acres from the Mills Estate to develop the City's future airport. The Mills Estate offered hundreds of acres of submerged land that airport engineers could later reclaim and develop immediately. On May 7, 1927, Mayor James Rolph dedicated the Mills Field Municipal Airport of San Francisco. The Airport opened in June of 1927, and for the next ten years it conducted business from a terminal building that "was little more than a two-room wooden shack."[100] None of the original Mills Field buildings remain at SFO.

By 1930, the City purchased 1,100 acres from the Mills Estate, and the next year the airfield became known as the San Francisco Municipal Airport. Between 1934 and 1935, the Works Progress Administration put 2,000 people into work-relief programs to lengthen and widen the runways. Hundreds of tons of dirt and rocks were carved from the nearby San Mateo hills, and approximately 319 acres of marsh and tidelands were filled.

During World War II, the U.S. Navy assumed control of the Airport and filled another 100 acres. Airport facilities in general were modified to meet military requirements. Apron areas were enlarged and strengthened to accommodate multi-engine military aircraft. It was during this period that the U.S. Coast Guard Air Station was constructed, commissioned, and in operation when the United States entered the war in December 1941. (See the detailed history of the air station above.)

By the end of World War II, the Airport had 700 acres in use with another 2,000 under development. By the end of the 1940s, the Old Bayshore Highway, which ran through the Airport lands, was abandoned and a new Bayshore Freeway (now U.S. Highway 101) was constructed farther to the west.

On August 27, 1954, a new terminal, then called the Central Terminal (now Terminal 2), was opened. The terminal employed a then-innovative two-level design. The upper level was for departures and the lower level for arrivals, each with dedicated terminal roadways. By 1963, the South Terminal (or Terminal 1) was completed. A central garage parking structure, which accommodated 2,700 vehicles, opened in 1965.

In 1979, the North Terminal (or Terminal 3) was completed. By 1979, the North Terminal with Boarding Area F was completed. The same year, the central garage was modified to provide an additional 4,150 parking stalls. Boarding Area E was completed in the North Terminal in 1981, and the annual passenger count exceeded 20 million.

In 1983, the Central Terminal (or Terminal 2) was extensively renovated, which included the addition of a new Boarding Area D with an inspections area to accommodate international passenger traffic. In 1988, the South Terminal (or Terminal 1) was renovated, and a new Boarding Area C was opened.

Beginning in 1996, an automated people mover system known as AirTrain was constructed to transport people between the three terminal buildings and the central parking garage. A new International Terminal was completed in early 2000 with additional public parking facilities and Bay Area Rapid Transit (BART) extension to provide public transit options for employees and passengers.[101]

---

100 Michael Svanevik, "Other Times – The Never-ending Story of the SF Airport," *The Times* (San Mateo Newspaper), December 15, 1989, C3, quoted in David Chávez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California,* February 1991, 15–19.

101 ESA, *Recommended Airport Development Plan, San Francisco International Airport, Historic Resources Evaluation, Part 1*. Prepared for San Francisco International Airport, 2018, 29.

The Central Terminal (Terminal 2), which closed to the public in 2000 following the completion of the new International Terminal, was renovated and reopened for use in 2011 as a domestic terminal. A complete renovation of Boarding Area E on the east side of Terminal 3 began in 2012, and the modernized facility opened to the public in 2015. Subsequently, a separate project to renovate the west side of Terminal 3 was developed with construction anticipated to occur from 2021 through 2023. The construction of a new Airport Traffic Control Tower located between Terminals 1 and 2 took place between 2012 and 2016, and large-scale renovations of Terminal 1 began in 2016 and are projected to conclude in 2024.

Architectural Styles of Buildings at U.S. Coast Guard Air Station San Francisco

Streamline Moderne and Moderne Styles

The oldest extant buildings at the U.S. Coast Guard Air Station – Buildings A/1019A and B/1019B – were designed in the Streamline Moderne Style, which was popular from roughly 1935 to 1950. Other extant ancillary buildings—Buildings G and J—were designed in the more modest Moderne Style. The following description of these styles is an excerpt from the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*:

> Described as a unique American style, Streamline Moderne is considered the first “modern” style to gain widespread acceptance in mainstream America. Streamline Moderne, also referred to as Art Moderne, Moderne, Modernistic, or Depression Modern, was a conscious architectural expression of the speed and sleekness of the Machine Age. The style referenced the aerodynamic forms of airplanes, ships, and automobiles of the period with sleek, streamline rounded corners and curves, and evoked a machine made quality. It evolved from the Art Deco movement and incorporated design elements associated with the International Style. Nationwide, construction in this style began in the 1930s and peaked around 1940. In San Francisco, the period of construction of Streamline Moderne buildings began in the mid-1930s and continued through to at least 1950. This period overlapped with the precipitous decline in building construction due to the impacts of the Depression and bans on non-war-related building construction enacted during World War II; as a result, relatively few buildings were constructed in the early iteration (pre-1945) of the Streamline Moderne. This style is most closely associated with small-scale residential development; it was not uncommon, however, for older commercial storefronts to be remodeled to incorporate elements of this popular style. Streamline Moderne was the dominant style promoted by the Federal Housing Administration in its storefront modernization campaigns begun in 1934. The style incorporated newly developed products such as Vitrolite glass and Carrara glass (tinted structural glass), decorative plastic laminates, porcelain enamel, extruded aluminum and stainless steel fittings and fixtures, ceramic veneer, glass block, and advancements in building technologies such as the ability to bend structural glass.
>
> A boxy version of the style, frequently referred to simply as Moderne or Art Moderne, incorporates many of the same features as Streamline Moderne, absent the curves. In addition, larger-scale public buildings, structures (such as walls and stairs), and sculpture constructed by New Deal federal agencies during the Depression era frequently utilized a stripped-down Moderne style.

[Character-defining features of the Streamline Moderne Style include:]

Primary

- Rounded corners and curved surfaces
- Curved railings and overhangs
- Speed lines (bands of horizontal piping, also known as “speed whiskers”)
- Curved glass windows or small porthole windows
- Horizontal ribbon windows
- Flat roof with coping at the roofline
- Smooth stucco or concrete wall surface, often painted white
- Wraparound windows at the corners
- Metal balconettes/railings, often curved
- General absence of historically derived ornamentation
- Horizontal orientation and asymmetrical façade

Secondary

- Glass block windows and walls
- Aluminum, stainless steel, chrome, and or wood used for door and window trim
- Towers and vertical projections, typically found on commercial or institutional buildings
- Awning or double-leaf garage door
- Curvilinear/geometric landscaping and/or hardscape, dyed concrete paving, typically found with residential buildings[102]

Brutalism

One extant building at the U.S. Coast Guard Air Station – Building C/1019C – was designed in the Brutalist Style, which was popular in San Francisco from about to 1960 to the early 1980s. The following description of the style is an excerpt from the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*:

> Brutalist buildings in San Francisco are massive in scale, often imposing, and represent a short-lived exploration of the expressive qualities of reinforced concrete. The style evolves from Le Corbusier’s 1940s–1950s experimentation with rough concrete in its crudest, most brutal form. The term Brutalism is derived from the French term “beton brut” or raw concrete. It was coined by English architects Alison and Peter Smithson in 1953. Brutalist buildings often incorporate large expanses of glass, however fenestration is often deeply recessed, resulting in shadowed windows that appear as dark voids. The plasticity of reinforced concrete allows for a myriad of shapes and forms, though repetitive angled geometries predominate. Concrete is poured on-site and left unpolished, often revealing the texture and grain of wood forms and small pebbles of the aggregate. Brutalist buildings in San Francisco can embody

[102] San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement,* 2011, 164-165.

the distinctive characteristics and high artistic values of a short-lived method of construction and design. The raw, expressive quality of Brutalist buildings are the antithesis of precision-machined glass and steel vertical boxes then dominating large-scale projects. Brutalist designs are considered a reaction against the slickness and anonymity of corporate "Miesian" glass curtain wall buildings.

A relatively inexpensive building material, reinforced concrete conveys a sense of permanence and stability. As such it was employed widely around the world in large-scale building projects during the 1950-1970s. Renowned Brutalist masterworks include Louis Kahn's Salk Institute in La Jolla and Le Corbusier's government complex in Chandigarh, India. It was widely used in college campuses during the 1950s–'70s; excellent examples include Paul Rudolph's (1958) Yale Art and Architecture Building and Walter Netsch's design for the University of Illinois-Chicago Circle Campus. Occasionally a building's interior functions, such as plumbing or electrical conduits, are left exposed, as at Wurster Hall, the architecture building at the University of California, Berkeley. Several large-scale Brutalist-inspired projects were constructed in San Francisco just outside of the period of Significance, including John Portman's Embarcadero Center (1967–81) and the Hyatt Regency Hotel (1973).

[Character-defining features of the Brutalist Style include:]

- Rough unadorned poured concrete construction
- Massive form and heavy cubic shapes
- Visible imprints of wood grain forms
- Recessed windows that read as voids
- Repeating geometric patterns
- Strong right angles and simple cubic forms
- Deeply shadowed irregular openings
- Rectangular block-like shape
- Precast concrete panels with exposed joinery[103]

Evaluations

The following section provides an evaluation of historic significance based on the site surveys and research and follows the California Register Criteria 1 through 4. The subject buildings and structures that are at least 45 years old at this writing (i.e., constructed in or before 1975) were evaluated individually, and they were also evaluated as to whether or not they could be contributors to a potential historic district.

Building A/1019A, Main Hangar (1939–40)

Criterion 1 (Events)

Research does not indicate that Building A/1019A is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or

[103] San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement,* 2011, 201-202.

the United States. Since its construction in 1939–40, the building has historically functioned primarily as a hangar for the storage and maintenance of U.S. Coast Guard aircraft. It is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station San Francisco. For these reasons, Building A/1019A does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that Building A/1019A is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the building, which has historically functioned primarily as a hangar for storage and maintenance of U.S. Coast Guard aircraft. For this reason, Building A/1019A does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

The U.S. Coast Guard Air Station, as a complex of buildings and structures, can be considered institutional architecture, as opposed to residential, commercial, industrial, or recreational. According to the evaluation criteria set forth in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, for an institutional building to be individually eligible for listing under Criterion 3, it "would typically be a notable, full expression of the Streamline Moderne or Moderne style, rather than a restrained version that incorporates only a few character-defining features."[104] Building A/1019A is a utilitarian building that exhibits some of the character-defining features of the Streamline Moderne Style, namely one rounded corner (the first floor of the southeast corner; the windows are not curved glass), horizontal ribbon windows (original fenestration has been replaced), flat roof with coping at the roofline (first floor only), smooth stucco cladding that has historically been painted a light color, wraparound windows at the northeast and southeast corners (first floor only), and general absence of historically derived ornamentation. Several of these features are discreet and not prominently located (e.g., the rounded corner and wraparound windows), and others have been altered (e.g., all original windows have been replaced). Overall, the building appears to be a restrained application of the Streamline Moderne Style that incorporates only a few character-defining features as identified in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*. As such, it does not possess high artistic values. Additionally, archival research indicates that the building was designed by the U.S. Coast Guard Civil Engineering Office in San Francisco and does not represent the work of a master.[105] Rather, it appears to be adapted from earlier designs for hangars located at other U.S. Coast Guard air stations around the country. Extant examples include those in San Diego, California (commissioned in 1937);[106] Brooklyn, New York (commissioned in 1938);[107] and Elizabeth City, North Carolina (commissioned in 1940).[108] For these reasons, Building A/1019A does not appear individually eligible for listing under California Register Criterion 3.

---

[104] San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, 2011, 170.

[105] "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April-July 1945), 34.

[106] "1937: Coast Guard Air Station San Diego Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1937-coast-guard-air-station-san-diego-established/*, accessed September 29, 2020.

[107] "1938: Coast Guard Air Station Brooklyn Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1938-coast-guard-air-station-brooklyn-established/*, accessed September 29, 2020.

[108] "1940: Coast Guard Air Station Elizabeth City Established," *United States Coast Guard Aviation History*, *https://cgaviationhistory.org/1940-coast-guard-air-station-elizabeth-city-established/*, accessed September 29, 2020.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building A/1019A has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Building B/1019B, Administration Building (1939–40)

Criterion 1 (Events)

Research does not indicate that Building B/1019B is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Since its construction in 1939–40, the building has had both residential and administrative functions, and it is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station San Francisco. For these reasons, Building B/1019B does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that Building B/1019B is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) A "wall of heroes" located inside Building B/1019B lists "Coast Guard aviators who have been recognized with prestigious operational aviation awards such as the Air Medal, Distinguished Flying Cross and Coast Guard Medal" and was dedicated in November 2016.[109] However, no individuals are directly and significantly associated with the building, which has had multiple functions since it was constructed: first as the original barracks for U.S. Coast Guard personnel and later as administration for the U.S. Coast Guard Air Station. For this reason, Building B/1019B does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

Building B/1019B is a residential-turned-administrative building that exhibits some of the character-defining features of the Streamline Moderne Style, namely one rounded corner (near the northwest corner; the windows are not curved glass) and rounded overhangs, horizontal ribbon windows (original fenestration has been replaced), porthole windows, a series of flat roofs with coping at the roofline, smooth stucco cladding that has historically been painted a light color, general absence of historically derived ornamentation, and horizontal orientation and asymmetrical façade. Building B/1019B embodies more distinctive characteristics than Building A/1019A, but because it was originally designed as a residential building, "particular attention should be given to retention of fenestration pattern, building form, cladding materials, and roofline features," as per guidance in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*.[110] Several character-defining features have been altered (e.g., all original windows have been replaced, original primary entrance on east façade has been reconfigured and spiral staircase and rooftop observation deck

---

[109] "Coast Guard Air Station San Francisco Celebrates 75 Years of Aviation," *Coast Guard News,* November 2, 2016, *https://coastguardnews.com/coast-guard-air-station-san-francisco-celebrates-75-years-of-aviation/2016/11/02/,* accessed November 3, 2020.

[110] San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement,* 2011, 166.

removed, building footprint has been enlarged). Overall, the building appears to be an altered example of a mid-size residential building with a restrained application of the Streamline Moderne Style that incorporates only a few character-defining features as identified by the planning department. As such, it does not possess high artistic values. Additionally, archival research indicates that the building was designed by the U.S. Coast Guard Civil Engineering Office in San Francisco and does not represent the work of a master architect.[111] For these reasons, Building B/1019B does not appear individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building B/1019B has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Building C/1019C, Port Security Unit 312 (Formerly Stonerock Barracks, ca. 1968–70)

Criterion 1 (Events)

Research does not indicate that Building C/1019C is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Since its construction ca. 1968–70 when it replaced an earlier barracks, the building has had both residential and administrative functions, and it is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station San Francisco. For these reasons, Building C/1019C does not appear individually eligible for listing under California Register Criterion 1. This finding is consistent with the previous U.S. Coast Guard determination and SHPO concurrence that Building C/1019C "has no strong associations with significant historical events."[112]

Criterion 2 (People)

Research does not indicate that Building C/1019C is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) It is possible that the building was named after Aviation Machinist's Mate First Class Petty Officer (AMM1) Leonard Stonerock, a U.S. Coast Guard pilot who was killed in a plane crash in 1941 after being stationed at the U.S. Coast Guard Air Station for less than six months.[113] Archival research did not confirm this association, but even if confirmed, the building was constructed decades after Stonerock's death, and it is not associated with his productive life. No individuals are directly and significantly associated with the building, which has had multiple functions since it was constructed: first as barracks for U.S. Coast Guard personnel from ca. 1970 to the mid-1980s and later as administration for the PSU 312 from 2006 to the present. Because both of these functions have been relatively brief in the history of the U.S. Coast Guard Air Station and many people have either resided or worked in the building, Building C/1019C does not appear individually eligible for listing under California Register Criterion 2.

---

[111] "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April-July 1945), 34.

[112] Cherilyn Widell (California State Historic Preservation Officer), concurrence letter to Susan L. Boyle (USCG), April 16, 1998 (re: USCG980318A). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

[113] "Huge Plane Crashes Off S.F., 3 Killed," *San Francisco Chronicle*, August 5, 1941, 1, 5.

This finding is consistent with the previous U.S. Coast Guard determination and SHPO concurrence that Building C/1019C "has no strong associations with significant historical […] persons."[114]

Criterion 3 (Design/Construction)

Building C/1019C is a residential-turned-administrative building that was constructed approximately 30 years after the first building campaign at the U.S. Coast Guard Air Station. It replaced an earlier barracks building in the same location and was designed in the Brutalist Style. According to the evaluation criteria set forth in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, for a Brutalist building to be individually eligible for listing under Criterion 3, it "would need to be designed in a high-style interpretation of the style. In addition, it would need to retain many of its character-defining features. While Brutalist buildings are somewhat rare in San Francisco, utilitarian versions that incorporated elements (i.e., poured reinforced concrete) of the style in order to expedite and lower the cost of construction are not considered architecturally significant."[115] Building C/1019C exhibits some of the character-defining features of the Brutalist Style, namely massive form and heavy cubic/block-like shapes, recessed first floor (on the two-story component) that reads as voids, repeating geometric patterns, strong right angles, and precast concrete panels (without exposed joinery). Despite its massive, cubic form and concrete construction, however, the concrete structure itself is not exposed, which is arguably the most important characteristic of Brutalism. Overall, the building appears to be a modest (as opposed to high-style) building with a restrained application of the Brutalist Style that incorporates only a few character-defining features as identified in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*. As such, it does not possess high artistic values.

One archival source suggests that Building C/1019C was designed by the San Francisco architectural firm of Rockrise & Watson; however, no citation is listed, and further research did not confirm this.[116] Significant extant buildings designed by Rockrise & Watson in the Brutalist Style include the Cathedral Boys School (1965; a component of Article 10 City Landmark No. 160)[117] and Fire Station No. 26 at 80 Digby Street (1963; recommended as individually eligible for listing in the California Register as "the only Brutalist building in [the] Diamond Heights [neighborhood] and […] an excellent expression of the architectural type").[118] George Rockrise is identified as a master architect in the *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*.[119] He had an illustrious career after his short-lived partnership with William Watson (1960–68), including earning 23 national and regional design awards as a partner of the ROMA Design Group.[120]

---

114 Cherilyn Widell (California State Historic Preservation Officer), concurrence letter to Susan L. Boyle (USCG), April 16, 1998 (re: USCG980318A). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

115 San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement,* 2011, 203.

116 "Rockrise and Watson, Architects (Partnership)," *Pacific Coast Architecture Database, http://pcad.lib.washington.edu/firm/2072/*, accessed November 3, 2020.

117 San Francisco Planning Commission, "Resolution No. 9917" (designating the Grace Cathedral Close as a landmark), January 12, 1984.

118 Hannah Lise Simonson. *Diamond Heights Draft Historic Context Statement.* Prepared for the San Francisco City and County Planning Department, 2016, 73, Appendix A-10.

119 San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement,* 2011, 259–261.

120 Jim Doyle, "George T. Rockrise" (obituary), *San Francisco Chronicle,* July 14, 2000, D6.

Assuming that Building C/1019C was in fact designed by Rockrise & Watson and in light of this context, it does not appear that the building is significant within the firm's oeuvre.

For these reasons, Building C/1019C does not appear individually eligible for listing under California Register Criterion 3. This finding is consistent with the previous U.S. Coast Guard determination and SHPO concurrence that Building C/1019C is not architecturally significant.[121]

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building C/1019C has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Building E, Pump House/Storage (1960)

Criterion 1 (Events)

Research does not indicate that Building E is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Since its construction in 1960, the building has had utilitarian functions, and it is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station. For these reasons, Building E does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that Building E is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the building, which has historically functioned as a mechanical and storage building. For this reason, Building E does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

Building E is a utilitarian building designed in a vernacular style. It does not embody the distinctive characteristics of a type, period, region, or method of construction; represent the work of a master; or possess high artistic values. For these reasons, Building E does not appear individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building E has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

---

[121] Cherilyn Widell (California State Historic Preservation Officer), concurrence letter to Susan L. Boyle (USCG), April 16, 1998 (re: USCG980318A). Appended to Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998.

Building G, Utility/Fuel/Repair/Storage Building (Ca. 1944)

Criterion 1 (Events)

Research does not indicate that Building G is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Since its construction ca. 1944, the building has had utilitarian functions, and it is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station. For these reasons, Building G does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that Building G is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the building, which has historically functioned as a utility building. For this reason, Building G does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

Building G is a utilitarian building designed in the Moderne Style. As a minor example of the style, it embodies few distinctive characteristics of a type, period, region, or method of construction. Nor does it represent the work of a master or possess high artistic values. For these reasons, Building G does not appear individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building G has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Building J, Utility/Sewage/Pump House (Ca. 1944–50)

Criterion 1 (Events)

Research does not indicate that Building J is individually associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Since its construction ca. 1944–50, the building has had utilitarian functions, and it is part of a larger complex of buildings and structures that were designed to operate together as U.S. Coast Guard Air Station. For these reasons, Building J does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that Building J is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the building, which has historically functioned as a utility building. For this reason, Building J does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

Building J is a utilitarian building designed in the Moderne Style and has been significantly altered. As a minor and altered example of the style, it embodies few distinctive characteristics of a type, period, region, or method of construction. Nor does it represent the work of a master or possess high artistic values. For these reasons, Building J does not appear individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because Building J has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Seaplane Ramp (1941)

Criterion 1 (Events)

From its construction in 1941 to ca. 1964, by which time the U.S. Coast Guard Air Station retired its entire fleet of seaplanes, the structure served the purely utilitarian function of moving amphibious aircraft between water and land, and it is part of a larger complex of buildings and structures that were designed to operate together as the U.S. Coast Guard Air Station. Additionally, the seaplane ramp was one component of related shoreline improvements constructed around Seaplane Harbor in the early 1940s to optimize its utility for the U.S. Coast Guard.

Seaplanes – and by extension the related infrastructure including seaplane ramps – were first observed around San Francisco Bay beginning in the 1910s. The first recreational seaplane ferry service between San Francisco was operated by Airy Ferry from May 1914 to November 1915,[122] and Air Ferries Ltd. offered commutes between Pier 5 in San Francisco to Jack London Square in Oakland, Vallejo, and Alameda from 1930 to 1933.[123] The subject seaplane ramp at the U.S. Coast Guard Air Station is not associated with the history of seaplane ferry services in the Bay Area.

In addition to the U.S. Coast Guard Air Station San Francisco, archival research identified several other military facilities in and around San Francisco that operated seaplanes in the early 20th century. These included: Crissy Field, which was designed as a combined land and seaplane base for the U.S. Army, and multiple seaplanes used one seaplane ramp that was constructed ca. 1921;[124] Naval Station Treasure Island, which operated both land and seaplanes and included two seaplane hangars and one seaplane ramp that were constructed before the Golden Gate International Exposition opened to the public in February 1939;[125] and Naval Air Station Alameda, which included four seaplane ramps built between 1939 and 1942.[126] All of these air bases and air stations are associated

[122] Katie Dowd, "The Short History of San Francisco's Coolest Commute: The Air Ferry," *SFGate*, October 27, 2016, *https://www.sfgate.com/bayarea/article/history-seaplane-air-ferry-San-Francisco-Oakland-10331533.php*, accessed April 21, 2021.

[123] Ibid.

[124] Stephen A. Haller (Golden Gate National Recreation Area), *The Last Word in Airfields: A Special History Study of Crissy Field, Presidio of San Francisco, California*, 1994, 57, *https://home.nps.gov/goga/learn/historyculture/upload/Last-Word-in-Airfields-Crissy-Field-vr2.pdf*, accessed April 20, 2021.

[125] Paul Freeman, "California: San Francisco Area," *Abandoned and Little-Known Airfields*, *http://www.airfields-freeman.com/CA/Airfields_CA_SanFran.htm*, accessed April 20, 2021.

[126] Iva Dean Myers, "New Airbase in Alameda," *Oakland Tribune*, May 23, 1940, S-17; "Work to Begin on Alameda Base Shops," *Oakland Tribune*, January 11, 1939, 13.

with military operations during World War II. While both Crissy Field, which is part of the Presidio of San Francisco National Historic Landmark, and the Naval Air Station Alameda, which is listed in the National and California Registers as a historic district, include seaplane ramps that contribute to the significance of each property, the respective seaplane ramps do not appear to have been individually evaluated for listing in the California Register.

Research does not indicate that the seaplane ramp, which is presumed to have been reconstructed after World War II, is individually associated with World War II or other events in the more recent past that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. For these reasons, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 1.

Criterion 2 (People)

Research does not indicate that the seaplane ramp is associated with the lives of persons important to local, California, or national history. (Design professionals are discussed under Criterion 3.) No individuals are directly and significantly associated with the structure, which functioned from 1941 to ca. 1978 as a component of the U.S. Coast Guard Air Station's shoreline infrastructure. For this reason, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 2.

Criterion 3 (Design/Construction)

The seaplane ramp is a utilitarian structure designed to be purely functional and does not represent any architectural style. Photographs from the 1940s show that it was originally composed of an even inclined plane that connected an upper level to a lower level, and the design of the seaplane ramp followed basic principles of physics. A review of archival sources indicates that the seaplane ramp's original design was altered in the early 1950s. The original creosoted timber piles were replaced with steel piles at an unknown date, and the inclined surface was reconstructed ca. 1951. The ramp's current materials – reinforced concrete and steel piles – were widely available in the mid-20th century and relatively inexpensive, and it is possible that they date to the 1950s. The combination of basic design elements and commonplace materials does not indicate that the seaplane ramp represents a significant variation, evolution, or transition of construction types, nor does it appear to have influenced later construction efforts at the U.S. Coast Guard Air Station or SFO. The ramp does not embody the distinctive characteristics of a type, period, region, or method of construction; represent the work of a master; or possess high artistic values. For these reasons, the seaplane ramp does not appear individually eligible for listing under California Register Criterion 3.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because the seaplane ramp has not yielded or is not likely to yield information important in history or prehistory, it does not appear individually eligible for listing under Criterion 4.

Historic District Considerations

As summarized above, the U.S. Coast Guard Air Station was determined to be eligible for listing as a historic district in the National Register in 1998 and subsequently listed in the California Register. The 1998 evaluation is

23 years old, and the historic district is being re-evaluated pursuant to current professional standards for continued eligibility for listing in the California Register, per California Public Resources Code Section 5024.1(g)(4).

Criterion 1 (Events)

ESA concurs with the previous evaluation that the U.S. Coast Guard Air Station is historically significant. Under Criterion 1, it is significant at the regional level for its association with the early history of the U.S. Coast Guard's presence on the Pacific Coast, as it was the third air station commissioned (1940) after those in Port Angeles (1935) and San Diego (1937). It is also significant at the national level as the first U.S. Coast Guard air station on the Pacific Coast constructed during wartime and in operation when the United States entered World War II in December 1941, since which time the U.S. Coast Guard Air Station has continuously manned search and rescue missions. For these reasons, the U.S. Coast Guard Air Station San Francisco appears to be eligible for listing as a historic district under Criterion 1. The period of significance is 1939–1945, which reflects the construction (ca. 1939–41) and commission (1940) of the U.S. Coast Guard Air Station and includes the construction of the three contributing buildings. These dates also represent the beginning and end of World War II. The three contributing buildings constructed during the period of significance are Building A/1019A, B/1019B, and G. All other buildings and structures constructed at the U.S. Coast Guard Air Station during World War II have been demolished or significantly altered after the period of significance (i.e., Building J and the seaplane ramp). For these reasons, they do not contribute to the significance of the historic district.

However, ESA does not concur with the previous evaluation regarding the significance of the U.S. Coast Guard Air Station's association with the development of SFO. The 150-acre Mills Field Municipal Airport of San Francisco (as SFO was originally known) opened for domestic commercial flights in 1927. That same year, the first of many land reclamation efforts began to enlarge the airport property. In 1930, the City purchased over 1,000 acres of the Mills Estate and renamed the airport as the San Francisco Municipal Airport. By the time the reclaimed land occupied by the U.S. Coast Guard Air Station was deeded to the Federal Government in 1939 and the U.S. Coast Guard Air Station was commissioned in 1940, the airport had grown significantly in area, contained three runways measuring over 3,000 feet in length, and had begun offering international commercial flights.[127] After the war had concluded in 1945, the airport continued to undergo significant development that was entirely independent of the U.S. Coast Guard's presence, as described under "SFO History" above. For these reasons, U.S. Coast Guard Air Station San Francisco does not appear eligible as a historic district under Criterion 1 for its association with the physical development of SFO.

Criterion 2 (People)

Archival research did not identify individuals who are significantly associated with the U.S. Coast Guard Air Station. The U.S. Coast Guard Historian's Office in Washington, D.C., maintains an online directory of notable

---

[127] David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco Airport Master Plan EIR,* 1990, 16–17.

U.S. Coast Guard personnel, and the following notable people served at the U.S. Coast Guard Air Station (listed in alphabetical order by last name):

- Vice Admiral Terry M. Cross, Commanding Officer (no dates provided, likely in recent decades).[128]
- Rear Admiral William A. Jenkins, aviator from ca. 1944 to ca. 1946. "He piloted aircraft on air-sea rescue missions, was in charge of flight crews engaged in RACON calibrating and LORAN accuracy checks, and was in charge of the station's air-sea rescue boats. In addition, he served as navigator and watch officer."[129]
- Rear Admiral William P. Kozlovsky, search and rescue pilot from 1960 to 1962.[130]
- Vice Admiral Charles E. Larkin, Jr., Commanding Officer from ca. 1970 to ca. 1973. During this time, "The air station received the Commandant's Unit Commendation and [Larkin] was awarded the Coast Guard Commendation Medal."[131]
- Vice Admiral William D. Shields, Commanding Officer from 1948 to 1951.[132]
- Rear Admiral Joseph R. Steele, aviator and Assistant Engineer Officer from ca. 1947 to 1949.[133]
- Rear Admiral Charles Tighe, Executive Officer from April 1944 to approximately June 1945. Additionally, he served as "Deputy Commander of an Air-Sea Rescue Task Unit, instructor and training officer, and on occasions acting Commanding Officer."[134]

All of these men had distinguished careers in the U.S. Coast Guard before and or/after their brief assignments at the U.S. Coast Guard Air Station. Although many men (and possibly some women) successfully operated the facility and its aircraft since it was commissioned in 1940, the U.S. Coast Guard Air Station is significant for the role it played in coastal search and rescue missions, rather than for its association with specific people. Therefore, U.S. Coast Guard Air Station San Francisco does not appear eligible as a historic district under Criterion 2.

Criterion 3 (Design/Construction)

ESA concurs with the previous evaluation that U.S. Coast Guard Air Station San Francisco is architecturally significant. However, rather than "representing a distinguishable entity whose components may lack individual distinction,"[135] ESA finds that the contributing buildings embody distinctive characteristics of the Streamline Moderne Style. In 1939, it was announced that "[m]odernistic lines will be followed in the architectural designs" for the earliest buildings constructed at the U.S. Coast Guard Air Station (i.e., Buildings A/1019A and B/1019B),[136] which were designed by the U.S. Coast Guard Civil Engineering Office in San Francisco.[137] The

---

[128] "Vice Admiral Terry M. Cross," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1778265/vice-admiral-terry-m-cross/*, accessed November 3, 2020.

[129] "Rear Admiral William A. Jenkins," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1879249/rear-admiral-william-a-jenkins/*, accessed November 3, 2020.

[130] "Rear Admiral William P. Kozlovsky," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1881083/rear-admiral-william-p-kozlovsky/*, accessed November 3, 2020.

[131] "Vice Admiral Charles E. Larkin, Jr.," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1881601/vice-admiral-charles-e-larkin-jr/*, accessed November 3, 2020.

[132] "Vice Admiral William D. Shields," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1778101/vice-admiral-william-d-shields/*, accessed November 3, 2020.

[133] "Rear Admiral Joseph R. Steele," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1911740/rear-admiral-joseph-r-steele/*, accessed November 3, 2020.

[134] "Rear Admiral Charles Tighe," *United States Coast Guard Historian's Office, https://www.history.uscg.mil/Browse-by-Topic/Notable-People/All/Article/1918475/rear-admiral-charles-tighe/*, accessed November 3, 2020.

[135] Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998, 11.

[136] San Francisco Public Utilities Commission, *Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939*, 187.

[137] "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April-July 1945), 34.

only other extant and intact building that was certainly constructed during the war years is Building G, which is of secondary importance compared to the much larger and more thoughtfully designed Buildings A/1019A and B/1019B. However, because all other buildings and structures constructed at the U.S. Coast Guard Air Station during World War II have been demolished, altered (i.e., Building J), or appear to have been reconstructed after the period of significance (i.e., seaplane ramp), Building G would contribute to the historic district because of the relative scarcity of contributors and because it is believed to reflect its original design. Furthermore, Buildings A/1019A, B/1019B, and G together represent the various functions of the U.S. Coast Guard Air Station and are concentrated along the taxiway, an original site feature that separated the operational buildings to the north from the administrative buildings to the south.

For these reasons, U.S. Coast Guard Air Station San Francisco appears eligible as a historic district under Criterion 3. The period of significance is 1939–1945, which reflects the construction (ca. 1939–41) and commission (1940) of the U.S. Coast Guard Air Station and includes the construction of the three contributing buildings. These dates also represent the beginning and end of World War II.

Criterion 4 (Information Potential)

Criterion 4 generally refers to a property's information and research potential in terms of archaeological values. Because the U.S. Coast Guard Air Station has not yielded or is not likely to yield information important in history or prehistory, it does not appear eligible as a historic district under Criterion 4.

Summary of Historic District Eligibility

In summary, U.S. Coast Guard Air Station San Francisco appears eligible as a historic district under Criterion 1 for its association with the early history of the U.S. Coast Guard's presence on the Pacific Coast, as the first U.S. Coast Guard air station on the Pacific Coast constructed during wartime and in operation when the United States entered World War II in December 1941, and for its continuously manned search and rescue missions. It also appears eligible under Criterion 3 as embodying distinctive characteristics of the Streamline Moderne Style. The three contributing buildings under both criteria are Buildings A/1019A, B/1019B, and G. The period of significance under both criteria is 1939–1945, which reflects the construction (ca. 1939–41) and commission (1940) of the U.S. Coast Guard Air Station and includes the construction of the three contributing buildings. These dates also represent the beginning and end of World War II.

Regarding the seaplane ramp, which was previously determined to be a contributor to the National Register-eligible historic district, ESA recommends that it no longer contributes to the significance of the U.S. Coast Guard Air Station under any criteria due to its lack of integrity (i.e., the ability of a property to convey its significance) and poor condition (i.e., assessment of the physical state of the property). Constructed in 1941, the seaplane ramp was the earliest structure built on Seaplane Harbor for use by the U.S. Coast Guard for launching and retrieving amphibious aircraft. As presented under the construction chronology of the seaplane ramp above, a review of historic photographs concludes that the inclined surface of the ramp was reconstructed at an unknown date ca. 1951, and the ramp was lengthened in 1953. Both of these alterations occurred after the period of significance. The subject seaplane ramp likely remained in use until ca. 1964, by which time the U.S. Coast Guard Air Station retired its entire fleet of seaplanes in favor of landplanes and helicopters. Over the course of subsequent decades, the seaplane ramp and the adjacent seawall became deteriorated. Because of the seaplane ramp's altered design and poor physical condition, the seaplane ramp does not appear to contribute to the significance of the California Register-eligible U.S. Coast Guard Air Station San Francisco historic district.

Integrity

In addition to being eligible for listing under at least one of the California Register significance criteria, a property must also retain sufficient integrity to convey its historical significance in order to be considered a historical resource. The California Register defines integrity as the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. As discussed above, none of the historic-age buildings or structures appear individually eligible under any California Register criteria; therefore, they do not have a period(s) of significance, and a discussion of integrity is not applicable. The U.S. Coast Guard Air Station appears eligible for listing as a historic district under California Register Criteria 1 and 3 with a period of significance of 1939–1945. According to National Park Service guidance, "For a district to retain integrity as a whole, the majority of the components that make up the district's historic character must possess integrity even if they are individually undistinguished. In addition, the relationships among the district's components must be substantially unchanged since the period of significance."[138] Additionally, "A component of a district cannot contribute to the significance if it has been substantially altered since the period of the district's significance."[139] The following integrity analysis is specific to the historic district.

The U.S. Coast Guard Air Station Historic District remains in its original location on the west side of Seaplane Harbor. Additionally, all of the individual buildings and structures remain in their original locations and have not been moved. The historic district therefore retains integrity of **location**.

SFO has undergone extensive development since the U.S. Coast Guard Air Station was constructed in the early 1940s. The air station has also been altered, including the demolition of at least six World War II-era buildings and structures, construction of new buildings since the 1960s, and the creation of a sizable easement at the northwest corner of the property in 1990. While the U.S. Coast Guard Air Station retains its overall layout and the buildings and structures retain their relative locations, the seaplane ramp has been physically separated from the rest of the air station since ca. 2004 when a chain-link fence was installed. Despite these changes, the U.S. Coast Guard Air Station remains a discreet collection of buildings and structures in a defined area adjacent to SFO that fronts Seaplane Harbor. For this reason, the U.S. Coast Guard Air Station Historic District retains integrity of **setting**.

The three buildings that contribute to the significance of the U.S. Coast Guard Air Station Historic District (i.e., Buildings A/1019A, B/1019B, and G) closely resemble their original 1940s-era architectural design, despite some alterations. Together they represent a group of institutional buildings that retain many character-defining features of the Streamline Moderne style, and the U.S. Coast Guard Air Station Historic District therefore retains integrity of **design**. All other buildings and structures constructed at the U.S. Coast Guard Air Station during World War II have been demolished or significantly altered after the period of significance (i.e., Building J and the seaplane ramp), and they do not retain integrity of design.

---

[138] National Park Service, *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, 1997, 46, *https://www.nps.gov/subjects/nationalregister/upload/NRB-15_web508.pdf*, accessed April 29, 2021.

[139] Ibid.

The three contributing buildings were constructed of reinforced concrete and steel, robust materials that were employed using simple, utilitarian techniques. There are few decorative details seen in the U.S. Coast Guard Air Station, which is reflective of the time period in which they were built and the government agency that used them. For these reasons, the U.S. Coast Guard Air Station Historic District retains integrity of **workmanship**. All other buildings and structures constructed at the U.S. Coast Guard Air Station during World War II have been demolished or significantly altered after the period of significance (i.e., Building J and the seaplane ramp), and do not retain integrity of workmanship.

Alterations to Buildings A/1019A and B/1019B are generally limited to replacement of windows and doors, removal of rooftop features, and structural repairs. This has resulted in the removal of some original materials and features of the contributing buildings. Additionally, all other World War II-era buildings and structures have been demolished (with the exception of Building G, a historic district contributor) or significantly altered after the period of significance (i.e., Building J and the seaplane ramp, which are non-contributors). Therefore, the U.S. Coast Guard Air Station Historic District does not retain integrity of **materials**.

The U.S. Coast Guard Air Station has been in continuous operation since it was commissioned in 1940, and the historic district therefore retains integrity of **association**. The seaplane ramp, a non-contributor to the historic district, was likely decommissioned by ca. 1964, and it has been physically separated from the rest of the air station since ca. 2004 when a chain-link fence was installed along the ramp's west edge. As a structure that is no longer functionally related to the rest of the working air station, the seaplane ramp does not retain integrity of association.

Lastly, the U.S. Coast Guard Air Station has had a continuous presence at SFO since the property was deeded to the Federal Government in 1939. Buildings A/1019A and B/1019B, the two oldest and most architecturally distinctive buildings, date to ca. 1940, and despite some alterations to the buildings and the property, continue to convey a strong sense of how the facility originally appeared and was historically experienced by the U.S. Coast Guard personnel. While the scale, stylistic expression, and function are quite different, Building G contributes to this historic sense of place. As such, the U.S. Coast Guard Air Station Historic District retains integrity of **feeling** as a military facility constructed in the 1940s.

Overall, U.S. Coast Guard Air Station San Francisco Historic District retains sufficient integrity to convey its significance.

Conclusion

Based on a site survey, archival research, and analysis, none of the extant historic-age buildings and structures that comprise U.S. Coast Guard Air Station San Francisco appear to be individually eligible for listing in the California Register under any criteria. However, the U.S. Coast Guard Air Station appears eligible as a historic district under Criteria 1 and 3 and would be considered a historical resource for the purposes of CEQA. The three buildings that contribute to the significance of the U.S. Coast Guard Air Station—Buildings A/1019A, B/1019B, and G—would also be considered historical resources.

Sources

Newspaper, Newsletter, and Journal Articles

"11th Cavalry Transferred to Mexican Border," *San Francisco Chronicle*, November 16, 1940, 2.

Caen, Herb, "Saturday Scrapbook," *San Francisco Chronicle*, February 15, 1941, 13.

"Coast Guard Air Station & Sector Field Office Port Angeles," *Report to Base*, accessed November 3, 2020 at https://report-to-base.com/branch/coastguard/angeles/#:~:text=Base%20Population,Sector%20Field%20Office%20Port%20Angeles.

"Coast Guard Air Station Nearer Reality," *San Francisco Chronicle*, May 8, 1940, 32.

"Coast Guard Air Station San Francisco Celebrates 75 Years of Aviation," *Coast Guard News*, November 2, 2016. Accessed November 3, 2020, at https://coastguardnews.com/coast-guard-air-station-san-francisco-celebrates-75-years-of-aviation/2016/11/02/.

Doyle, Jim, "George T. Rockrise" (obituary), *San Francisco Chronicle*, July 14, 2000, D6.

"F.D.R. Signs S.F. Plane Patrol Bill," *San Francisco Chronicle*, June 16, 1937, 34.

"Huge Plane Crashes Off S.F., 3 Killed," *San Francisco Chronicle*, August 5, 1941, 1, 5.

Myers, Iva Dean, "New Airbase in Alameda," *Oakland Tribune*, May 23, 1940, S-17.

"Navy Takes Over the Coast Guard," *San Francisco Chronicle*, November 3, 1941, 1.

"Seaplane Base at City Airport Held Doubtful," *San Francisco Chronicle*, December 2, 1937, 6.

"Seaplane Ramp to Be Extended," *San Mateo Times*, June 23, 1953, 8.

"S.F. Air Base Fund Approved," *San Francisco Chronicle*, June 8, 1938, 3.

"S.F. Deeds Air Base to Coast Guard," *San Francisco Chronicle*, June 6, 1939, 10. "U.S. Coast Guard," *Federal Architect*, Vol. 14, No. 1 (April–July 1945), 34.

"U.S. Coast Guard Aviation Forces," *CIGeography*, November 2019, accessed November 3, 2020, at https://cigeography.blogspot.com/2019/12/us-coast-guards-aviation-2019.html.

"US Coast Guard Station Humboldt Bay," *Report to Base*, accessed November 3, 2020 at https://report-to-base.com/branch/coastguard/humboldtbay/.

"Work to Begin on Alameda Base Shops," *Oakland Tribune*, January 11, 1939, 13.

Reports

Architectural Resources Group, Historic Property Inventory Forms for U.S. Coast Guard Group Air Station Port Angeles Hangar (Property ID 3205) and Administration Building (Property ID 3206), October 3, 1996. Accessed November 3, 2020, www.wisaard.dahp.wa.gov.

California State Parks Office of Historic Preservation. "Determination of Eligibility for Air Station San Francisco, San Mateo County" (DOE 38-98-0018-9999 re: U.S. Coast Guard 980828A). To Susan L. Boyle, United States Coast Guard, October 19, 1998.

Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998. On file at SFO.

David Chavez & Associates, *Cultural Resources Evaluation for the San Francisco International Airport Master Plan EIR, San Mateo County, California*, February 1991.

ESA, *Final Historic Resources Evaluation Part 1 for the Recommended Airport Development Plan, San Francisco International Airport*, prepared for the San Francisco Planning Department, June 2018.

PAR & Associates, National Register of Historic Places Registration Form for the Sacramento Air Depot Historic District (Reference No. 91001969), August 31, 1998. Listed in the National Register in January 1992.

"Report No. 665: Coast Guard Air Station, San Francisco Airport, San Francisco, Calif.," *Senate of the United States Committee and Subcommittee Assignments for the 75th Congress*, June 1, 1937. Accessed November 3, 2020, at https://www.google.com/books/edition/Report/jaKD85LvjLcC?hl=en&gbpv=0.

San Francisco Bay Conservation and Development Commission, "Re: Supplemental Listing of Pending Administrative Matters," December 12, 2003. Included in Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998. On file at SFO.

San Francisco Planning Commission, "Resolution No. 9917" (designating the Grace Cathedral Close as a landmark), January 12, 1984.

San Francisco Planning Department, *San Francisco Modern Architecture and Landscape Design 1935–1970 Historic Context Statement*, January 2011.

San Francisco Public Utilities Commission, *Report of the San Francisco Public Utilities Commission for Fiscal Year 1938–1939*, 187.

Simonson, Hannah Lise, *Diamond Heights Draft Historic Context Statement*, Prepared for the San Francisco City and County Planning Department, 2016, 73, Appendix A-10.

Snyder, Jean Andrew, "The Operational Impact of Relocating Coast Guard Air Station San Francisco to Hamilton Air Force Base," Master's thesis, Naval Postgraduate School, 1975, https://archive.org/details/operationalimpac00snydpdf/mode/2up?q=hh-52A.

Telamon Engineering Consultants, Inc. and AECOM, *San Francisco International Airport Shoreline Protection Program Conceptual Design Development Report Vol. 1*, March 30, 2018, 26–27.

U.S. Coast Guard Civil Engineering Unit Oakland, *Environmental Assessment for the Seawall Repairs at U.S. Coast Guard Air Station San Francisco*, prepared by the Environmental Co., December 2003. Included in Carey & Co., *Cultural Resources Survey: U.S. Coast Guard Air Station, San Francisco California*, July 1998. On file at SFO.

U.S. Department of Transportation / U.S. Coast Guard, *Realignment of Support and Management Functions in the United States Coast Guard*, February 1987, accessed November 10, 2020, at https://media.defense.gov/2020/ Nov/10/2002533026/-1/-1/0/1987_GILBERT_STUDY01-SM.PDF.

Unpublished

California Office of Historic Preservation, *Built Environment Resource Directory for Alameda County*, March 2020.

———, *Built Environment Resource Directory for San Francisco County*, March 2020.

———, *Built Environment Resource Directory for San Diego County*, March 2020.

———, *Built Environment Resource Directory for San Mateo County*, March 2020.

Travis, John R. (Damage Controlman Chief Petty Officer, U.S. Coast Guard Air Station San Francisco). Email to Johanna Kahn (ESA), June 8, 2021.

U.S. Coast Guard Civil Engineering Unit Oakland, Spreadsheet detailing all construction activity at U.S. Coast Guard Air Station from 1989 to October 2020. Provided by Lieutenant Erick D. Jackson (CEU Oakland) to Johanna Kahn (ESA), October 9, 2020.

Websites and Internet Databases

"1935: Coast Guard Air Station Port Angeles Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1935-cgas-port-angeles-established/.

"1937: Coast Guard Air Station San Diego Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1937-coast-guard-air-station-san-diego-established/.

"1938: Coast Guard Air Station Brooklyn Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1938-coast-guard-air-station-brooklyn-established/.

"1940: Coast Guard Air Station Elizabeth City Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1940-coast-guard-air-station-elizabeth-city-established/.

"1941: Coast Guard Air Station San Francisco Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1941-coast-guard-air-station-san-francisco-established/.

"1962: Coast Guard Air Station Los Angeles Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1962-coast-guard-air-station-los-angeles-established/.

"1964: Coast Guard Air Station Astoria Oregon Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1964-coast-guard-air-station-astoria-oregon-established/.

"1974: Air Station North Bend Oregon Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1974-air-station-north-bend-oregon-established/.

"1977: Air Station/Group Humboldt Bay, California Commissioned," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1977-air-stationgroup-humboldt-bay-california-commissioned/.

"1978: Coast Guard Air Station Sacramento Established," *United States Coast Guard Aviation History*, accessed September 29, 2020, https://cgaviationhistory.org/1978-coast-guard-air-station-sacramento-established/.

"Coast Guard Air Station Sacramento Welcomes New Commanding Officer," *Coast Guard News*, July 12, 2019, accessed November 3, 2020, at https://coastguardnews.com/coast-guard-air-station-sacramento-welcomes-new-commanding-officer/2019/07/12/.

Dowd, Katie, "The Short History of San Francisco's Coolest Commute: The Air Ferry," *SFGate*, October 27, 2016, accessed April 21, 2021, at https://www.sfgate.com/bayarea/article/history-seaplane-air-ferry-San-Francisco-Oakland-10331533.php.

Freeman, Paul, "California: San Francisco Area," *Abandoned and Little-Known Airfields*, accessed April 20, 2021, at http://www.airfields-freeman.com/CA/Airfields_CA_SanFran.htm.

Green, Nick, "Local Coast Guard Station to Shrink After Air Station Los Angeles at LAX Shuts in 2016," *Daily Breeze*, April 7, 2015. Accessed November 3, 2020, at https://www.dailybreeze.com/2015/04/07/local-coast-guard-station-to-shrink-after-air-station-los-angeles-at-lax-shuts-in-2016/.

Haller, Stephen A. (Golden Gate National Recreation Area), *The Last Word in Airfields: A Special History Study of Crissy Field, Presidio of San Francisco, California*, 1994, accessed April 20, 2021, at https://home.nps.gov/goga/learn/historyculture/upload/Last-Word-in-Airfields-Crissy-Field-vr2.pdf.

"Historic California Posts, Camps Stations and Airfields: McClellan Air Force Base," *California State Military Museum*, accessed September 29, 2020, http://www.militarymuseum.org/McClellan AFB.html.

"Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Francisco," *California State Military Museum*, accessed September 29, 2020, http://www.militarymuseum.org/cgassf.html.

"Historic California Posts, Camps Stations and Airfields: Coast Guard Air Station, San Diego," *California State Military Museum*, accessed September 29, 2020, http://www.militarymuseum.org/cgassd.html.

National Park Service, *A History of Service: The Origins of the U.S. Coast Guard*, accessed November 10, 2020, at https://www.nps.gov/piro/learn/historyculture/upload/U.S. COAST GUARDThreeAgencies.pdf.

———, *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, 1997, 46, accessed April 29, 2021, at https://www.nps.gov/subjects/nationalregister/upload/NRB-15_web508.pdf.

Ogden Environmental and Energy Services, Inc., *Historic American Buildings Survey: Naval Air Station North Island Seaplane Ramps, Nos. 2, 3, and 4* (HABS No. CA-2652-B), October 1995, accessed April 20, 2021, at https://tile.loc.gov/storage-services/master/pnp/habshaer/ca/ca2100/ca2170/data/ca2170data.pdf.

"Rear Admiral Charles Tighe," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1918475/rear-admiral-charles-tighe/.

"Rear Admiral Joseph R. Steele," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1911740/rear-admiral-joseph-r-steele/.

"Rear Admiral William A. Jenkins," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1879249/rear-admiral-william-a-jenkins/.

"Rear Admiral William P. Kozlovsky," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1881083/rear-admiral-william-p-kozlovsky/.

"Rockrise and Watson, Architects (Partnership)," *Pacific Coast Architecture Database*, accessed November 3, 2020, at http://pcad.lib.washington.edu/firm/2072/

Siegfried, Doug, "Seaplanes of San Diego Bay," *Coronado Times*, September 27, 2009, accessed April 26, 2021, at https://coronadotimes.com/news/2009/09/27/seaplanes-of-san-diego-bay-by-cdr-doug-siegfried-usn-ret/.

Treasury and Post Office Departments Appropriation Bill, Fiscal Year 1939, Supplemental Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives, 75th Congress (Washington, DC: U.S. Government Printing Office, 1938), accessed April 29, 2021, https://www.google.com/books/edition/Hearings/zB10H_I3MWkC?hl=en&gbpv=1&bsq=%22seaplane%20ramp%22.

U.S. Coast Guard, "Group/Air Station Astoria" (press release), June 3, 2003, accessed November 3, 2020, https://www.pacificarea.U.S. Coast Guard.mil/Portals/8/District_13/lib/doc/factsheet/sector_columbia_river.pdf.

U.S. Coast Guard Pacific Area, "Coast Guard Port Security Unit 312 To Hold Change-of-Command Ceremony," June 7, 2019. Accessed September 29, 2020. https://content.govdelivery.com/accounts/USDHSCG/bulletins/240295a.

"Vice Admiral Charles E. Larkin, Jr.," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1881601/vice-admiral-charles-e-larkin-jr/.

"Vice Admiral Terry M. Cross," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1778265/vice-admiral-terry-m-cross/.

"Vice Admiral William D. Shields," *United States Coast Guard Historian's Office*, accessed November 3, 2020, at https://www.history.U.S. Coast Guard.mil/Browse-by-Topic/Notable-People/All/Article/1778101/vice-admiral-william-d-shields/.

Workman, Jr., Robert B., "Seaplanes and Offshore Operations: Rough Seas and Cigars," *United States Coast Guard Aviation History*, accessed April 26, 2021, at https://cgaviationhistory.org/historical-narrative/rough-seas-and-cigars/#:~:text=Large%20seaplane%20open%20sea%20landing,in%201960%20ending%20an%20era.

APPENDIX C.2

Memorandum to File

San Francisco Planning
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103
628.652.7600
www.sfplanning.org

MEMORANDUM TO FILE

Date: November 30, 2021

To: Michael Li, Senior Environmental Planner
(628) 652-7538
Michael.J.Li@sfgov.org

From: Charles Enchill, Preservation Planner
(628) 652-7551
Charles.Enchill@sfgov.org

Justin Greving, Senior Preservation Planner
(628) 652-7553
Justin.greving@sfgov.org

Reviewed by: Allison Vanderslice
(628) 652-7505
Allison.Vanderslice@sfgov.org

Re: **SFO Shoreline Protection Program (SPP)**
Case No. **2020-004398ENV**

The proposed project consists of various shoreline protection improvements throughout Reaches 1-15 at San Francisco International Airport. Specifically, the proposed work involves a combination of concrete walls and steel king and sheet pile walls, some with armor rock revetments and/or soil fill; reconstruction of nine stormwater outfalls above the previously mentioned wall; vehicle service road relocation; new private roadway; and lighting trestle reconstruction. Reach 16 work was reviewed at the programmatic level.

Preservation staff has reviewed the Historic Resource Evaluation (HRE) dated November 2021 by ESA and staff concurs with the findings of the HRE. The HRE evaluated age-eligible buildings and structures that currently meet (in 2021) or will meet by the full build-out of the SPP (anticipated complete in 2032) the 45-year age criterion and were within a 100-foot buffer of the project site. The HRE identified no new age-eligible historic resources (see Table 1 of the HRE). The HRE determined the following properties are not historic resources for the purpose of CEQA: Building 918 and 922 (associated with Mel Long Treatment Plant), Building 1080 (Field Lighting Building

No. 2), and various stormwater infrastructure structures. The HRE also evaluated a number of age-eligible buildings within 100 feet of the construction staging area Plot 16 D (also shown in Table 1 of the HRE); buildings at the following South San Francisco addresses were determined to not be historic resources: 160 Beacon Street, 168 Beacon Street, 182 Beacon Street, 192 Beacon Street, and 508 South Airport Boulevard. Properties and structures previously identified in 1998 as part of the U.S. Coast Guard Air Station San Francisco Historic District (adjacent to Reach 4), have been re-evaluated according to current professional standards and are captured within Appendix A of the HRE.[1] Preservation staff concurs with the findings of the re-evaluation.

Additionally, preservation staff has reviewed and confirms the historic resources evaluation presented in HRE Table 2 associated with Reach 16. Planning Department preservation staff has reviewed the West Field Cargo Redevelopment Project Cultural Resources Survey Report by ESA dated April 2021 and has determined that Buildings 602, 606, 612, 624, 710, 730 and 750 are not historic resources for the purpose of CEQA review.

[1] Re-evaluation of U.S. Coast Guard Air Station San Francisco for Eligibility for Listing in the California Register of Historical Resources, 2021, Table 2: Updated Inventory.

APPENDIX D.1

Noise Technical Memorandum

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900 phone
415.896.0332 fax

esassoc.com

Technical Memorandum

date December 15, 2021

to Michael Li, San Francisco Planning Department

from Chris Sanchez, ESA

cc David Kim, San Francisco International Airport

subject SFO Shoreline Protection Program Noise Technical Memorandum – Final

1. Project Description

The project sponsor, San Francisco International Airport (SFO or Airport), proposes to implement the San Francisco International Airport (SFO or Airport) Shoreline Protection Program (proposed project) to address flood protection against a 100-year flood event and future sea-level rise for the expected lifespan of the shoreline improvements. The proposed project would install new shoreline protection infrastructure that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection and incorporate protection for future sea-level rise. The proposed project would remove the existing shoreline protection structures and would construct a new shoreline protection system comprised of a combination of concrete walls and steel sheet pile walls. These structures would vary from reach to reach, depending on the existing site characteristics, and would range in height from approximately 3.9 to 13.5 feet above the existing ground for the steel sheet pile and concrete walls, given that the elevation and slope of the ground varies for each reach. In total, the proposed project would construct an approximately 55,550 feet (10.5 miles) new shoreline protection system, which would require approximately 26 acres of open water fill in the San Francisco Bay (bay) for various reaches and impact approximately 3 acres of wetland areas.

The Airport's shoreline and western landside boundary are divided into 16 reaches[1] based on shoreline orientation, existing protection type, existing foreshore[2] conditions, and existing landside conditions (see **Figure 1**). The proposed project would construct a new shoreline protection system for 15 of the reaches to eliminate the probability of substantial inundation at the Airport through 2085.

In order to address landside flood protection, Reach 16, which would be located along the western perimeter of the Airport east of U.S. 101, may be required to form a continuous, closed flood protection system. However, Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae, located to the north and south of the Airport, respectively. As such, while Reaches 1–15 will be analyzed at the project level, the analysis of the landside Reach 16 will be analyzed at a program level.

---

[1] A *reach* is defined as a longshore segment of a shoreline where influences and impacts, such as wind direction, wave energy, littoral transport, etc., mutually interact.

[2] The *foreshore* refers to the area between low and high tide along the shoreline.

SOURCE: SFO, 2021

FIGURE 1
PROJECT SITE AND CONSTRUCTION STAGING AREAS

1.1 Other Proposed Project Components

As part of construction of the proposed project, nine of the 10 stormwater outfalls located on Airport property also would be raised over the height of the proposed wall to ensure their functionality in tandem with the shoreline protection program system. Raising the stormwater outfalls would require cutting the outfalls on the landside of the proposed wall and installing one or two additional concrete piles in the bay, depending on the reach, to a maximum depth of approximately 80 feet. The outfalls would then rest and extend over the proposed wall and slope down to reconnect with the outfalls on the bay side of the shoreline protection program system. In addition, two seaplane ramps, including one in Reach 3 and one in Reach 4, are slated for demolition as part of the proposed project.

The vehicle service road (VSR) along Sub-reach 7C, as well as Reaches 8, 9, 10, 11, 13, and 14, would be relocated to meet existing Federal Aviation Administration (FAA) Taxiway and Taxilane Object-Free Area (TOFA) standards.[3] The relocated VSRs would be shifted towards the San Francisco Bay, away from the existing taxiways to maintain a required separation distance of 193 feet per FAA design standards, and would have a new shoulder. The relocated VSRs would have two 12-foot lanes (one for each direction) and a 12-foot shoulder, resulting in a total width of 36 feet. The existing VSR along a portion of Sub-reach 7C and the entirety of Reaches 8, 9, 10, 11, 13, and 14 would be removed and backfilled with open water fill.

The proposed project would include a new non-publicly accessible road along the alignment of Reach 2, east of the Mel Leong Wastewater Treatment Plant, to support fire safety capabilities for the wastewater treatment facility and allow for greater connectivity of the roadways on Airport property. Finally, in order to accommodate construction of Sub-reach 7B, the existing lighting trestle at the end of Runway 19L would be demolished, and a new lighting trestle would be constructed in the same location and at the same elevation of the proposed double sheet pile wall. The proposed project would install new, longer composite or plastic lumber piles in the bay and reconstruct the lighting trestle platform, which would be approximately 4.5 feet taller than the current platform.

1.2 Project Construction

Construction of Reaches 1 through 15 would begin in 2025 and completion is anticipated by 2032, for a total 7-year construction period. However, for purposes of a conservative analysis, this technical memorandum considers an accelerated construction timeline of approximately 6.5 years (June 2025 to November 2031) to analyze the worst-case scenario with regard to overlapping construction activity. For the accelerated construction schedule, project construction would generally occur in two phases; however, to ensure a seamless construction process, simultaneous construction of non-contiguous reaches is anticipated to occur and work in adjacent reaches is anticipated to overlap. The first construction phase would begin at Reach 7, proceed with Reach 2, move east toward Reach 6, and conclude at Reach 1. With the exception of Reach 7, which is anticipated to be completed in early 2028 for the accelerated schedule, the first phase of construction is anticipated to be completed by mid-2027. The second construction phase would begin with Reach 15, then Reach 14 would follow. Construction of Reach 8 would begin shortly before Reach 14 is complete, and the remaining reaches (Reaches 13–9) would be constructed in reverse numerical order (see **Table 8,** Table 8 Construction Schedule, p. 18).

---

[3] The *taxilane object-free area* is a clearing standard to prohibit service vehicle roads, parked aircraft, and other objects, except for objects that need to be located in the object-free area for air navigation or aircraft ground maneuvering purposes.

Construction activities would occur at eight staging areas, six of which are located at the Airport (see Figure 1). The Aviador Lot, the largest construction staging area, is located on Airport property west of U.S. 101 in the City of Millbrae and Plot 16D is located on Airport property north of the U.S. 101/I-380 Interchange in the City of South San Francisco. Construction activities associated with the shifting of the VSRs would include: site preparation (clearing, grubbing, excavation, grading/road preparation); backfilling of sand; and grading.

2. Characteristics of Noise and Vibration

2.1 Noise Principles and Descriptors

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise is defined as unwanted sound. The sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level is measured in decibels (dB), with 0 dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. Because sound pressure can vary greatly within the range of human hearing, a logarithmic loudness scale is used to keep sound intensity numbers at a convenient and manageable level.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequency spanning 20 to 20,000 Hz.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. When assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting is typically applied to community noise measurements. All noise levels presented in this report are A-weighted unless otherwise stated.

2.2 Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time. A noise level is a measure of noise at a given period of time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic. What makes community noise variable throughout a day, besides the slowly changing background noise, is the addition of short-duration, single-event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment change the community noise level from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise effects. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

L_{eq}: The L_{eq}, or equivalent sound level, is used to describe noise over a specified period of time in terms of a single numerical value; the L_{eq} of a time-varying signal and that of a steady signal are the same if they deliver the same acoustic energy over a given time. The L_{eq} may also be referred to as the average sound level.

L_{max}: The maximum, instantaneous noise level experienced during a given period of time.

L_{90}: The level of noise exceeded 90 percent of the time is sometimes conservatively considered as the background ambient noise level for the purposes of assessing conformity with noise ordinance standards with respect to noise from stationary equipment or entertainment venues.

L_{dn}: Also termed the day-night average noise level (DNL), the L_{dn} is the average A-weighted noise level during a 24-hour day, obtained after an addition of 10 dB to measured noise levels between the hours of 10 p.m. to 7 a.m. to account for greater nighttime noise sensitivity.

CNEL: CNEL, or Community Noise Equivalent Level, is the average A-weighted noise level during a 24-hour day that is obtained after an addition of 5 dB to measured noise levels between the hours of 7 p.m. to 10 p.m. and after an addition of 10 dB to noise levels between the hours of 10 p.m. to 7 a.m. to account for greater noise sensitivity in the evening and nighttime, respectively.

2.3 Effects of Noise on People

Noise is generally loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity that is a nuisance or disruptive. The effects of noise on people include subjective effects (e.g., dissatisfaction, annoyance), interference effects (e.g., communication, sleep, and learning interference), physiological effects (e.g., startle response), and physical effects (e.g., hearing loss). With regard to increases in A-weighted noise level, the following relationships generally occur:

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived;
- Outside of the laboratory, a 3 dB change in noise levels is considered to be a barely perceivable difference;
- A change in noise levels of 5 dB is considered to be a readily perceivable difference; and
- A change in noise levels of 10 dB is subjectively heard as doubling of the perceived loudness.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence the decibel scale was developed. Since the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dB, the combined sound level would be 53 dB, not 100 dB.

2.4 Fundamentals of Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Several different methods are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe physical vibration effects on buildings. Typically, groundborne vibration generated by human activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors to vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick people), and vibration-sensitive equipment.

Another useful vibration descriptor is known as vibration decibels or VdBs. VdBs are generally used when evaluating human response to vibration, as opposed to structural effects (for which PPV is the more commonly used descriptor). Vibration decibels are established relative to a reference quantity, typically 1×10^{-6} inches per second (in/sec).[4]

The effects of groundborne vibration include movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In limited cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting, use of vibratory equipment, and pile-driving during construction. Annoyance from vibration often occurs when the vibration levels exceed the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The Federal Transit Administration (FTA) measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV.[5]

A vibration velocity level of 75 VdB is considered the approximate threshold between barely perceptible and distinctly perceptible levels for many people.

3. Environmental Setting

3.1 Existing Ambient Noise Levels

The project site is generally bordered by U.S. 101 to the west and San Francisco Bay to the east and is primarily located in unincorporated San Mateo County, California, with portions of the Airport within the city boundaries of South San Francisco to the north and Millbrae to the south (see Figure 1, p. 2).

The study area for the proposed project vicinity consists primarily of commercial hotel uses to the south, residential uses to the west across U.S. 101 in the Cities of Millbrae and San Bruno, and industrial uses to the north in the City of South San Francisco. To characterize the background noise environment for sensitive receptors[6] in the project vicinity, a combination of data was collected including ground-level noise monitoring data from SFO, supplemented with long-term (24 hours) and short-term (20 minutes) noise monitoring conducted by ESA (see **Figure 2**). Short-term measurements were collected in the project area in October of 2019 and updated at some locations in 2021.[7]

SFO operates a network of noise monitoring sites that measure aircraft noise throughout the vicinity of the Airport Influence Area,[8] including San Mateo County as a whole. Long-term data from SFO monitoring stations were collected in 2019 prior to Covid-19 shelter-in-place orders and the associated economic downturn, which have affected local roadway volumes and aircraft operations (the primary noise sources in the area). Therefore, to supplement the existing data collected by SFO, ESA conducted one long-term (24 hour or more) sound level measurement across the street from the Westin Hotel[9] (LT-3) adjacent the project site from February 8, 2021 (Monday), to February 10, 2021 (Wednesday). The purpose of this measurement was to determine the existing noise levels in the immediate project vicinity of the closest noise sensitive receptor to the proposed construction activity

---

4 U.S. Department of Transportation, Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment*, September 2018.

5 Ibid.

6 Some land uses are more sensitive to noise levels due to the types of activities typically associated with those uses. Residences, hotels, schools, daycare facilities, senior care facilities, and hospitals are generally more sensitive to increases in noise levels than commercial and industrial land uses, and therefore are considered sensitive receptors.

7 All monitoring was conducted using a Larson Davis LxT sound level meter, which was calibrated prior to use and operated according to the manufacturer's specifications.

8 The Airport Influence Area are boundaries that define areas where height, noise, overflight and safety standards, policies, and criteria are applied to certain proposed land use policy actions.

9 Hotels are a commercial land use that is not considered noise sensitive during daytime hours; however, as a location where people are reasonably expected to sleep, they are considered a noise sensitive receptor during nighttime hours.

SOURCE: Google, 2020; ESA, 2021

SFO Shoreline Protection Program

FIGURE 2

NOISE MONITORING LOCATIONS

that would occur with implementation of the proposed project (see following section identifying sensitive receptors). Additionally, short-term (20-minute) measurements were collected at roadside locations, as shown in Figure 2, where off-site sensitive receptors may be impacted by construction haul and delivery trucks, and at the nearest off-site sensitive receptors to proposed daytime construction work along Reach 1 and Reach 16 (ST-5, ST-6, and ST-7). A short-term measurement also was conducted at the Grand Hyatt at SFO, the only sensitive receptor located on the project site. Measurement locations are indicated on Figure 2 (see Appendix A for noise measurement data). A summary of noise measurement results is presented in **Table 1**. Long-term data from the SFO locations in Table 1 are from weekend days and mid-weekdays (Tuesdays and Wednesdays), which were selected to represent typical weekly variations in travel patterns. As shown in Table 1, noise measurements indicate that daytime noise levels in the study area range from 58 to 73 dBA, while nighttime noise levels range from 56 to 68 dBA. Noise sources vary by monitoring location, but generally consist of aircraft operations and vehicle traffic on highways and local roadways.

TABLE 1
SUMMARY OF LONG-TERM (LT) AND SHORT-TERM (ST) NOISE MONITORING ON THE PROJECT SITE AND VICINITY (DBA)

	Measurement Location	Time Period	Average Ldn or Leq	Audible Noise Sources
Long-Term Measurements (24 hours or more)				
LT-1	San Bruno. 4th Avenue between San Bruno Avenue and Walnut Street	Saturday 10/16/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 68 dBA (Leq) 68 dBA (Leq) 68 dBA (Leq) 74 dBA (Ldn)	Aircraft and vehicle traffic on I-380, U.S.101 and local roadways
LT-1	San Bruno. 4th Avenue between San Bruno Avenue and Walnut Street	Sunday 10/17/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 69 dBA (Leq) 70 dBA (Leq) 66 dBA (Leq) 73 dBA (Ldn)	Aircraft and vehicle traffic on I-380, U.S.101 and local roadways
LT-1	San Bruno. 4th Avenue between San Bruno Avenue and Walnut Street	Wednesday 10/20/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 68 dBA (Leq) 68 dBA (Leq) 67 dBA (Leq) 73 dBA (Ldn)	Aircraft and vehicle traffic on I-380, U.S.101 and local roadways
LT-3	Millbrae. Old Bay shore Highway, across from Westin Hotel	Tuesday 2/9/21 Daytime: Evening: Nighttime: 24-hour Ldn: 24-hour L90:	 65 dBA (Leq) 65 dBA (Leq) 61 dBA (Leq) 68 dBA (Ldn) 51 dBA (L90)	Aircraft and vehicle traffic on Old Bayshore Highway and U.S. 101
LT-3	Millbrae. Old Bay shore Highway, across from Westin Hotel	Wednesday 2/10/21 Daytime: Evening: Nighttime: 24-hour Ldn: 24-hour L90:	 69 dBA (Leq) 66 dBA (Leq) 62 dBA (Leq) 71 dBA (Ldn) 51 dBA (L90)	Aircraft and vehicle traffic on Old Bayshore Highway and U.S. 101; adjacent lawn mower affecting 2 hours, driving up daytime value and Ldn
LT-5	San Bruno. Easton Avenue approximately 150 feet north of Kaines Avenue	Saturday 10/16/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 62 dBA (Leq) 62 dBA (Leq) 61 dBA (Leq) 68 dBA (Ldn)	Aircraft, vehicle traffic on local roadways, and Caltrain
LT-5	San Bruno. Easton Avenue approximately 150 feet north of Kaines Avenue	Sunday 10/17/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 64 dBA (Leq) 66 dBA (Leq) 61 dBA (Leq) 68 dBA (Ldn)	Aircraft, vehicle traffic on local roadways, and Caltrain

	Measurement Location	Time Period	Average Ldn or Leq	Audible Noise Sources
LT-5	San Bruno. Easton Avenue approximately 150 feet north of Kaines Avenue	Wednesday 10/20/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 63 dBA (Leq) 62 dBA (Leq) 62 dBA (Leq) 68 dBA (Ldn)	Aircraft, vehicle traffic on local roadways, and Caltrain
LT-8	Millbrae. Approximately 450 feet east of the intersection of Aviador Avenue and Roblar Avenue.	Saturday 10/16/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 63 dBA (Leq) 59 dBA (Leq) 62 dBA (Leq) 69 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
LT-8	Millbrae. Approximately 450 feet east of the intersection of Aviador Avenue and Roblar Avenue.	Sunday 10/17/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 62 dBA (Leq) 62 dBA (Leq) 60 dBA (Leq) 67 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
LT-8	Millbrae. Approximately 450 feet east of the intersection of Aviador Avenue and Roblar Avenue.	Wednesday 10/20/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 63 dBA (Leq) 61 dBA (Leq) 61 dBA (Leq) 68 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
LT-22	San Bruno. Santa Dominga Avenue between San Anselmo Avenue and San Antonio Avenue.	Saturday 10/16/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 59 dBA (Leq) 57 dBA (Leq) 56 dBA (Leq) 63 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
LT-22	San Bruno. Santa Dominga Avenue between San Anselmo Avenue and San Antonio Avenue.	Sunday 10/17/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 60 dBA (Leq) 62 dBA (Leq) 56 dBA (Leq) 63 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
LT-22	San Bruno. Santa Dominga Avenue between San Anselmo Avenue and San Antonio Avenue.	Wednesday 10/20/19 Daytime: Evening: Nighttime: 24-hour Ldn:	 58 dBA (Leq) 58 dBA (Leq) 59 dBA (Leq) 65 dBA (Ldn)	Aircraft, vehicle traffic on U.S.101 and local roadways, and Caltrain/BART station operations
Short-Term Measurements (20 minutes)				
ST-1	San Bruno. San Bruno Avenue east of 7th Avenue.	Friday 10/15/19; 1:12 p.m. to 1:32 p.m.	72 dBA (Leq)	Vehicle traffic on San Bruno Avenue and U.S. 101
ST-1	San Bruno. San Bruno Avenue east of 7th Avenue.	Monday 2/8/21; 12:15 p.m. to 12:30 p.m.	73 dBA (Leq)	Vehicle traffic on San Bruno Avenue and U.S. 101
ST-2	SFO- Grand Hyatt Hotel	Friday 10/15/19; 10:16 a.m. to 10:36 a.m.	66 dBA (Leq)	Aircraft and Vehicle traffic on South McDonnel Road and U.S. 101
ST-3	Millbrae. Aloft Hotel on Millbrae Avenue	Friday 10/15/19; 11:01 a.m. to 11:21 a.m.	68 dBA (Leq)	Aircraft and Vehicle traffic on Millbrae Avenue and U.S. 101
ST-4	Millbrae. Condominiums on El Camino Real south of Millbrae Avenue	Friday 10/15/19; 11:40 a.m. to 12:00 p.m.	68 dBA (Leq)	Aircraft and Vehicle traffic on El Camino Real and Millbrae Avenue
ST-4	Millbrae. Condominiums on El Camino Real south of Millbrae Avenue	Monday 2/8/21; 11:43 a.m. to 11:58 a.m.	68 dBA (Leq)	Aircraft and vehicle traffic on El Camino Real and Millbrae Avenue
ST-5	South San Francisco, Safe Harbor Shelter (295 North Access Road)	Friday 5/21/21; 10:05 a.m. to 10:25 a.m.	59 dBA (Leq)	Vehicle traffic on North Access Road, aircraft, and public address system of Safe Harbor Shelter

	Measurement Location	Time Period	Average Ldn or Leq	Audible Noise Sources
ST-6	Millbrae. Residential area south of Bay Street	Thursday 7/1/21; 10:32 a.m. to 10:52 a.m.	64 dBA,(Leq)	Traffic on U.S. 101 and distant Caltrain horns
ST-7	San Bruno. Residential area south of San Antonio Avenue	Thursday 7/1/21; 11:06 a.m. to 11:36 a.m.	60 dBA,(Leq)	Distant traffic on U.S. 101 (blocked by sound wall); Caltrain and BART pass-by events (no sound wall); Traffic on San Antonio Avenue

SOURCES: Environmental Science Associates (ESA), 2019 and 2021 (Appendix D) and SFO, 2019.

3.2 Existing Groundborne Vibration Levels

The nearest sources of vibration within the study area are operations along the Caltrain and BART tracks, located approximately 1,000 feet to the southwest from the closest Airport property line. As shown in **Table 2**, FTA has published generalized ground-surface vibration curves for locomotive-powered passenger and freight trains. While many Caltrain operations stop at Millbrae Station, express and bullet trains do not. Hence, train speeds along the rail line can vary from 10 to 50 (for a bullet train) miles per hour on approach.

TABLE 2
GENERALIZED VIBRATION LEVELS FROM LOCOMOTIVE-POWERED PASSENGER OR FREIGHT TRAINS*
(VIBRATION DECIBELS)

Train Speed	Distance from Tracks					
	30 Feet	50 Feet	100 Feet	150 Feet	200 Feet	300 Feet
10 mph	74 VdB	71 VdB	64 VdB	61 VdB	58 VdB	53 VdB
20 mph	80 VdB	77 VdB	70 VdB	67 VdB	64 VdB	59 VdB
30 mph	84 VdB	81 VdB	74 VdB	71 VdB	68 VdB	63 VdB
50 mph	88 VdB	85 VdB	78 VdB	75 VdB	72 VdB	67 VdB

SOURCE: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.

NOTES:
mph = miles per hour; VdB = Vibration Decibels

* These levels reflect generalized diesel locomotive activity and do not reflect potential future reductions from electrification of Caltrain.

FTA also has published generalized ground-surface vibration curves for rapid transit and light rail vehicles similar to trains run by BART, which are presented in **Table 3**.

At a distance of 300 feet, vibration levels from BART trains would be attenuated to background levels based on propagation curves published by FTA.[10]

[10] U.S. Department of Transportation, Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, September 2018. Figure 6-4, p. 137.

TABLE 3
GENERALIZED VIBRATION LEVELS FROM LIGHT RAIL PASSENGER TRAINS (VIBRATION DECIBELS)

Train Speed	Distance from Tracks					
	30 Feet	50 Feet	100 Feet	150 Feet	200 Feet	300 Feet
10 mph	63 VdB	59 VdB	54 VdB	50 VdB	47 VdB	42 VdB
20 mph	69 VdB	65 VdB	60 VdB	56 VdB	53 VdB	48 VdB
30 mph	73 VdB	69 VdB	64 VdB	60 VdB	57 VdB	52 VdB
50 mph	77 VdB	73 VdB	68 VdB	64 VdB	61 VdB	56 VdB

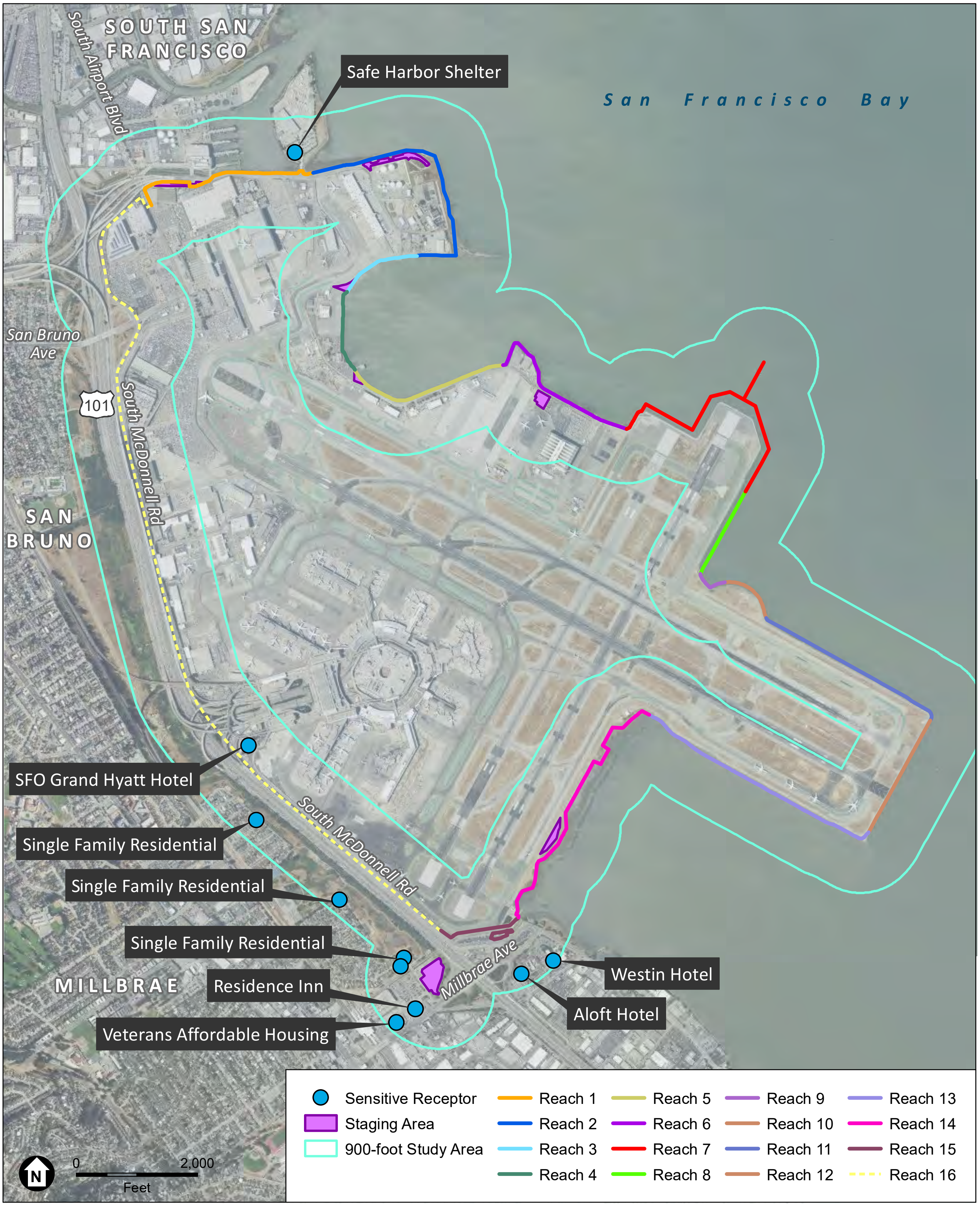
SOURCE: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.
NOTES:
mph = miles per hour; VdB = Vibration Decibels

3.3 Existing Sensitive Receptors

Some land uses are more sensitive to noise levels due to the types of activities typically associated with those uses. Residences, hotels, schools, daycare facilities, senior care facilities, and hospitals are generally more sensitive to increases in noise levels than commercial and industrial land uses, and therefore are considered sensitive receptors. There are hotel and residential uses within 900 feet of the project site and construction staging areas (see Figure 1, p. 2). Currently, the nearest noise-sensitive receptors to the proposed project and construction staging areas are the Westin and Aloft hotels, both of which are located approximately 700 feet south from the southernmost end of Reach 14 and 350 feet southeast from Reach 15. The nearest noise-sensitive receptors to Reach 16 activity would be the SFO Grand Hyatt Hotel 150 feet to the north and residential uses on Bay Street and Corte Ana, approximately 570 and 750 feet to the south, respectively. The nearest sensitive receptors to the off-Airport Aviador Lot construction staging area are residences on Roblar and Aviador avenues, located approximately 200 feet north of the Aviador Lot (see **Figure 3**). All other construction staging areas for the proposed project are located approximately 1,200 to 6,800 feet from the nearest sensitive receptor; given this distance, construction noise activities would attenuate,[11] and these sites would not result in a perceptible increase in noise levels for sensitive receptors. Sensitive receptors that could be affected by the proposed project are listed below in **Table 4**.[12] There are no existing schools, daycare facilities, senior care facilities, or hospitals located within 900 feet of the project site or construction staging areas.

[11] Based on acoustical attenuation equations, typical construction noise levels attenuate to approximately 55 dBA at a distance of 900 feet if there is a direct line-of-sight between a noise source and a noise receptor (i.e., two pieces of equipment generating 85 dBA would attenuate to 55 dBA over a distance of 900 feet).

[12] Reach 16 would be located approximately 150 feet west of The Grand Hyatt at SFO hotel located on Airport property. While Reach 16 is being analyzed at the programmatic level, this noise technical memorandum discusses potential impacts to the nearest sensitive receptors to this reach.



SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE 4.B-2
NOISE SENSITIVE RECEPTORS WITHIN 900 FEET OF THE PROJECT SITE AND STAGING AREAS

TABLE 4
EXISTING NOISE-SENSITIVE RECEPTORS WITHIN 900 FEET OF THE PROJECT SITE AND STAGING AREAS

Type of Sensitive Receptor	Location	Minimum Distance from Project Site Work Area	Representative Monitoring Location
Within 900 Feet of Reaches 14 and 15			
Westin Hotel	1 Old Bayshore Highway	350 feet[a]	LT-3
Aloft Hotel	401 East Millbrae Avenue	350 feet[a]	LT-3
Within 900 Feet of Reach 1			
Safe Harbor Shelter	295 North Access Road	200 feet	ST-5
Within 900 Feet of the Aviador Staging Area			
Single Family Residential	300 Block Roblar Avenue	200 feet	LT-8
Single Family Residential	100 Block Aviador Avenue	300 feet	LT-8
Within 900 Feet of the Aviador Staging Area			
Veterans Affordable Housing (under construction)	East side of Rollins Road north of Millbrae Avenue	300 feet	LT-8
Residence Inn (under construction)	East side of Rollins Road north of Millbrae Avenue	300 feet	LT-8
Within 900 Feet of Reach 16			
SFO Grand Hyatt Hotel	55 South McDonnell Road	150 feet	ST-2
Single Family Residential	300 to 600 of Bay Street, Millbrae	570 feet	ST-6
Single Family Residential	Corte Ana and Corte Balboa, Millbrae	750 feet	LT-8

SOURCES: ESA, 2021; Google Earth (Imagery Date 9/11/2017) for parcel data (address and distance to the site).

NOTES:

[a] Based on minimum diagonal distance from building setback to Reach 15.

The Gateway project at Millbrae Station is currently under construction and is therefore considered part of the existing environmental setting. The project includes development of residential and hotel land uses (Veterans Affordable Housing and Residence Inn) on former parking lots that served Millbrae Station located approximately 300 feet west of the Aviador Lot construction staging area.

4. Noise and Vibration Effects and Recommended Reduction Measures

This section describes the noise and vibration analysis for the proposed project. It describes the methods used to determine the effects of the proposed project and lists the criteria used to evaluate whether the project would exceed those criteria.

4.1 Methodology

Construction Noise Levels

Construction noise levels were estimated using the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM). As presented in **Table 5**, a general estimate of the proposed project's construction equipment roster and schedule were provided by the project applicant. An estimate of construction noise levels is conducted for the purpose of this analysis based on the general assessment approach recommended by the FTA.[13]

TABLE 5
PROPOSED CONSTRUCTION EQUIPMENT

Equipment	Equipment	Equipment
Air Compressors	Standard Light Setup	Surfacing Equipment
Backhoes	Graders	Sweepers/Scrubbers
Bore/Drill Rigs	Loaders, 3.5 CY	Trenchers
Cement and Mortar Mixers	Highway Dump Trucks, Super 10	Derrick Barge
Concrete/Industrial Saws	On-Highway Truck Tractors	Material Barge, 180' x 54' x 12', 1,600-Ton Capacity/1,066 CY Capacity
Compactor	Off-Highway Dump Trucks, 25 CY	Material Barge, 155' x 55' x 9', 585-Ton Capacity/390 CY Capacity
Rubber-Tired RT Crane, 40-Ton	Pavers	Sand Dredge with Conveyors
Rubber-Tired RT Crane, 75-Ton	Paving Equipment	Sand Hopper w/Conveyor
Cranes, 110-Ton, 150-Ton, 275-Ton	Pump Truck, Long Reach	Spud Barge w/Deck Winches
Crawler Tractors	Pumps	Push Boat
Crushing/Proc. Equipment	Rollers	Crew Boat
Dumpsters, 30 CY	Rubber-Tired Dozers	Skiff w/Outboard Motor
Excavator	Rubber-Tired Loaders	Vibratory Hammer Power Pack
Excavator, Amphibious	Scraper	Impact Hammer
Excavator, Mounted Sheet-Pile Installer	Signal Boards	Pickup Trucks, Company Owned
Forklift, 10,000 lb and 30,000 lb	Skid Steer Loaders	Flat Bed Truck, 3-Axle

SOURCE: COWI; construction equipment list and schedule provided to ESA on April 16, 2021.

The FTA methodology for general assessment of construction noise entails a process for calculating the hourly dBA, Leq for each stage of construction. This calculation considers: (1) the reference noise emission level at 50 feet for equipment to be used for each stage of construction, (2) the usage factor for each piece of equipment, (3) the distance between construction centerline and sensitive receptors, and (4) adjusting for any ground effects, as applicable.[14] This methodology calls for determining the resultant noise levels only the for the two noisiest pieces of equipment expected to be used in each stage of construction, then summing the levels for each stage of construction using decibel (logarithmic) addition.[15]

The estimated construction noise levels resulting from the proposed project at the nearby off-site sensitive receptors were then analyzed against two criteria to assess the magnitude of noise impact. First, construction noise levels were assessed based on whether ambient noise levels at nearby sensitive receptors would increase by 10 dBA or more.

[13] The FTA does not publish a software noise model; as such, the analysis relies on FHWA's model and impacts were assessed using FTA's methodology for assessing impact.

[14] In an urban area such as the developed areas surrounding SFO, which has acoustically non-absorptive ground conditions, the ground factor is zero.

[15] U.S. Department of Transportation, Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment*, September 2018, pp. 174–179.

Consistent with FTA and FHWA methodology, this increase in construction noise is assessed relative to an hourly Leq and also accounts for percentage of use for equipment as inventoried by FHWA. As some construction is proposed to occur at night, nighttime construction noise (10 p.m. to 7 a.m.) was assessed based on its potential to result in sleep disturbance at nearby residential uses, which includes increasing interior noise levels above 45 dBA.

Second, this analysis applies the general assessment criteria of the FTA, which establish criteria for residential land uses of 90 dBA during daytime hours and 80 dBA during nighttime hours. For all other land uses, the criterion is 100 dBA during the daytime and nighttime hours.

A list of proposed construction equipment for Reach 7, which is a representative reach that would include the most construction equipment and activity such as pile driving, as well as the greatest duration of activity, is presented in Table 5.

This analysis also evaluates the potential for construction-related traffic to result in noise impacts along local access roads (e.g., Millbrae Avenue, San Bruno Avenue) by determining whether noise-sensitive receptors would be located along proposed/likely construction haul routes and the degree of noise increase on these routes from project-related peak hourly increases in construction truck traffic. Impacts from construction truck traffic are assessed using the same criteria as for operational roadway traffic. In general, traffic noise increases of less than 3 dBA are barely perceptible to people, while a 5 dBA increase is readily noticeable.[16] Consistent with the City of Millbrae General Plan Policy NS 1.2, for purposes of this analysis a 3 dBA increase is considered a substantial temporary increase in roadside noise levels along these roadways. Garden Lane, which would be used by trucks to access the Aviador Lot for construction staging, is currently closed for construction of the Gateway Project at Millbrae Station. The Gateway Project would include residential uses and a hotel that would straddle this roadway. The traffic analysis[17] for the Gateway Project included future operational traffic volumes along Garden Lane that were used to determine an operational roadside noise level of 62.5 dBA, representative of existing conditions without the proposed project.

Groundborne Vibration Levels and Criteria

Groundborne vibration levels resulting from construction activities at the project site were estimated using data published by Caltrans in its *Transportation and Construction Vibration Guidance Manual* (2020). The equations used to estimate vibration propagation considered the specific soil types in underlying bay muds and silty clay in the project areas as determined by geotechnical reports.[18] Potential vibration levels resulting from construction of the proposed project are identified for off-site and on-site locations that are sensitive to vibration (i.e., existing residences and hotels) based on their distance from construction or staging activities. The main concerns associated with construction-generated vibration include sleep disturbance, building damage, and interference with vibration-sensitive instruments or machinery, such as that used in research laboratories or hospitals. The potential for construction activities to generate vibration affecting each of these sensitive receptor types are considered below, following the discussion of vibration levels that may be generated during construction activities and equipment. While the city has not adopted any thresholds for construction or operational groundborne vibration impacts, this analysis uses the vibration criteria established in Caltrans' *Transportation and Construction Vibration Guidance Manual*. The potential vibration levels at off-site sensitive locations resulting from construction of the proposed

[16] Caltrans, *Technical Noise Supplement (TeNS) to the Traffic Noise Analysis Protocol*, pp. 2–44, September 2013, *http://www.dot.ca.gov/env/noise/docs/tens-sep2013.pdf*, accessed March 25, 2021.

[17] Fehr & Peers, Millbrae Station Final Access and Circulation Plan, July 2016, *https://www.ci.millbrae.ca.us/home/showpublisheddocument?id=12306*, accessed March 24, 2021.

[18] ESA, 2021, telephone conversation with Peter Hudson of Sutro Science, July, 7, 2021.

project are analyzed against the vibration criteria established by Caltrans to determine whether an exceedance of allowable vibration levels would occur.

The state CEQA Guidelines do not define the levels at which groundborne vibration or groundborne noises are considered "excessive." Therefore, with respect to construction-related vibration effects on occupied residential and institutional land uses (e.g., schools, churches, libraries, other institutions, and quiet offices), the vibration criteria for structural damage established in Caltrans' *Transportation and Construction Vibration Guidance Manual*, and shown in **Table 6**, and the criteria for human annoyance during nighttime hours established in the FTA's *Transit Noise and Vibration Impact Assessment* are used in this analysis with respect to construction vibration. Vibration reduction measures are required if predicted vibration at sensitive receptor locations exceeds the Category 2 criteria for residences and locations where people sleep, as shown in **Table 7**.

TABLE 6
CALTRANS VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA

	Maximum PPV (in/sec)	
Structure and Condition	**Transient Sources**	**Continuous/Frequent Intermittent Sources**
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

SOURCE: Caltrans, *Transportation and Construction Vibration Guidance Manual*, April 2020.

NOTE:

Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

TABLE 7
FEDERAL TRANSIT ADMINISTRATION GENERAL ASSESSMENT CRITERIA FOR GROUNDBORNE VIBRATION

	Impact Levels (VdB; relative to 1 micro-inch per second)		
Land Use Category	**Frequent Events[a]**	**Occasional Events[b]**	**Infrequent Events[c]**
Category 1: Buildings where vibration would interfere with interior operations	65[d]	65[d]	65[d]
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime use	75	78	83

SOURCE: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, FTA Report No. 0123, Office of Planning and Environment, 2018.

NOTES:

a "Frequent events" is defined as more than 70 vibration events from the same source per day.
b "Occasional events" is defined as 30 to 70 vibration events from the same source per day.
c "Infrequent events" is defined as fewer than 30 vibration events from the same source per day.
b This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels.

Operational Noise Levels

As there would be no new operational noise from either stationary sources (i.e., mechanical equipment) or a permanent increase in vehicle traffic due to operation of the proposed project, the assessment of operational noise impacts is not included in this analysis.

Operational Vibration Levels

Given that the proposed project consists of a wall around the north, east, and south perimeters of the Airport, any "excessive" groundborne vibration or noises that would be generated at the project site would be those generated only during project construction. Once construction is complete, the proposed project would not involve the use of heavy machinery that is associated with large commercial or industrial uses. As such, no sources of "excessive" groundborne vibration or noise levels are anticipated as part of the proposed project's operations.

4.2 Project Noise Analysis

Construction Noise – Daytime

Construction of the proposed project would require the use of heavy equipment during demolition activities, pile installation, and riprap placement stages. Construction activities would also involve the use of smaller power tools, generators, and other sources of noise. Throughout all stages of construction, there would be a changing mix of the equipment, as shown in Table 5, p. 14. Thus, construction activity noise levels at and near the project site would fluctuate depending on the particular type, number, and duration of use of the various pieces of construction equipment.

Under an accelerated schedule, construction of the proposed project would begin in June 2025 and would be completed in November 2031.[19] Project construction is anticipated to occur as shown in **Table 8**. To ensure a seamless construction process, work in adjacent reaches is anticipated to overlap; for example, work on Reach 5 would begin before full completion of Reach 6. This schedule is based on a 5-day work week; however, work may proceed up to seven days per week.

Table 9 shows the hourly noise levels (L_{max}) produced by the various types of the noisiest equipment proposed by the applicant at a distance of 50 feet from the equipment and noise sensitive receptor. It should be noted that L_{max} noise levels associated with the construction equipment would only be generated when equipment is operated at full power. Typically, the operating cycle for a piece of construction equipment would involve 1 or 2 minutes of full power operation followed by operation at lower power settings. The L_{max} noise levels shown in Table 9 would, therefore, be expected to only occur briefly throughout the construction day.

[19] The construction schedule is subject to change based on project design refinements, construction contractor requirements, and other unforeseeable factors at this time. For purposes of a conservative analysis, this technical memorandum considers an accelerated construction timeline of approximately 6.5 years (June 2025 to November 2031) to analyze the worst-case scenario with regard to overlapping construction activity.

TABLE 8
CONSTRUCTION SCHEDULE

Reach #[a, c]	Name of Reach	Working Days [b]	Start Date	End Date	Work Hours
1	San Bruno Channel	102	11/27/2026	4/19/2027	Daytime
2	Treatment Plant	159	6/1/2025	1/9/2026	Daytime
3	Sea Plane Harbor 1	71	12/5/2025	3/13/2026	Daytime
4	Coast Guard	67	2/10/2026	5/14/2026	Daytime
5	Sea Plane Harbor 2	111	4/14/2026	9/15/2026	Daytime
6	Superbay	97	8/14/2026	12/28/2026	Daytime
7	Runway 19L End	800	6/1/2025	6/25/2028	Nighttime
8	Runway 19L Edge	401	11/24/2027	6/6/2029	Nighttime
9	Intersection 1	22	12/24/2030	1/22/2031	Nighttime
10	Intersection 2	30	11/15/2030	12/26/2030	Nighttime
11	Runway 28R Edge	339	8/6/2030	11/23/2031	Nighttime
12	End of Runway 28R & 28L	73	6/7/2029	9/17/2029	Nighttime
13	Runway 28L Edge	428	6/7/2029	1/27/2031	Nighttime
14	Mudflat	135	7/21/2027	1/25/2028	Nighttime
15	Millbrae Channel	70	4/15/2027	7/21/2027	Daytime
	All Construction	**1,690**	**6/1/2025**	**11/23/31**	

NOTES:
[a] Reaches are shown in the order of construction.
[b] Working days are rounded up based on whole workdays for each activity provided by the project sponsor.
[c] The construction timeline for Reach 16 is currently unknown.

SOURCE: COWI, construction equipment list and schedule provided to ESA on April 16, 2021.

General Assessment Construction Noise Criteria of the FTA

The FTA has developed guidelines that can be considered reasonable criteria for assessment. For residential land uses, the daytime criterion is 90 dBA during daytime hours and 80 dBA during nighttime hours, which are also conservatively applied to other non-residential noise sensitive land uses. If these criteria are exceeded, the guidelines note that there may be adverse community reaction.[20]

The FTA methodology for general assessment described above was applied for each stage of construction to determine the resultant noise levels for the two noisiest pieces of equipment expected to be used simultaneously. While project construction activities would involve an array of different equipment throughout each reach, as presented in Table 5, p. 14, the two noisiest pieces of equipment would be the same for construction of Reaches 2 through 14, which would include a vibratory pile driver and a crane to maneuver piles into place. For Reach 1 and Reach 15 there would be no pile installation. The two noisiest pieces of equipment expected to be used simultaneously for these reaches would be a concrete saw and grader. Given the extent of each reach around the project area, noise levels were estimated for each reach based on the distance to the nearest noise-sensitive receptors. Additionally, noise levels were estimated for sensitive receptors closest to the Aviador Lot construction staging area. It should be noted that the Aviador Lot is actively used for other SFO projects and its operation is part of the existing environmental setting.

[20] U.S. Department of Transportation, Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment*, September 2018. Table 7-2, p. 179.

TABLE 9
MAXIMUM NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Level at 50 Feet (dB, L_{max})	Noise Level at 100 Feet (dB, L_{max})
Air Compressors	78	72
Backhoes	78	72
Bore/Drill Rigs	84	78
Compactor	83	77
Crawler Tractor	84	78
Grader	85	79
Crane	81	75
Excavator	81	75
Generator Sets	81	75
Haul Truck	77	71
Paver	77	71
Rollers	80	74
Rough Terrain Forklifts	83	77
Front End Loaders	79	73
Dozer	82	76
Scraper	84	78
Sweepers/scrubbers	82	76
Pump	81	75
Concrete Pump	81	75
Concrete Truck	79	73
Concrete Saw	90	84
Rock/Concrete Crusher[a]	90	84
Tug Boats for Barges	87	50
Impact and Vibratory Pile Drivers	101	95

SOURCE: U.S. Department of Transportation (U.D. DOT), Federal Highway Administration (FHWA), Construction Noise Handbook, 9.0, Construction Equipment Noise Levels and Ranges, Table 9.1, RCNM Default Noise Emission Reference Levels and Usage Factors, updated August 24, 2017, http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm, accessed February 16, 2021;
U.S. DOT, FTA, *Transit Noise and Vibration Impact Assessment Manual*, September 2018; Epsilon Associates, Hudson River PCB's Superfund Site, Phase 1 Final Design Report, Appendix J-Noise Impact Assessment, 2006.

[a] Noise measurements from various rock and concrete recycling crusher plants indicate that a crusher and conveyor plant can generate noise levels ranging between 81 and 90 dBA (Leq) at 50 feet. This evaluation conservatively applies the higher reference noise level.

Input values and calculated noise levels using FTA methodology and the RCNM noise model for each of these construction stages are presented in **Table 10**. In the table, input values are presented for FTA methodology considerations for the nearest sensitive-receptor locations identified in Table 4, p. 13. Adjusted noise levels at each sensitive receptor are also presented in the table and then compared to the FTA criteria for daytime construction. As shown in Table 10, daytime construction noise from all construction reaches would be below the 90 dBA daytime criterion for the nearest sensitive receptors, which are also conservatively applied to hotel land uses in this analysis.

TABLE 10
DAYTIME NOISE LEVELS FROM CONSTRUCTION

Receptor	Existing Daytime Noise Level (dBA, Leq)[a]	Loudest Two Noise Sources	Reference Noise Level (dBA)[a]	Distance to Receptor (feet)[b]	Usage Factor	Adjusted L_{eq} Level (dBA)[c]	Exceed 90 dBA Daytime Standard?	Existing + Construction Noise Resultant Noise Level (dBA)	Exceed Ambient + 10 dBA Standard?
REACH 1: San Bruno Channel									
Safe Harbor Shelter, South San Francisco	59	Concrete saw/grader	90/85	200	20/40 %	73	No	**73**	**Yes**
REACH 2: Treatment Plant Subreach									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	395	20/16 %	76	No	**76**	**Yes**
REACH 3: Seaplane Harbor 1									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	2,310	20/16 %	61	No	63	No
REACH 4: Coast Guard									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	2,340	20/16 %	61	No	63	No
REACH 5: Seaplane Harbor 2									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	3,560	20/16 %	57	No	61	No
REACH 6: Superbay									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	4,900	20/16 %	54	No	60	No
REACH 7: Runway 19 End									
Safe Harbor Shelter, South San Francisco	59	Pile driver/crane	101/81	7,100	20/16 %	51	No	60	No
REACH 8: Runway 19 Edge and VSR									
Westin Hotel	65	Pile driver/crane	101/81	6,700	20/16 %	51	No	65	No
REACHES 9 and 10: Intersection 1 and 2									
Westin Hotel	65	Pile driver/crane	101/81	6,500	20/16 %	52	No	65	No
REACH 11: Runway 28R and VSR Relocation									
Westin Hotel	65	Pile driver/crane	101/81	6,400	20/16 %	52	No	65	No
REACH 12: Runway 28 End and VSR Relocation									
Westin Hotel	65	Pile driver/crane	NA	5,400	20/16 %	53	No	65	No
REACH 13: Runway 28L and VSR Relocation									
Westin Hotel	65	Pile driver/crane	101/81	4,000	20/16 %	56	No	66	No
REACH 14: Mudflat Reach and VSR Relocation									
Westin Hotel	65	Pile driver/crane	101/81	700	20/16 %	71	No	72	No
REACH 15: Millbrae Channel									
Westin Hotel	65	Concrete saw/grader	90/85	350	20/40 %	68	No	70	No

Receptor	Existing Daytime Noise Level (dBA, Leq)[a]	Loudest Two Noise Sources	Reference Noise Level (dBA)[a]	Distance to Receptor (feet)[b]	Usage Factor	Adjusted L_{eq} Level (dBA)[c]	Exceed 90 dBA Daytime Standard?	Existing + Construction Noise Resultant Noise Level (dBA)	Exceed Ambient + 10 dBA Standard?
REACH 16: Airport Landside Protection									
SFO Grand Hyatt Hotel	66	Concrete saw/grader	90/85	150	20/40 %	75	No	76	No
300 Block Bay Street, Millbrae	64	Concrete saw/grader	90/85	570	20/40 %	64	No	67	No
Aviador Lot Staging Area									
Roblar Avenue Residences	62	Loader/Gradall forklift	79/83	200	40%	69	No	70	No

SOURCE: FHWA, 2005; ESA, 2021

NOTES:

a Lmax at 50 feet.
b Distance between approximate location of equipment and property line of sensitive receptor.
c The L_{eq} level is adjusted for distance and percentage of usage.

Consideration of a Temporary Increase in Ambient Noise Levels in the Project Vicinity

The daytime construction noise analysis quantitatively evaluates noise from the two loudest pieces of equipment at sensitive receptor locations to determine if construction noise would be 10 dBA above the ambient noise level. If so, the evaluation then qualitatively considers the frequency, duration, and intensity of noise levels in determining whether the proposed project would result in a substantial noise impact that would warrant noise control measures.

Construction noise impacts may also be assessed with respect to the overall increase in noise from combined construction equipment at a given sensitive receptor compared to existing conditions. This methodology applies a 10 dBA increase over ambient standard for sensitive receptors that would reasonably be expected in exterior areas. Such an increase represents a perceived doubling of loudness. Table 10 presents both the existing ambient noise level as well as the existing-plus-construction resultant noise level for each sensitive receptor, and identifies whether the resultant noise level would exceed the ambient level by more than 10 dBA. As shown in the table, the resultant noise level increase from daytime construction would increase by more than 10 dBA for the residents of the Safe Harbor Shelter during construction of Reaches 1 and 2. Construction noise levels at all of the other nearest sensitive receptors analyzed for Reaches 3 through 16 would not increase by more than 10 dBA above the ambient level.

Since noise from construction of Reaches 1 and 2 near the Safe Harbor Shelter could exceed the ambient level by more than 10 dBA, **Noise Impact Reduction Measure NO-1, Construction Noise Control Measures**, is identified to address potential construction noise impacts to the shelter.

> **Noise Impact Reduction Measure NO-1: Construction Noise Control Measures.** Incorporate the following practices into the construction contract, for implementation by the construction contractor during the project's daytime construction in Reaches 1 and 2 when working within 400 feet of the Safe Harbor Shelter.
>
> Prior to issuance of any demolition or building permit, the project sponsor shall submit a project-specific construction noise control plan for Reaches 1 and 2 to the ERO or the ERO's designee for approval. The construction noise control plan shall be prepared by a qualified acoustical engineer with input from the

construction contractor, and include all feasible measures to reduce construction noise to less than significant. The construction noise control plan shall identify noise control measures to meet a performance target of construction activities not resulting in a noise level greater than 90 dBA at noise sensitive receptors and 10 dBA above the ambient noise level at noise sensitive receptors. The project sponsor shall ensure that requirements of the construction noise control plan are included in contract specifications. The plan shall also include measures for notifying the public of construction activities, complaint procedures, and a plan for monitoring construction noise levels in the event complaints are received. The construction noise control plan shall include the following measures to the degree feasible, or other effective measures, to reduce construction noise levels:

- Use construction equipment that is in good working order, and inspect mufflers for proper functionality;
- Select "quiet" construction methods and equipment (e.g., improved mufflers, use of intake silencers, engine enclosures);
- Use construction equipment with lower noise emission ratings whenever possible, particularly for air compressors;
- Prohibit the idling of inactive construction equipment for more than five minutes;
- Locate stationary noise sources (such as compressors) as far from nearby noise sensitive receptors as possible, muffle such noise sources, and construct barriers around such sources and/or the construction site;
- Avoid placing stationary noise-generating equipment (e.g., generators, compressors) within noise-sensitive buffer areas (as determined by the acoustical engineer) immediately adjacent to neighbors;
- Enclose or shield stationary noise sources from neighboring noise-sensitive properties with noise barriers to the extent feasible. To further reduce noise, locate stationary equipment in pit areas or excavated areas, if feasible; and
- Install temporary barriers, barrier-backed sound curtains and/or acoustical panels around working powered impact equipment and, if necessary, around the project site perimeter. When temporary barrier units are joined together, the mating surfaces shall be flush with each other. Gaps between barrier units, and between the bottom edge of the barrier panels and the ground, shall be closed with material that completely closes the gaps, and dense enough to attenuate noise.

The construction noise control plan shall include the following measures for notifying the public of construction activities, complaint procedures and monitoring of construction noise levels:

- Designation of an on-site construction noise manager for the project;
- Notification of neighboring noise sensitive receptors within 300 feet of the project construction area at least 30 days in advance of high-intensity noise-generating activities (e.g., pier drilling, pile driving, and other activities that may generate noise levels greater than 90 dBA at noise sensitive receptors) about the estimated duration of the activity;
- A notification to the Safe Harbor Shelter (295 North Access Road) describing noise complaint procedures and a complaint hotline number that shall always be answered during construction;
- A procedure for notifying the planning department of any noise complaints within one week of receiving a complaint;

- A list of measures for responding to and tracking complaints pertaining to construction noise. Such measures may include the evaluation and implementation of additional noise controls at the Safe Harbor Shelter (295 North Access Road) sensitive receptor; and
- Conduct noise monitoring (measurements) at the beginning of major construction phases (e.g., demolition, grading, excavation) and during high-intensity construction activities to determine the effectiveness of noise attenuation measures and, if necessary, implement additional noise control measures.

The construction noise control plan shall include the following additional measures during pile-driving activities at Reaches 1 and 2:

- When pile driving is to occur within 600 feet of the Safe Harbor Shelter (295 North Access Road), implement "quiet" pile-driving technology (such as pre-drilling of piles, sonic pile drivers, auger cast-in-place, or drilled-displacement, or the use of more than one pile driver to shorten the total pile-driving duration [only if such measure is preferable to reduce impacts to sensitive receptors]) where feasible, in consideration of geotechnical and structural requirements and conditions;
- Where the use of driven impact piles cannot be avoided, properly fit impact pile driving equipment with an intake and exhaust muffler and a sound-attenuating shroud, as specified by the manufacturer; and
- Conduct noise monitoring (measurements) before, during, and after the pile driving activity if "quiet" pile driving technology is not feasible and an impact pile driver is used.

Construction Noise – Nighttime

The nighttime construction noise analysis quantitatively evaluates noise from the two loudest pieces of equipment at sensitive receptor locations to determine if construction noise would exceed 80 dBA at a residential or hotel sensitive receptor during nighttime hours or if construction noise would result in sleep disturbance. If so, the evaluation then qualitatively considers the frequency, duration, and intensity of noise levels in determining whether the proposed project would result in a substantial noise impact that would warrant noise control measures.

Nighttime construction noise impacts may also be assessed with respect to the potential to result in sleep disturbance. The United States Environmental Protection Agency identifies a 24-hour interior noise level of 45 dBA, Leq to protect indoor activity interference, and a 45 dBA, Ldn for indoor residential areas. Sleep disturbance can occur when continuous indoor noise levels exceed 30 dBA, or when intermittent interior noise levels reach 45 dBA, particularly if the background noise level is low. This methodology applies a resultant interior noise level exceeding 45 dBA to protect sleep disturbance in land uses where people would reasonably be expected to sleep (residences, transient lodging, and hospitals).

Reaches 7 through 14 are anticipated to be constructed during nighttime hours (10 p.m. to 7 a.m.) to minimize interference with aircraft operations. Additionally, deliveries and transport of materials to reaches would occur at the Aviador Lot construction staging area during some nighttime hours. **Table 11** presents the construction noise levels for Reaches 7 through 14 and the Aviador Lot and compares them to the applicable nighttime criteria. As shown in Table 11, nighttime construction noise from all reaches would be below the 80 dBA nighttime criterion for the nearest residential uses, which are also conservatively applied to hotel land uses in this analysis.

TABLE 11
NIGHTTIME NOISE LEVELS FROM CONSTRUCTION

Sensitive Receptor	Existing Nighttime Noise Level (dBA, Leq)[a]	Distance to Sensitive Receptor[b] (feet)	Adjusted L_{eq} Level (dBA)[c]	Exceed 80 dBA Nighttime Standard?	Existing + Construction Noise Resultant Noise Level (dBA)	Resultant Interior Noise Level (dBA)[d]	Exceed Ambient 45 dBA Interior Standard?
REACH 7: Runway 19 End							
Westin Hotel	61	8,200	50	No	61	36	No
REACH 8: Runway 19 Edge and VSR							
Westin Hotel	61	6,700	51	No	61	36	No
REACH 9 and 10 Intersection 1 and 2							
Westin Hotel	61	6,500	52	No	62	37	No
REACH 11 Runway 28R and VSR Relocation							
Westin Hotel	61	6,400	52	No	62	37	No
REACH 12 Runway 28 End and VSR Relocation							
Westin Hotel	61	5,400	53	No	62	37	No
REACH 13 Runway 28L and VSR Relocation							
Westin Hotel	61	4,000	56	No	62	37	No
REACH 14 Mudflat Reach and VSR Relocation							
Westin Hotel	61	700	71	No	71	**46**	**Yes**
REACH 15: Millbrae Channel							
Westin Hotel	61	350	68	No	69	44	No
Aviador Lot Construction Staging Area							
Roblar Avenue Residences	60	200	69	No	70	45	No

SOURCE: FHWA, 2005; ESA, 2021

NOTES:

a Monitored average hourly Leq between 10 p.m. and 7 a.m.
b Distance between approximate location of equipment and property line of sensitive receptor.
c The L_{eq} level is adjusted for distance and percentage of usage.
d Assumes a 25 dBA exterior to interior noise reduction attributable to standard building construction materials and windows closed.

Table 11 presents both the existing ambient average hourly Leq noise level during nighttime hours, the existing-plus-construction resultant noise level for each sensitive receptor, and then applies a typical 25 dBA exterior to interior noise reduction attributable to standard building construction with windows closed. As shown in Table 11, nighttime noise during construction activities for Reaches 1 through 13, Reach 15, and the Aviador Lot construction staging area would not result in interior noise levels that exceed 45 dBA. However, nighttime noise from construction of Reach 14 could be as high as 72 dBA at the exterior of the Westin Hotel, which would result in an interior noise level of 46 dBA.

Hotel construction is subject to the noise transmission requirements of Title 24 of the California Building Code, and hotels constructed in the vicinity of airports are constructed with sound-rated materials and windows to meet Title 24 requirements, when required. A conservative assumption for standard modern building construction is a 25 dBA exterior to interior noise reduction with windows closed. However, given the Westin Hotel's location adjacent to an airport runway and within the 70 CNEL noise contour for aircraft operations, the required construction materials for noise abatement at both the Aloft and Westin hotels likely would exceed the 25 dBA exterior to interior noise reduction assumed for standard building materials. Therefore, the predicted interior noise levels assuming standard construction materials indicate the possibility for a 1 dBA increase above the 45 dBA interior threshold when pile driving is conducted at the southern end of the Reach 14 (within 700 feet of the Westin Hotel; at 800 feet noise levels are 2 dBA less). This potential exceedance of the interior noise standard, which assumes standard building construction, would only be expected to occur during 100 feet (approximately two percent) of the total approximately 4,700 feet of pile installation of Reach 14, slated to occur over a 63-day period. Given the limited duration of work in proximity to the Westin Hotel (approximately two days), which could result in an exterior noise level of 71 dBA, and consideration of the reasonable likelihood that sound transmission requirements of Title 24 have resulted in the hotel providing more than the standard exterior-to-interior noise attenuation of 25 dBA, the potential for nighttime noise levels to result in an interior noise level greater than 45 dBA is not considered substantial and noise control measures are not required.

Noise Impacts from Construction Truck Traffic

Under an accelerated construction schedule, construction of the proposed project would occur between June 2025 and November 2031. The construction truck trip travel demand developed for the proposed project[21] considered that construction of the reaches would overlap and that the laydown/staging area for all reaches would be primarily split between Plot 16D and the Aviador Lot (see Figure 1, p. 2), which would be used for bulk material storage for all reaches.

Vehicular access to Reaches 1 through 8 would be via North Access Road, while access to Reaches 9 through 15 would be via Millbrae Avenue/South McDonnell Road. The material and equipment for Reaches 1 through 8 would use Plot 16D as a construction staging area while construction staging for Reaches 9 through 15 would be accommodated at the Aviador Lot (see Figure 1). Truck traffic would access the Aviador Lot from Rollins Road via either Garden Lane, which will be located within the Gateway Project (currently under construction) or the northern parking lot access route. Noise-sensitive land uses along these roadways consist of hotels and residences along Millbrae Avenue and Garden Lane. Therefore, the analysis of truck traffic noise impacts focuses on these roadways. There are no noise-sensitive receptors along South Airport Boulevard or Beacon Street that would be used to access Plot 16D and, therefore, noise increases from trucks accessing Plot 16D would have no impact on sensitive receptors.

Both Garden Lane and the northern parking lot access route to the north of Garden Lane will accommodate truck trips to the Aviador Lot. Although this northern parking lot access route does not currently exist, it will be part of the existing setting once construction of the proposed project commences in 2025. The existing daytime noise levels at the adjacent residences to the north of this route on Aviador Way was recorded to be 62 dBA on weekdays.

This analysis assesses truck traffic noise levels based on algorithms of the FHWA Traffic Noise Prediction Model, which includes the existing environmental setting and future traffic projections developed as part of the transportation analysis. Modeled weekday noise level estimates for roadway segments are presented in **Table 12**, for the worst case weekday a.m. peak commute hour. Consistent with the City of Millbrae General Plan Policy NS 1.2, for purposes of this analysis a 3 dBA increase is considered a substantial temporary increase in roadside noise levels along these roadways. As shown in Table 12, increases in roadside noise levels from project construction worker and truck traffic would be less than 3 dBA along San Bruno Avenue, Millbrae Avenue, Garden Lane, and the northern parking lot access route Therefore, there would not be a substantial noise impact along these roadways from construction traffic.

---

[21] LCW Consulting, SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities, December 2021.

TABLE 12
TRAFFIC NOISE INCREASES ALONG ROADS IN THE PROJECT VICINITY

Roadway Segment	Existing[a]	Applicable Increase Threshold (dB)	Existing plus Project	dBA Difference	Substantial Increase?
Weekday A.M. Peak-Hour Noise Levels					
Millbrae Avenue from U.S. 101 Ramp to Old Bayshore Road	70.3	3	70.7	0.4	No
Millbrae Avenue from U.S. 101 Ramp to Rollins Road	73.8	3	74.2	0.4	No
San Bruno Avenue from U.S. 101 Ramp to Old Bayshore Road	69.9	3	70.1	0.2	No
Garden Lane from Rollins Road to Aviador Avenue	62.5	3	65.0	2.5	No
Northern parking lot access route	62.0[b]	3	62.9	0.9	No

SOURCES: Traffic data compiled by LCW Consulting in 2021, and modeling performed by Environmental Science Associates in 2021.
NOTES:
dB = decibels; dBA = A-weighted decibels; NA = not applicable
a Existing noise levels are modeled traffic contributions only and do not reflect aircraft noise.
b This roadway does not currently exist. Existing daytime noise level provided was monitored at the nearest receptors.

Cumulative Construction Noise

There are three cumulative projects identified within 0.25 mile of the project site and of these, only one would be within 900 feet of sensitive receptors. The Moxy Hotel project would construct a 209-room, 6-story hotel at 401 Millbrae Avenue in the parking lot of the existing Aloft Hotel. An initial study prepared for this project noted that all construction activity would be conducted during daytime hours. The analysis estimated 8-hour construction noise levels would be 76 dBA at 100 feet and identified a less-than-significant noise impact.[22] As shown in Table 10, p. 20, maximum daytime construction noise from the proposed project at the nearest sensitive receptor (Westin Hotel) would be 71 dBA. The construction noise generated from this project combined with the proposed project would result in a noise level of 77 dBA. Therefore, if construction activities for both projects were to overlap, the proposed project would increase noise levels by 1 dBA. As noted above, an increase of 1 dBA cannot be perceived outside of a laboratory. As such, the proposed project, in combination with cumulative projects, would not result in a cumulative construction noise impact.

4.3 Groundborne Vibration Levels

Construction activities that would occur within the project site would include pile driving, drilling, and compaction, which would have the potential to generate groundborne vibration. As such, any existing residential and hotel land uses located in the immediate vicinity of pile driving or compaction work could be exposed to the generation of some degree of groundborne vibration. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibrations at moderate levels, to structural damage at the highest levels. Ground vibration from construction activities can occasionally reach levels that can damage structures.

Structural Damage from Construction Vibration

As shown in Table 6, p. 16, vibration impact criteria for structural damage depends on the type of structure potentially impacted. The vibration building damage thresholds for non-historic structures is 0.5 PPV. The building damage threshold for historic structures is 0.25 PPV. With regard to potential damage to nearby structures due to

[22] City of Millbrae, *401 East Millbrae Avenue Project (Moxy Hotel) Initial Study-Mitigated Negative Declaration*, June 2020.

groundborne vibration, the various PPV levels for the types of construction equipment that would operate during construction of each reach of the proposed project are identified in **Table 13**.

TABLE 13
VIBRATION LEVELS FROM CONSTRUCTION EQUIPMENT

Nearest Building/Receptor	Vibration Inducing Equipment	Reference Vibration Level (PPV)[a]	Distance to nearest Receptor (feet)[b]	Adjusted vibration at building (PPV)[c]	Exceed 0.5 PPV Standard? [c]	Adjusted vibration at receptor (VdB)[d]	Exceed Frequent Event Criterion for Type 2 receptors (72 VdB)?
REACH 1: San Bruno Channel							
Safe Harbor Shelter, South San Francisco	Vibratory Roller	0.21	200	0.009	No	NA	No Nighttime Work Reach 1
	Caisson Drill	0.089	200	0.004	No	NA	
	Loaded Trucks	0.076	200	0.003	No	NA	
REACH 2: Treatment Plant Subreach							
Building 928 (CCSF Airport Building)	Pile Driver	0.65	90	0.10	No	NA	No Nighttime Work Reach 2
	Vibratory Roller	0.21	90	0.03	No	NA	
	Caisson Drill	0.089	90	0.01	No	NA	
	Loaded Trucks	0.076	90	0.01	No	NA	
REACH 3: Seaplane Harbor 1							
Storage Building at Southern end of Reach 3	Pile Driver	0.65	55	0.20	No	NA	No Nighttime Work Reach 3
	Vibratory Roller	0.21	55	0.06	No	NA	
	Caisson Drill	0.089	55	0.03	No	NA	
	Loaded Trucks	0.076	55	0.02	No	NA	
REACH 4: Coast Guard							
Building C/1019C of the U.S. Coast Guard	Pile Driver	0.65	30	0.49	No	NA	No Nighttime Work Reach 4
	Vibratory Roller	0.21	30	0.16	No	NA	
	Caisson Drill	0.089	30	0.07	No	NA	
	Loaded Trucks	0.076	30	0.06	No	NA	
REACH 5: Seaplane Harbor 2							
Building 1057 (Airfield Operations Building)	Pile Driver	0.65	100	0.08	No	NA	No Nighttime Work Reach 5
	Vibratory Roller	0.21	100	0.03	No	NA	
	Caisson Drill	0.089	100	0.01	No	NA	
	Loaded Trucks	0.076	100	0.01	No	NA	
REACH 6: Superbay							
Building 1059 (Airfield Operations Building)	Pile Driver	0.65	100	0.08	No	NA	No Nighttime Work Reach 6
	Vibratory Roller	0.21	100	0.03	No	NA	
	Caisson Drill	0.089	100	0.01	No	NA	
	Loaded Trucks	0.076	100	0.01	No	NA	
REACH 7: Runway 19 End							
Nearest Structure: Building 1060 (Superbay Hangar)	Pile Driver	0.65	560	0.006	No	NA	Not a Sensitive Receptor
	Vibratory Roller	0.21	560	0.002	No	NA	
	Caisson Drill	0.089	560	0.0008	No	NA	
	Loaded Trucks	0.076	560	0.0007	No	NA	

Nearest Building/Receptor	Vibration Inducing Equipment	Reference Vibration Level (PPV)[a]	Distance to nearest Receptor (feet)[b]	Adjusted vibration at building (PPV)[c]	Exceed 0.5 PPV Standard? [c]	Adjusted vibration at receptor (VdB)[d]	Exceed Frequent Event Criterion for Type 2 receptors (72 VdB)?
Nearest Receptor: Westin Hotel	Pile Driver	0.65	8,200	0.0001	No	29	No
	Vibratory Roller	0.21	8,200	0.00004	No	19	No
	Caisson Drill	0.089	8,200	0.00002	No	12	No
	Loaded Trucks	0.076	8,200	0.00001	No	11	No
REACH 8: Runway 19 Edge and VSR							
Nearest Structure: Building 1060 (Superbay Hangar)	Pile Driver	0.65	2,700	0.0006	No	NA	Not a Sensitive Receptor
	Vibratory Roller	0.21	2,700	0.0002	No	NA	
	Caisson Drill	0.089	2,700	0.00008	No	NA	
	Loaded Trucks	0.076	2,700	0.00007	No	NA	
Nearest Receptor: Westin Hotel	Pile Driver	0.65	6,700	0.0002	No	31	No
	Vibratory Roller	0.21	6,700	0.00005	No	21	No
	Caisson Drill	0.089	6,700	0.00002	No	14	No
	Loaded Trucks	0.076	6,700	0.00002	No	13	No
REACHES 9 and 10: Intersection 1 and 2							
Nearest Structure: Building 1060 (Superbay Hangar)	Pile Driver	0.65	2,800	0.0005	No	NA	Not a Sensitive Receptor
	Vibratory Roller	0.21	2,800	0.0002	No	NA	
	Caisson Drill	0.089	2,800	0.00008	No	NA	
	Loaded Trucks	0.076	2,800	0.00003	No	NA	
Nearest Receptor: Westin Hotel	Pile Driver	0.65	6,500	0.0002	No	32	No
	Vibratory Roller	0.21	6,500	0.00005	No	22	No
	Caisson Drill	0.089	6,500	0.00002	No	15	No
	Loaded Trucks	0.076	6,500	0.00002	No	14	No
REACH 11: Runway 28R and VSR Relocation							
Nearest Structure and Receptor: Westin Hotel	Pile Driver	0.65	6,400	0.0002	No	32	No
	Vibratory Roller	0.21	6,400	0.00005	No	22	No
	Caisson Drill	0.089	6,400	0.00002	No	15	No
	Loaded Trucks	0.076	6,400	0.00002	No	14	No
REACH 12: Runway 28 End and VSR Relocation							
Nearest Structure and Receptor: Westin Hotel	Pile Driver	0.65	5,400	0.0002	No	34	No
	Vibratory Roller	0.21	5,400	0.00007	No	24	No
	Caisson Drill	0.089	5,400	0.00003	No	17	No
	Loaded Trucks	0.076	5,400	0.000022	No	16	No
REACH 13: Runway 28L and VSR Relocation							
Nearest Structure and Receptor: Westin Hotel	Pile Driver	0.65	4,000	0.0003	No	38	No
	Vibratory Roller	0.21	4,000	0.0001	No	28	No
	Caisson Drill	0.089	4,000	0.00004	No	22	No
	Loaded Trucks	0.076	4,000	0.00004	No	20	No
REACH 14: Mudflat Reach and VSR Relocation							
	Pile Driver	0.65	700	0.004	No	61	No

Nearest Building/Receptor	Vibration Inducing Equipment	Reference Vibration Level (PPV)[a]	Distance to nearest Receptor (feet)[b]	Adjusted vibration at building (PPV)[c]	Exceed 0.5 PPV Standard? [c]	Adjusted vibration at receptor (VdB)[d]	Exceed Frequent Event Criterion for Type 2 receptors (72 VdB)?
Nearest Structure and Receptor: Westin Hotel	Vibratory Roller	0.21	700	0.001	No	51	No
	Caisson Drill	0.089	700	0.0006	No	44	No
	Loaded Trucks	0.076	700	0.0005	No	43	No
REACH 15: Millbrae Channel							
Nearest Structure and Receptor: Westin Hotel	Vibratory Roller	0.21	350	0.004	No	NA	No Nighttime Work Reach 15
	Caisson Drill	0.089	350	0.002	No	NA	
	Loaded Trucks	0.076	350	0.001	No	NA	
REACH 16: Airport Landside Protection							
Nearest Structures: Building 779 (Rental Car Center Air Train Station) and Building 780 (Rental Car Center)	Vibratory Roller	0.21	15	0.45	No	NA	No Nighttime Work Reach 16
	Caisson Drill	0.089	15	0.19	No	NA	
	Loaded Trucks	0.076	15	0.16	No	NA	
Aviador Staging Area							
Nearest Structure and Receptor: Roblar Avenue Residences	Loaded Trucks	0.076	200	0.008	No	59	No

SOURCE: FTA 2018; ESA 2021; Caltrans 2020; Sutro Science 2021.

NOTES:

a PPV at 25 feet.
b Distance between approximate location of equipment and property line of structure or sensitive receptor. Propagation estimates assume a site-specific vibration attenuation rate ("n") of 1.5 based on FTA guidance, Caltrans Guidance, and consultation with project geologist.
c The 0.5 PPV vibration standard for non-historic structures applies to all structures analyzed in this analysis.
d The PPV or VdB level is adjusted for distance.

As shown in Table 13, vibration from construction equipment at all reaches would be below the applicable criteria for building damage. While the U.S. Coast Guard Air Station, as a whole, has been identified as a historic district, Building C/1019C was constructed between 1968 and 1970 and would not be considered fragile or otherwise uniquely vulnerable to damage from vibration. Therefore, the criterion for non-historic structures of modern construction is applied. Because groundborne vibration generated from pile driving and other activities associated with the construction is predicted to be below the 0.5 PPV threshold, construction-related vibration is not anticipated to result in potential groundborne vibration impacts and control measures are not warranted.

Human Annoyance from Construction Vibration

With regard to human annoyance from groundborne vibration, construction activities associated with the proposed project would have the potential to affect the nearest off-site sensitive receptors to the project site, which include the guests at the Westin and Aloft hotels. These hotels would be the closest sensitive receptors to any pile driving or other construction activity that could occur during nighttime hours, and therefore could have the potential to result in sleep disturbance. These hotels would be 700 feet south of pile driving activity for Reach 14, and 350 feet southeast from standard construction activity for Reach 15. The Grand Hyatt hotel would be approximately 150 feet from construction work for Reach 16.

Nighttime sleep disturbance impacts at these sensitive receptor locations would occur if vibration levels were to exceed the criteria for human annoyance at Type 2 receptors (residences and hotels) during nighttime hours established in the FTA's *Transit Noise and Vibration Impact Assessment*, indicated in Table 7, p. 16. Construction activity along Reaches 1 through 6 and along Reaches 15 and 16 would occur only during daytime hours, hence, there would be no potential for nighttime sleep disturbance at sensitive receptors located near these reaches.

As shown in Table 13, p. 27, the maximum vibration level from pile driving (at 700 feet) would be 61 VdB, which is below the 72 VdB threshold; therefore, the potential for human annoyance would not be substantial. Similarly, the maximum vibration level from nighttime truck deliveries at the Aviador staging area (at 200 feet) would be 59 VdB, which is also below the 72 VdB threshold; therefore, the potential for human annoyance would not be substantial.

Vibration from pile driving and other construction activities also has the potential to affect land uses that engage in vibration-sensitive research and manufacturing, hospitals with vibration-sensitive equipment, and university research operations. However, none of these land uses exist within 1,000 feet of the construction areas for the proposed project. Navigational aids used to direct aircraft in the areas adjacent to the runways are not vibration sensitive. As such, there would be no impact to vibration-sensitive equipment from project-related construction activities.

Cumulative Construction Vibration

There are three cumulative projects identified within 0.25 mile of the project site and none of these would be within 200 feet of the proposed project work areas. As shown in Table 13, p. 27 (Reach 1), the operation of standard construction equipment and activities generates vibration levels below the applicable 0.5 PPV threshold for non-historic structures at a distance of 200 feet. Therefore, none of the cumulative projects would combine with the proposed project to result in significant cumulative construction vibration impacts.

Appendix A
Supporting Materials for Noise Analysis

A.1 Construction Noise Modeling Output

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 03/03/2021
Case Description: SFO SPP Aviado Lot

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Roblar Avenue	Residential	62.0	62.0	60.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Front End Loader	No	40		79.1	200.0	0.0
Gradall	No	40		83.4	200.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Front End Loader	67.1	63.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gradall	71.4	67.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	71.4	68.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 1

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	2260.0	0.0
Grader	No	40	85.0		2260.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Concrete Saw	56.5	49.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	51.9	47.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	56.5	51.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 1

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	2260.0	0.0
Grader	No	40	85.0		2260.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	56.5	49.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	51.9	47.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	56.5	51.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	200.0	0.0
Grader	No	40	85.0		200.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Noise Limits (dBA) Day Leq	Noise Limits (dBA) Evening Lmax	Noise Limits (dBA) Evening Leq	Noise Limits (dBA) Night Lmax	Noise Limits (dBA) Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Noise Limit Exceedance (dBA) Day Leq	Noise Limit Exceedance (dBA) Evening Lmax	Noise Limit Exceedance (dBA) Evening Leq	Noise Limit Exceedance (dBA) Night Lmax	Noise Limit Exceedance (dBA) Night Leq
Concrete Saw	77.5	70.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	73.0	69.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	77.5	72.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 2

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	4600.0	0.0
Crane	No	16		80.6	4600.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Vibratory Pile Driver	61.5	54.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	41.3	33.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	61.5	54.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	395.0	0.0
Crane	No	16		80.6	395.0	0.0

Results

			Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
	Calculated (dBA)		Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	82.9	75.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	62.6	54.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	82.9	75.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 3

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	4800.0	0.0
Crane	No	16		80.6	4800.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Vibratory Pile Driver	61.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	40.9	32.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	61.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	2310.0	0.0
Crane	No	16		80.6	2310.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Noise Limits (dBA) Day Leq	Noise Limits (dBA) Evening Lmax	Noise Limits (dBA) Evening Leq	Noise Limits (dBA) Night Lmax	Noise Limits (dBA) Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Noise Limit Exceedance (dBA) Day Leq	Noise Limit Exceedance (dBA) Evening Lmax	Noise Limit Exceedance (dBA) Evening Leq	Noise Limit Exceedance (dBA) Night Lmax	Noise Limit Exceedance (dBA) Night Leq
Vibratory Pile Driver	67.5	60.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	47.3	39.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	67.5	60.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 4

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	4800.0	0.0
Crane	No	16		80.6	4800.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	61.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	40.9	32.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	61.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	2340.0	0.0
Crane	No	16		80.6	2340.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	67.4	60.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	47.1	39.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	67.4	60.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 05/24/2021
Case Description: SFO SPP Reach 5

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
7th Ave. San Bruno	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	5100.0	0.0
Crane	No	16		80.6	5100.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	60.6	53.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	40.4	32.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	60.6	53.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	59.0	59.0	59.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	3560.0	0.0
Crane	No	16		80.6	3560.0	0.0

Results

Equipment	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	63.8	56.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	43.5	35.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	63.8	56.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/12/2021
Case Description: SFO SPP Reach 6

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Grand Hyatt	Residential	66.0	66.0	66.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	7300.0	0.0
Crane	No	16		80.6	7300.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Vibratory Pile Driver	57.5	50.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	37.3	29.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	57.5	50.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	4900.0	0.0
Crane	No	16		80.6	4900.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Noise Limits (dBA) Day Leq	Noise Limits (dBA) Evening Lmax	Noise Limits (dBA) Evening Leq	Noise Limits (dBA) Night Lmax	Noise Limits (dBA) Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Noise Limit Exceedance (dBA) Day Leq	Noise Limit Exceedance (dBA) Evening Lmax	Noise Limit Exceedance (dBA) Evening Leq	Noise Limit Exceedance (dBA) Night Lmax	Noise Limit Exceedance (dBA) Night Leq
Vibratory Pile Driver	61.0	54.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	40.7	32.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	61.0	54.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/12/2021
Case Description: SFO SPP Reach 7

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	8200.0	0.0
Crane	No	16		80.6	8200.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	56.5	49.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	36.3	28.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	56.5	49.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Safe Harbor Homeless Shelter	Residential	68.0	68.0	68.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	7100.0	0.0
Crane	No	16		80.6	7100.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Noise Limits (dBA) Day Leq	Noise Limits (dBA) Evening Lmax	Noise Limits (dBA) Evening Leq	Noise Limits (dBA) Night Lmax	Noise Limits (dBA) Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Noise Limit Exceedance (dBA) Day Leq	Noise Limit Exceedance (dBA) Evening Lmax	Noise Limit Exceedance (dBA) Evening Leq	Noise Limit Exceedance (dBA) Night Lmax	Noise Limit Exceedance (dBA) Night Leq
Vibratory Pile Driver	57.8	50.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	37.5	29.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	57.8	50.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 8

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	6700.0	0.0
Crane	No	16		80.6	6700.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	58.3	51.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	38.0	30.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	58.3	51.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 9 & 10

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	6500.0	0.0
Crane	No	16		80.6	6500.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Vibratory Pile Driver	58.5	51.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	38.3	30.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	58.5	51.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 11

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	6400.0	0.0
Crane	No	16		80.6	6400.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Vibratory Pile Driver	58.7	51.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	38.4	30.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	58.7	51.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 12

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	5400.0	0.0
Crane	No	16		80.6	5400.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	60.2	53.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	39.9	31.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	60.2	53.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 13

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	4000.0	0.0
Crane	No	16		80.6	4000.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	62.8	55.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	42.5	34.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	62.8	55.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 14

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Vibratory Pile Driver	No	20		100.8	700.0	0.0
Crane	No	16		80.6	700.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Vibratory Pile Driver	77.9	70.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Crane	57.6	49.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	77.9	70.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 02/18/2021
Case Description: SFO SPP Reach 15

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Westin Hotel	Residential	65.0	65.0	61.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	350.0	0.0
Grader	No	40	85.0		350.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Concrete Saw	72.7	65.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	68.1	64.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	72.7	68.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/02/2021
Case Description: SFO SPP Reach 16

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Grand Hyatt	Residential	66.0	66.0	66.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	150.0	0.0
Grader	No	40	85.0		150.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	75.5	71.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.0	75.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #2 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Bay Street	Residential	64.0	64.0	64.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	570.0	0.0
Grader	No	40	85.0		570.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Noise Limits (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Noise Limit Exceedance (dBA) Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq
Concrete Saw	68.4	61.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	63.9	59.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	68.4	63.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**** Receptor #3 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Corte Ana	Residential	62.0	62.0	62.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20		89.6	750.0	0.0
Grader	No	40	85.0		750.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	66.1	59.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	61.5	57.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	66.1	61.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

A.2 Traffic Noise Modeling Reports

SFO SPP Roadway Noise Analysis

Existing

ROAD SEGMENT: Calveno Peak

Road Segment	from:	to:	TOTAL # VEHICLES	VEHICLE TYPE % Auto %	Auto	MT %	MT	HT %	HT	VEHICLE SPEED Auto	k/h	MT	k/h	HT	k/h	NOISE LEVEL (dBA) Auto	MT	HT	CALCULATED NOISE LEVEL (15 meters from roadway center)
Milbrae Ave	U.S.101	Old Bayshore	1689	95	1604.6	3	50.67	2.5	42.23	35	56	35	56	35	56	66.4	61.1	67.0	70.3
Milbrae Ave	U.S. 101	Rollins	3490	95	3315.5	3	104.7	3	104.7	35	56	35	56	35	56	69.5	64.2	70.9	73.8
San Bruno Av	U.S.101	N. Mcdonnell	1198	95	1138.1	4	47.92	4	47.92	35	56	35	56	35	56	64.9	60.8	67.5	70.0
Garden Way	Rollins	Aviador	351	95	333.45	4	14.04	4	14.04	25	40	25	40	25	40	55.3	53.2	60.9	62.5

Assumptions: AM peak hour traffic data from LCW Consulting

Existing + Project

ROAD SEGMENT: Calveno Peak

Road Segment	from:	to:	TOTAL # VEHICLES	VEHICLE TYPE % Auto %	Auto	MT %	MT	HT %	HT	VEHICLE SPEED Auto	k/h	MT	k/h	HT	k/h	NOISE LEVEL (dBA) Auto	MT	HT	CALCULATED NOISE LEVEL (15 meters from roadway center)
Milbrae Ave	U.S.101	Old Bayshore	1707	95	1604.6	3	50.67	3.1	52.23	35	56	35	56	35	56	66.4	61.1	67.9	70.7
Milbrae Ave	U.S. 101	Rollins	3562	93	3315.5	3	104.7	4.0	141.7	35	56	35	56	35	56	69.5	64.2	72.3	74.5
San Bruno Av	U.S.101	N. Mcdonnell	1360	95	1264.1	4	47.92	4	47.92	35	56	35	56	35	56	65.3	60.8	67.5	70.1
Garden Way	Rollins	Aviador	399	83	333.45	4	14.04	12.8	51.04	25	40	25	40	25	40	55.3	53.2	66.5	67.0

Assumptions: AM peak hour traffic data from LCW Consulting

Truck Percentages

Per Intersection 9 Turning Movement Sheet for AM
Millbrae Ave/ Mcdonnell Way

Milbrae Ave total Pk hour vol =	960
Millbrae Ave Truck vol =	26
Old Bashore NB lfts total Vol =	349
Old Bashore NB lfts truck Vol =	33
S. Mcdonnell SB rights total Vol =	150
S. Mcdonnell SB rights truck Vol =	21
Total volume on Millbrae Ave =	1459
Total Truck Volume on Millbrae Ave =	80
Truck % =	5.48%

Per Intersection 11 Turning Movement Sheet for AM
Millbrae Ave/ US 101

Milbrae Ave total Pk hour vol =	1766
Millbrae Ave Truck vol =	75
US 101 SB rights total Vol =	817
US 101 SB rights truck Vol =	35
Total volume on Millbrae Ave =	1841
Total Truck Volume on Millbrae Ave =	110
Truck % =	5.98%

A.3 Sound Level Meter Reports

Calculated Ldn from long-term noise monitoring data - SFO-1

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/16/2019	Midnight	0 / 24	68.6	7244360	72443596	22908677
	am 1:00	100	70.8	12022644	120226443	38018940
	2:00	200	66.2	4168694	41686938	13182567
	3:00	300	66.7	4677351	46773514	14791084
	4:00	400	65.1	3235937	32359366	10232930
	5:00	500	62.5	1778279	17782794	5623413
	6:00	600	63.3	2137962	21379621	6760830
	7:00	700	64.7	2951209	29512092	9332543
	8:00	800	65.2	3311311	33113112	10471285
	9:00	900	66.1	4073803	40738028	12882496
	10:00	1000	62.4	1737801	17378008	5495409
	11:00	1100	70.0	10000000	100000000	31622777
	12:00	1200	68.0	6309573	63095734	19952623
	pm 1:00	1300	70.5	11220185	112201845	35481339
	2:00	1400	67.8	6025596	60255959	19054607
	3:00	1500	69.5	8912509	89125094	28183829
	4:00	1600	68.0	6309573	63095734	19952623
	5:00	1700	69.6	9120108	91201084	28840315
	6:00	1800	65.0	3162278	31622777	10000000
	7:00	1900	67.3	5370318	53703180	16982437
	8:00	2000	68.3	6760830	67608298	21379621
	9:00	2100	66.8	4786301	47863009	15135612
	10:00	2200	70.3	10715193	107151931	33884416
	pm 11:00	2300	69.8	9549926	95499259	30199517

Leq Morning Peak Hour 7:00-10:00 a.m.
65 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
68 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
68 dBA

Leq Daytime 7:00 am-10:00 p.m.
68 dBA

Leq 24-Hour
68 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
74 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
75 dBA

CNEL - Ldn : 0.23944448

Calculated Ldn from long-term noise monitoring data - SFO-1

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/17/2019	Midnight	0 / 24	67.3	5370318	53703180	16982437
	am 1:00	100	68.1	6456542	64565423	20417379
	2:00	200	65.4	3467369	34673685	10964782
	3:00	300	62.6	1819701	18197009	5754399
	4:00	400	59.1	812831	8128305	2570396
	5:00	500	63.0	1995262	19952623	6309573
	6:00	600	64.2	2630268	26302680	8317638
	7:00	700	64.4	2754229	27542287	8709636
	8:00	800	65.7	3715352	37153523	11748976
	9:00	900	65.6	3630781	36307805	11481536
	10:00	1000	64.2	2630268	26302680	8317638
	11:00	1100	68.9	7762471	77624712	24547089
	12:00	1200	68.5	7079458	70794578	22387211
	pm 1:00	1300	70.5	11220185	112201845	35481339
	2:00	1400	67.8	6025596	60255959	19054607
	3:00	1500	71.1	12882496	128824955	40738028
	4:00	1600	68.9	7762471	77624712	24547089
	5:00	1700	70.9	12302688	123026877	38904514
	6:00	1800	69.0	7943282	79432823	25118864
	7:00	1900	69.3	8511380	85113804	26915348
	8:00	2000	69.9	9772372	97723722	30902954
	9:00	2100	64.8	3019952	30199517	9549926
	10:00	2200	64.4	2754229	27542287	8709636
	pm 11:00	2300	70.1	10232930	102329299	32359366

Leq Morning Peak Hour 7:00-10:00 a.m.
65 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
70 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
66 dBA

Leq Daytime 7:00 am-10:00 p.m.
69 dBA

Leq 24-Hour
68 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
73 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
73 dBA

CNEL - Ldn = 0.41242196

Calculated Ldn from long-term noise monitoring data - SFO-1

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/20/2019	Midnight	0 / 24	68.0	6309573	63095734	19952623
	am 1:00	100	71.0	12589254	125892541	39810717
	2:00	200	60.7	1174898	11748976	3715352
	3:00	300	65.2	3311311	33113112	10471285
	4:00	400	62.3	1698244	16982437	5370318
	5:00	500	63.0	1995262	19952623	6309573
	6:00	600	62.6	1819701	18197009	5754399
	7:00	700	65.2	3311311	33113112	10471285
	8:00	800	65.7	3715352	37153523	11748976
	9:00	900	65.4	3467369	34673685	10964782
	10:00	1000	64.8	3019952	30199517	9549926
	11:00	1100	71.0	12589254	125892541	39810717
	12:00	1200	68.7	7413102	74131024	23442288
	pm 1:00	1300	68.1	6456542	64565423	20417379
	2:00	1400	68.7	7413102	74131024	23442288
	3:00	1500	69.7	9332543	93325430	29512092
	4:00	1600	68.5	7079458	70794578	22387211
	5:00	1700	67.4	5495409	54954087	17378008
	6:00	1800	67.9	6165950	61659500	19498446
	7:00	1900	68.3	6760830	67608298	21379621
	8:00	2000	68.8	7585776	75857758	23988329
	9:00	2100	69.1	8128305	81283052	25703958
	10:00	2200	69.6	9120108	91201084	28840315
	pm 11:00	2300	69.7	9332543	93325430	29512092

Leq Morning Peak Hour 7:00-10:00 a.m.
65 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
68 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
67 dBA

Leq Daytime 7:00 am-10:00 p.m.
68 dBA

Leq 24-Hour
68 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
74 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
74 dBA

CNEL - Ldn : 0.35446777

Calculated Ldn from long-term noise monitoring data - ESA-3

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
2/9/2021	Midnight	0 / 24	60.1	1019927	10199268	3225292
	am 1:00	100	53.7	236494	2364945	747861
	2:00	200	53.8	237932	2379321	752407
	3:00	300	57.9	617885	6178855	1953925
	4:00	400	58.3	671792	6717923	2124394
	5:00	500	61.2	1310397	13103973	4143840
	6:00	600	64.8	3049727	30497272	9644084
	7:00	700	65.1	3239373	32393733	10243798
	8:00	800	64.5	2841901	28419014	8986881
	9:00	900	65.2	3334210	33342104	10543699
	10:00	1000	64.3	2708420	27084199	8564776
	11:00	1100	65.3	3371025	33710252	10660118
2/8/2021	12:00	1200	66.8	4821443	48214426	15246740
	pm 1:00	1300	67.4	5437709	54377095	17195547
	2:00	1400	65.4	3436956	34369562	10868610
	3:00	1500	65.0	3165272	31652717	10009468
	4:00	1600	65.5	3514374	35143742	11113427
	5:00	1700	65.5	3523344	35233436	11141791
	6:00	1800	65.4	3501297	35012974	11072075
	7:00	1900	62.8	1906207	19062067	6027955
	8:00	2000	62.5	1788908	17889080	5657024
	9:00	2100	60.5	1133517	11335169	3584495
	10:00	2200	62.7	1868259	18682586	5907953
	pm 11:00	2300	61.8	1524362	15243616	4820455

Leq Morning Peak Hour 7:00-10:00 a.m.
65 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
65 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
61 dBA

Leq Daytime 7:00 am-10:00 p.m.
65 dBA

Leq 24-Hour
64 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL - Ldn : 0.2865254

Calculated Ldn from long-term noise monitoring data - ESA-3

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
2/10/2021	Midnight	0 / 24	61.2	1326243	13262427	4193948
	am 1:00	100	57.4	543798	5437985	1719642
	2:00	200	59.0	788502	7885024	2493463
	3:00	300	58.0	633502	6335020	2003309
	4:00	400	61.2	1320204	13202039	4174851
	5:00	500	64.8	3029654	30296538	9580606
	6:00	600	66.4	4359945	43599449	13787356
	7:00	700	69.9	9799840	97998403	30989816
	8:00	800	65.6	3609491	36094913	11414214
	9:00	900	66.2	4121307	41213073	13032718
	10:00	1000	78.1	64465299	644652988	203857174
	11:00	1100	71.6	14291276	142912758	45192982
2/9/2021	12:00	1200	65.5	3559566	35595656	11256335
	pm 1:00	1300	66.2	4173342	41733422	13197267
	2:00	1400	65.8	3845325	38453245	12159984
	3:00	1500	65.6	3625083	36250834	11463520
	4:00	1600	65.7	3712693	37126927	11740565
	5:00	1700	65.7	3700488	37004880	11701971
	6:00	1800	65.7	3675192	36751917	11621977
	7:00	1900	65.6	3619787	36197869	11446771
	8:00	2000	65.3	3361213	33612127	10629088
	9:00	2100	64.1	2548784	25487838	8059962
	10:00	2200	62.7	1879758	18797583	5944318
	pm 11:00	2300	60.3	1061441	10614413	3356572

Leq Morning Peak Hour 7:00-10:00 a.m.
68 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
66 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
62 dBA

Leq Daytime 7:00 am-10:00 p.m.
69 dBA

Leq 24-Hour
68 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
71 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
71 dBA

CNEL - Ldn = 0.30676885

Calculated Ldn from long-term noise monitoring data - SFO-5

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/16/2019	Midnight	0 / 24	63.7	2344229	23442288	7413102
	am 1:00	100	65.9	3890451	38904514	12302688
	2:00	200	57.1	512861	5128614	1621810
	3:00	300	56.7	467735	4677351	1479108
	4:00	400	52.0	158489	1584893	501187
	5:00	500	55.3	338844	3388442	1071519
	6:00	600	57.1	512861	5128614	1621810
	7:00	700	60.0	1000000	10000000	3162278
	8:00	800	60.5	1122018	11220185	3548134
	9:00	900	60.5	1122018	11220185	3548134
	10:00	1000	58.0	630957	6309573	1995262
	11:00	1100	63.5	2238721	22387211	7079458
	12:00	1200	63.0	1995262	19952623	6309573
	pm 1:00	1300	65.2	3311311	33113112	10471285
	2:00	1400	61.7	1479108	14791084	4677351
	3:00	1500	63.4	2187762	21877616	6918310
	4:00	1600	62.0	1584893	15848932	5011872
	5:00	1700	63.5	2238721	22387211	7079458
	6:00	1800	58.9	776247	7762471	2454709
	7:00	1900	62.1	1621810	16218101	5128614
	8:00	2000	63.3	2137962	21379621	6760830
	9:00	2100	62.0	1584893	15848932	5011872
	10:00	2200	61.2	1318257	13182567	4168694
	pm 11:00	2300	63.1	2041738	20417379	6456542

Leq Morning Peak Hour 7:00-10:00 a.m.
60 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
62 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
61 dBA

Leq Daytime 7:00 am-10:00 p.m.
62 dBA

Leq 24-Hour
62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL - Ldn = 0.34238571

Calculated Ldn from long-term noise monitoring data - SFO-5

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/17/2019	Midnight	0 / 24	62.7	1862087	18620871	5888437
	am 1:00	100	56.9	489779	4897788	1548817
	2:00	200	53.8	239883	2398833	758578
	3:00	300	51.2	131826	1318257	416869
	4:00	400	56.1	407380	4073803	1288250
	5:00	500	59.2	831764	8317638	2630268
	6:00	600	59.1	812831	8128305	2570396
	7:00	700	60.8	1202264	12022644	3801894
	8:00	800	60.7	1174898	11748976	3715352
	9:00	900	57.5	562341	5623413	1778279
	10:00	1000	63.7	2344229	23442288	7413102
	11:00	1100	63.6	2290868	22908677	7244360
	12:00	1200	66.3	4265795	42657952	13489629
	pm 1:00	1300	62.3	1698244	16982437	5370318
	2:00	1400	66.8	4786301	47863009	15135612
	3:00	1500	64.7	2951209	29512092	9332543
	4:00	1600	65.8	3801894	38018940	12022644
	5:00	1700	65.1	3235937	32359366	10232930
	6:00	1800	65.4	3467369	34673685	10964782
	7:00	1900	66.0	3981072	39810717	12589254
	8:00	2000	61.0	1258925	12589254	3981072
	9:00	2100	59.5	891251	8912509	2818383
	10:00	2200	65.5	3548134	35481339	11220185
	pm 11:00	2300	65.5	3548134	35481339	11220185

Leq Morning Peak Hour 7:00-10:00 a.m.
60 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
66 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
61 dBA

Leq Daytime 7:00 am-10:00 p.m.
64 dBA

Leq 24-Hour
63 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL - Ldn = 0.35286211

Calculated Ldn from long-term noise monitoring data - SFO-5

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/20/2019	Midnight	0 / 24	63.0	1995262	19952623	6309573
	am 1:00	100	66.1	4073803	40738028	12882496
	2:00	200	54.2	263027	2630268	831764
	3:00	300	58.2	660693	6606934	2089296
	4:00	400	55.6	363078	3630781	1148154
	5:00	500	57.8	602560	6025596	1905461
	6:00	600	59.2	831764	8317638	2630268
	7:00	700	61.2	1318257	13182567	4168694
	8:00	800	62.3	1698244	16982437	5370318
	9:00	900	58.6	724436	7244360	2290868
	10:00	1000	57.9	616595	6165950	1949845
	11:00	1100	64.0	2511886	25118864	7943282
	12:00	1200	63.8	2398833	23988329	7585776
	pm 1:00	1300	63.7	2344229	23442288	7413102
	2:00	1400	63.3	2137962	21379621	6760830
	3:00	1500	63.6	2290868	22908677	7244360
	4:00	1600	62.0	1584893	15848932	5011872
	5:00	1700	61.8	1513561	15135612	4786301
	6:00	1800	62.3	1698244	16982437	5370318
	7:00	1900	61.8	1513561	15135612	4786301
	8:00	2000	64.0	2511886	25118864	7943282
	9:00	2100	63.9	2454709	24547089	7762471
	10:00	2200	62.3	1698244	16982437	5370318
	pm 11:00	2300	64.1	2570396	25703958	8128305

Leq Morning Peak Hour 7:00-10:00 a.m.
61 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
62 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
62 dBA

Leq Daytime 7:00 am-10:00 p.m.
63 dBA

Leq 24-Hour
62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
69 dBA

CNEL - Ldn = 0.36922364

Calculated Ldn from long-term noise monitoring data - SFO-8

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/16/2019	Midnight	0 / 24	62.3	1698244	16982437	5370318
	am 1:00	100	60.7	1174898	11748976	3715352
	2:00	200	57.9	616595	6165950	1949845
	3:00	300	58.5	707946	7079458	2238721
	4:00	400	62.6	1819701	18197009	5754399
	5:00	500	64.6	2884032	28840315	9120108
	6:00	600	66.8	4786301	47863009	15135612
	7:00	700	67.0	5011872	50118723	15848932
	8:00	800	65.7	3715352	37153523	11748976
	9:00	900	63.1	2041738	20417379	6456542
	10:00	1000	61.9	1548817	15488166	4897788
	11:00	1100	64.2	2630268	26302680	8317638
	12:00	1200	64.3	2691535	26915348	8511380
	pm 1:00	1300	63.3	2137962	21379621	6760830
	2:00	1400	62.6	1819701	18197009	5754399
	3:00	1500	59.3	851138	8511380	2691535
	4:00	1600	59.3	851138	8511380	2691535
	5:00	1700	59.9	977237	9772372	3090295
	6:00	1800	58.2	660693	6606934	2089296
	7:00	1900	60.0	1000000	10000000	3162278
	8:00	2000	60.7	1174898	11748976	3715352
	9:00	2100	60.5	1122018	11220185	3548134
	10:00	2200	59.6	912011	9120108	2884032
	pm 11:00	2300	58.3	676083	6760830	2137962

Leq Morning Peak Hour 7:00-10:00 a.m.
66 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
59 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
62 dBA

Leq Daytime 7:00 am-10:00 p.m.
63 dBA

Leq 24-Hour
63 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
69 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
69 dBA

CNEL - Ldn : 0.16777507

Calculated Ldn from long-term noise monitoring data - SFO-8

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/17/2019	Midnight	0 / 24	55.4	346737	3467369	1096478
	am 1:00	100	54.4	275423	2754229	870964
	2:00	200	56.4	436516	4365158	1380384
	3:00	300	56.0	398107	3981072	1258925
	4:00	400	57.2	524807	5248075	1659587
	5:00	500	60.1	1023293	10232930	3235937
	6:00	600	63.0	1995262	19952623	6309573
	7:00	700	63.8	2398833	23988329	7585776
	8:00	800	63.1	2041738	20417379	6456542
	9:00	900	62.1	1621810	16218101	5128614
	10:00	1000	61.1	1288250	12882496	4073803
	11:00	1100	62.9	1949845	19498446	6165950
	12:00	1200	62.9	1949845	19498446	6165950
	pm 1:00	1300	62.0	1584893	15848932	5011872
	2:00	1400	63.2	2089296	20892961	6606934
	3:00	1500	61.2	1318257	13182567	4168694
	4:00	1600	61.0	1258925	12589254	3981072
	5:00	1700	61.4	1380384	13803843	4365158
	6:00	1800	62.9	1949845	19498446	6165950
	7:00	1900	63.9	2454709	24547089	7762471
	8:00	2000	61.7	1479108	14791084	4677351
	9:00	2100	60.2	1047129	10471285	3311311
	10:00	2200	62.9	1949845	19498446	6165950
	pm 11:00	2300	63.7	2344229	23442288	7413102

Leq Morning Peak Hour 7:00-10:00 a.m.
63 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
62 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
60 dBA

Leq Daytime 7:00 am-10:00 p.m.
62 dBA

Leq 24-Hour
62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
67 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
67 dBA

CNEL - Ldn = 0.3770231

Calculated Ldn from long-term noise monitoring data - SFO-8

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/20/2019	Midnight	0 / 24	62.0	1584893	15848932	5011872
	am 1:00	100	61.5	1412538	14125375	4466836
	2:00	200	58.6	724436	7244360	2290868
	3:00	300	57.0	501187	5011872	1584893
	4:00	400	57.3	537032	5370318	1698244
	5:00	500	60.3	1071519	10715193	3388442
	6:00	600	64.3	2691535	26915348	8511380
	7:00	700	67.3	5370318	53703180	16982437
	8:00	800	64.7	2951209	29512092	9332543
	9:00	900	62.5	1778279	17782794	5623413
	10:00	1000	62.8	1905461	19054607	6025596
	11:00	1100	63.2	2089296	20892961	6606934
	12:00	1200	62.0	1584893	15848932	5011872
	pm 1:00	1300	58.9	776247	7762471	2454709
	2:00	1400	61.4	1380384	13803843	4365158
	3:00	1500	61.2	1318257	13182567	4168694
	4:00	1600	61.9	1548817	15488166	4897788
	5:00	1700	59.9	977237	9772372	3090295
	6:00	1800	60.0	1000000	10000000	3162278
	7:00	1900	61.0	1258925	12589254	3981072
	8:00	2000	61.2	1318257	13182567	4168694
	9:00	2100	63.1	2041738	20417379	6456542
	10:00	2200	63.2	2089296	20892961	6606934
	pm 11:00	2300	62.6	1819701	18197009	5754399

Leq Morning Peak Hour 7:00-10:00 a.m.
65 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
61 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
61 dBA

Leq Daytime 7:00 am-10:00 p.m.
63 dBA

Leq 24-Hour
62 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
68 dBA

CNEL - Ldn = 0.27704596

Calculated Ldn from long-term noise monitoring data - SFO-22

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/16/2019	Midnight	0 / 24	59.3	851138	8511380	2691535
	am 1:00	100	58.6	724436	7244360	2290868
	2:00	200	52.6	181970	1819701	575440
	3:00	300	52.5	177828	1778279	562341
	4:00	400	52.9	194984	1949845	616595
	5:00	500	56.6	457088	4570882	1445440
	6:00	600	57.2	524807	5248075	1659587
	7:00	700	59.7	933254	9332543	2951209
	8:00	800	60.1	1023293	10232930	3235937
	9:00	900	61.6	1445440	14454398	4570882
	10:00	1000	60.7	1174898	11748976	3715352
	11:00	1100	58.5	707946	7079458	2238721
	12:00	1200	57.4	549541	5495409	1737801
	pm 1:00	1300	58.1	645654	6456542	2041738
	2:00	1400	56.8	478630	4786301	1513561
	3:00	1500	58.2	660693	6606934	2089296
	4:00	1600	57.5	562341	5623413	1778279
	5:00	1700	57.7	588844	5888437	1862087
	6:00	1800	56.2	416869	4168694	1318257
	7:00	1900	56.5	446684	4466836	1412538
	8:00	2000	58.4	691831	6918310	2187762
	9:00	2100	56.9	489779	4897788	1548817
	10:00	2200	55.7	371535	3715352	1174898
	pm 11:00	2300	56.0	398107	3981072	1258925

Leq Morning Peak Hour 7:00-10:00 a.m.
61 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
57 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
56 dBA

Leq Daytime 7:00 am-10:00 p.m.
59 dBA

Leq 24-Hour
58 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
63 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
63 dBA

CNEL - Ldn : 0.29763023

Calculated Ldn from long-term noise monitoring data - SFO-22

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/17/2019	Midnight	0 / 24	53.9	245471	2454709	776247
	am 1:00	100	54.1	257040	2570396	812831
	2:00	200	49.4	87096	870964	275423
	3:00	300	48.4	69183	691831	218776
	4:00	400	51.3	134896	1348963	426580
	5:00	500	58.6	724436	7244360	2290868
	6:00	600	58.2	660693	6606934	2089296
	7:00	700	59.2	831764	8317638	2630268
	8:00	800	58.5	707946	7079458	2238721
	9:00	900	58.2	660693	6606934	2089296
	10:00	1000	62.8	1905461	19054607	6025596
	11:00	1100	59.5	891251	8912509	2818383
	12:00	1200	59.5	891251	8912509	2818383
	pm 1:00	1300	60.3	1071519	10715193	3388442
	2:00	1400	59.0	794328	7943282	2511886
	3:00	1500	61.7	1479108	14791084	4677351
	4:00	1600	61.5	1412538	14125375	4466836
	5:00	1700	61.7	1479108	14791084	4677351
	6:00	1800	61.5	1412538	14125375	4466836
	7:00	1900	61.4	1380384	13803843	4365158
	8:00	2000	60.6	1148154	11481536	3630781
	9:00	2100	58.7	741310	7413102	2344229
	10:00	2200	57.2	524807	5248075	1659587
	pm 11:00	2300	58.4	691831	6918310	2187762

Leq Morning Peak Hour 7:00-10:00 a.m.
59 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
62 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
56 dBA

Leq Daytime 7:00 am-10:00 p.m.
60 dBA

Leq 24-Hour
59 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
63 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
64 dBA

CNEL - Ldn = 0.56631998

Calculated Ldn from long-term noise monitoring data - SFO-22

		TIME	dBA	Remove LOG	10 dBA Penalized Values	5 dBA Penalized Values
10/20/2019	Midnight	0 / 24	58.3	676083	6760830	2137962
	am 1:00	100	59.2	831764	8317638	2630268
	2:00	200	56.1	407380	4073803	1288250
	3:00	300	56.0	398107	3981072	1258925
	4:00	400	56.6	457088	4570882	1445440
	5:00	500	57.8	602560	6025596	1905461
	6:00	600	61.6	1445440	14454398	4570882
	7:00	700	62.2	1659587	16595869	5248075
	8:00	800	61.2	1318257	13182567	4168694
	9:00	900	56.2	416869	4168694	1318257
	10:00	1000	56.6	457088	4570882	1445440
	11:00	1100	59.2	831764	8317638	2630268
	12:00	1200	57.3	537032	5370318	1698244
	pm 1:00	1300	56.8	478630	4786301	1513561
	2:00	1400	57.1	512861	5128614	1621810
	3:00	1500	57.9	616595	6165950	1949845
	4:00	1600	57.6	575440	5754399	1819701
	5:00	1700	58.0	630957	6309573	1995262
	6:00	1800	57.4	549541	5495409	1737801
	7:00	1900	57.1	512861	5128614	1621810
	8:00	2000	57.5	562341	5623413	1778279
	9:00	2100	58.5	707946	7079458	2238721
	10:00	2200	57.7	588844	5888437	1862087
	pm 11:00	2300	61.3	1348963	13489629	4265795

Leq Morning Peak Hour 7:00-10:00 a.m.
61 dBA

Leq Evening Peak Hour 4:00-8:00 p.m.
58 dBA

Leq Nighttime 10:00 pm-7:00 a.m. (not penalized)
59 dBA

Leq Daytime 7:00 am-10:00 p.m.
58 dBA

Leq 24-Hour
59 dBA

Ldn: 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
65 dBA

CNEL: 5 dBA penalty for noise between 7:00p.m. and 10:00 p.m., and 10 dBA penalty for noise between 10:00 p.m. and 7:00 a.m.
65 dBA

CNEL - Ldn = 0.20972484

Summary

File Name on Meter	831_Data.043
File Name on PC	SLM_0002783_831_Data_043.00.ldbin
Serial Number	0002783
Model	Model 831
Firmware Version	2.402
User	C. Sanchez
Location	SFO LT-3 Old Bayshore Hwy, Across from Westin
Job Description	SFO SPP
Note	

Measurement

Description	
Start	2021-02-08 12:00:00
Stop	2021-02-10 12:00:00
Duration	48:00:00.0
Run Time	48:00:00.0
Pause	00:00:00.0
Pre Calibration	2021-02-08 10:24:03
Post Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRM831			
Microphone Correction	Off			
Integration Method	Linear			
OBA Range	Low			
OBA Bandwidth	1/1 and 1/3			
OBA Freq. Weighting	A Weighting			
OBA Max Spectrum	Bin Max			
Gain	20.0 dB			
Overload	124.6 dB			
	A	**C**	**Z**	
Under Range Peak	57.2	54.2	**59.2**	dB
Under Range Limit	**24.8**	25.5	33.2	dB
Noise Floor	15.6	16.3	21.5	dB

Results

LAeq	66.3		
LAE	118.7		
EA	82.091 mPa²h		
LZpeak (max)	2021-02-09 13:30:58	116.6	dB
LASmax	2021-02-10 10:33:45	94.2	dB
LASmin	2021-02-09 01:33:59	40.6	dB
SEA	-99.9 dB		
LAS > 65.0 dB (Exceedance Counts / Duration)	5020	51879.6	s
LAS > 85.0 dB (Exceedance Counts / Duration)	22	214.0	s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0	s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0	s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0	s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	69.5	67.7	61.5	69.8	68.3	63.8

LCeq	75.9 dB
LAeq	66.3 dB
LCeq - LAeq	9.5 dB
LAIeq	67.6 dB
LAeq	66.3 dB
LAIeq - LAeq	1.3 dB

Record #	Record Type	Date	Time	LAeq	LApeak	LZpeak	LA2.00	LA8.00	LA25.00	LA50.00	LA66.60	LA90.00	OVLD	Marker
1	Run	2021-02-08	12:00:00											
2		2021-02-08	12:00:00	66.8	104.7	110.9	73.4	70.3	67.2	63.7	61.6	56.7	No	
3		2021-02-08	13:00:00	67.4	97.5	106.6	74.9	71.4	67.6	63.7	61.7	57.4	No	
4		2021-02-08	14:00:00	65.4	99.9	105.8	71.9	69.3	66.2	62.7	60.4	56.0	No	
5		2021-02-08	15:00:00	65.0	92.9	101.8	72.0	69.1	66.0	62.3	59.9	55.5	No	
6		2021-02-08	16:00:00	65.5	105.7	113.9	72.1	69.1	66.1	62.3	60.0	55.9	No	
7		2021-02-08	17:00:00	65.5	100.0	105.5	72.4	69.5	66.2	62.8	60.6	56.8	No	
8		2021-02-08	18:00:00	65.4	95.0	105.6	72.7	69.6	66.1	62.9	60.7	56.3	No	
9		2021-02-08	19:00:00	62.8	91.1	104.2	70.8	67.3	62.7	59.2	57.4	54.2	No	
10		2021-02-08	20:00:00	62.5	95.6	100.8	70.4	66.9	62.5	59.0	56.9	52.5	No	
11		2021-02-08	21:00:00	60.5	90.2	102.1	68.9	65.0	60.5	56.8	54.3	49.6	No	
12		2021-02-08	22:00:00	62.7	99.0	112.9	70.2	66.1	61.0	57.2	55.2	51.8	No	
13		2021-02-08	23:00:00	61.8	93.9	110.1	70.6	64.9	59.9	56.5	54.5	51.6	No	
14		2021-02-09	0:00:00	60.1	93.0	106.1	69.2	62.2	57.5	53.5	51.3	49.2	No	
15		2021-02-09	1:00:00	53.7	87.4	94.7	63.3	57.2	51.0	47.0	44.8	42.6	No	
16		2021-02-09	2:00:00	53.8	87.5	99.8	62.6	57.1	51.1	48.0	46.6	43.4	No	
17		2021-02-09	3:00:00	57.9	92.4	104.1	68.1	61.1	54.9	49.5	47.4	45.3	No	
18		2021-02-09	4:00:00	58.3	93.3	98.4	66.8	61.3	56.5	51.5	49.2	47.5	No	
19		2021-02-09	5:00:00	61.2	93.6	98.6	69.5	65.2	60.4	57.0	54.8	51.9	No	
20		2021-02-09	6:00:00	64.8	96.6	109.9	73.4	68.7	64.1	60.6	58.9	56.5	No	
21		2021-02-09	7:00:00	65.1	95.0	105.0	73.4	69.4	65.1	61.4	59.6	56.4	No	
22		2021-02-09	8:00:00	64.5	93.7	103.9	71.7	68.5	65.1	61.8	59.2	54.3	No	
23		2021-02-09	9:00:00	65.2	96.7	108.2	72.2	69.5	65.8	62.4	60.2	56.4	No	
24		2021-02-09	10:00:00	64.3	91.9	103.8	71.8	68.6	64.9	61.3	59.3	54.7	No	
25		2021-02-09	11:00:00	65.3	95.3	104.5	72.4	69.2	66.1	62.6	60.0	55.1	No	
26		2021-02-09	12:00:00	65.5	96.3	102.1	73.1	69.6	66.3	62.6	60.3	55.9	No	
27		2021-02-09	13:00:00	66.2	107.1	116.6	73.7	70.3	66.3	62.4	60.1	56.8	No	
28		2021-02-09	14:00:00	65.8	99.0	113.4	73.4	69.7	66.3	62.6	60.2	57.0	No	
29		2021-02-09	15:00:00	65.6	94.8	109.5	73.0	69.5	66.1	62.7	60.6	57.2	No	
30		2021-02-09	16:00:00	65.7	96.0	110.0	72.6	69.3	66.3	63.1	61.2	58.4	No	
31		2021-02-09	17:00:00	65.7	94.5	105.5	72.6	69.5	66.4	62.8	60.9	58.2	No	
32		2021-02-09	18:00:00	65.7	99.7	104.9	72.8	69.5	65.9	62.5	60.7	58.4	No	
33		2021-02-09	19:00:00	65.6	96.4	105.8	73.1	69.4	65.0	61.5	59.8	56.9	No	
34		2021-02-09	20:00:00	65.3	92.6	107.8	72.0	69.4	66.4	62.4	60.2	56.7	No	
35		2021-02-09	21:00:00	64.1	101.1	104.4	71.8	68.5	64.7	60.2	57.7	53.4	No	
36		2021-02-09	22:00:00	62.7	93.6	107.6	71.0	67.6	62.4	58.0	55.6	50.6	No	
37		2021-02-09	23:00:00	60.3	92.6	98.8	68.7	65.4	59.8	55.9	53.6	50.3	No	
38		2021-02-10	0:00:00	61.2	94.6	106.4	70.7	65.2	58.7	55.1	53.0	50.0	No	
39		2021-02-10	1:00:00	57.4	90.7	101.6	67.3	60.9	55.1	51.0	49.3	47.5	No	
40		2021-02-10	2:00:00	59.0	93.1	103.3	68.3	62.3	55.7	52.4	50.7	47.4	No	
41		2021-02-10	3:00:00	58.0	96.3	101.3	67.0	60.8	54.8	51.6	48.8	45.4	No	
42		2021-02-10	4:00:00	61.2	102.0	109.4	69.9	65.3	59.7	55.9	54.2	52.2	No	
43		2021-02-10	5:00:00	64.8	95.6	102.0	72.5	68.5	64.5	62.5	61.4	57.9	No	
44		2021-02-10	6:00:00	66.4	99.4	104.6	75.0	70.1	65.7	63.2	61.7	59.2	No	
45		2021-02-10	7:00:00	69.9	114.1	115.1	80.3	71.6	67.0	63.6	61.7	58.8	No	
46		2021-02-10	8:00:00	65.6	94.7	103.7	72.0	69.4	66.4	63.3	61.5	58.2	No	
47		2021-02-10	9:00:00	66.2	102.9	104.4	74.0	70.5	66.3	63.0	61.3	57.8	No	
48		2021-02-10	10:00:00	78.1	113.1	114.9	90.8	79.4	71.9	66.8	64.5	60.9	No	
49		2021-02-10	11:00:00	71.6	102.4	112.7	81.5	75.0	69.6	66.1	64.2	61.2	No	
50	Stop	2021-02-10	12:00:00											

Summary

File Name on Meter	LxT_Data.100
File Name on PC	SLM_0004435_LxT_Data_100.00.ldbin
Serial Number	0004435
Model	SoundTrack LxT®
Firmware Version	2.402
User	C. Sanchez
Location	ST-1 San Bruno Ave. 2021 Update
Job Description	SFO SPP
Note	

Measurement

Description	
Start	2021-02-08 12:15:25
Stop	2021-02-08 12:30:26
Duration	00:15:01.1
Run Time	00:15:01.1
Pause	00:00:00.0
Pre Calibration	2021-02-08 11:41:28
Post Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRMLxT2B			
Microphone Correction	Off			
Integration Method	Exponential			
Overload	143.4 dB			
	A	**C**	**Z**	
Under Range Peak	99.6	96.6	**101.6**	dB
Under Range Limit	**37.9**	37.5	44.3	dB
Noise Floor	28.8	28.4	35.2	dB

Results

LASeq	72.6	
LASE	102.2	
EAS	1.836 mPa²h	
EAS8	58.674 mPa²h	
EAS40	293.372 mPa²h	
LZSpeak (max)	2021-02-08 12:18:00	119.3 dB
LASmax	2021-02-08 12:18:00	96.3 dB
LASmin	2021-02-08 12:23:52	55.5 dB
SEA	-99.9 dB	
LAS > 85.0 dB (Exceedance Counts / Duration)	1	5.9 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s
LCSeq	79.8 dB	
LASeq	72.6 dB	
LCSeq - LASeq	7.2 dB	
LAIeq	76.1 dB	
LAeq	72.6 dB	
LAIeq - LAeq	3.5 dB	

Record #	Record Type	Date	Time	LASeq	LASmax	LASmin	OVLD	Marker
1	Run	2021-02-08	12:15:25					
2		2021-02-08	12:15:25	69.6	74.8	57.9	No	
3		2021-02-08	12:16:25	70.2	78.2	57.7	No	
4		2021-02-08	12:17:25	81.3	96.3	59.5	No	
5		2021-02-08	12:18:25	68.2	74.9	55.9	No	
6		2021-02-08	12:19:25	68.0	73.9	56.3	No	
7		2021-02-08	12:20:25	71.9	80.5	57.6	No	
8		2021-02-08	12:21:25	71.0	77.1	60.1	No	
9		2021-02-08	12:22:25	69.6	75.5	55.8	No	
10		2021-02-08	12:23:25	69.3	78.6	55.5	No	
11		2021-02-08	12:24:25	70.6	76.1	60.6	No	
12		2021-02-08	12:25:25	69.6	75.3	61.0	No	
13		2021-02-08	12:26:25	69.4	76.4	56.5	No	
14		2021-02-08	12:27:25	71.9	78.9	56.6	No	
15		2021-02-08	12:28:25	68.5	76.7	56.7	No	
16		2021-02-08	12:29:25	69.6	78.7	56.1	No	
17		2021-02-08	12:30:25	65.5	66.5	65.1	No	
18	Stop	2021-02-08	12:30:26					

Summary

File Name on Meter	LxT_Data.033		
File Name on PC	SLM_0004435_LxT_Data_033.00.ldbin		
Serial Number	0004435		
Model	SoundTrack LxT®		
Firmware Version	2.302		
User	C. Sanchez		
Location	ST-1 San Bruno Ave		
Job Description	SFO		
Note			

Measurement

Description			
Start	2019-10-15 13:12:19		
Stop	2019-10-15 13:32:52		
Duration	00:20:33.1		
Run Time	00:19:52.4		
Pause	00:00:40.7		
Pre Calibration	2019-10-15 10:16:03		
Post Calibration	None		
Calibration Deviation	---		

Overall Settings

RMS Weight	A Weighting		
Peak Weight	Z Weighting		
Detector	Slow		
Preamp	PRMLxT2B		
Microphone Correction	Off		
Integration Method	Linear		
Overload	142.7 dB		
	A	**C**	**Z**
Under Range Peak	98.9	95.9	**100.9** dB
Under Range Limit	**47.9**	45.9	53.9 dB
Noise Floor	34.8	35.4	43.0 dB

Results

LAeq	71.8 dB	
LAE	102.6 dB	
EA	1.999 mPa²h	
EA8	48.292 mPa²h	
EA40	241.462 mPa²h	
LZpeak (max)	2019-10-15 13:18:54	108.3 dB
LASmax	2019-10-15 13:18:53	87.8 dB
LASmin	2019-10-15 13:26:07	57.6 dB
SEA	-99.9 dB	
LAS > 85.0 dB (Exceedance Counts / Duration)	2	8.9 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s
LCeq	79.4 dB	
LAeq	71.8 dB	
LCeq - LAeq	7.6 dB	
LAIeq	73.4 dB	
LAeq	71.8 dB	
LAIeq - LAeq	1.6 dB	

Record #	Record Type	Date	Time	LAeq	LZpeak	LASmax	LASmin	OVLD	OBA OVLD	Marker
1	Run	2019-10-15	13:12:19							
2		2019-10-15	13:12:19	69.7	96.0	74.0	63.5	No	No	
3		2019-10-15	13:13:19	72.2	100.3	79.1	64.0	No	No	
4		2019-10-15	13:14:19	68.7	96.0	75.1	60.3	No	No	
5		2019-10-15	13:15:19	68.9	97.1	78.6	60.6	No	No	
6		2019-10-15	13:16:19	69.6	100.1	78.6	62.2	No	No	
7		2019-10-15	13:17:19	66.8	100.8	70.2	59.9	No	No	
8	Pause	2019-10-15	13:17:46							
9	Resume	2019-10-15	13:18:26							
10		2019-10-15	13:18:26	77.7	108.3	87.8	63.5	No	No	
11		2019-10-15	13:19:26	69.8	96.7	76.0	64.1	No	No	
12		2019-10-15	13:20:26	69.3	102.8	76.1	58.9	No	No	
13		2019-10-15	13:21:26	71.0	97.9	76.4	61.6	No	No	
14		2019-10-15	13:22:26	70.5	100.0	78.0	58.2	No	No	
15		2019-10-15	13:23:26	75.1	104.9	85.8	59.9	No	No	
16		2019-10-15	13:24:26	75.0	104.6	87.4	58.7	No	No	
17		2019-10-15	13:25:26	67.1	95.6	74.8	57.6	No	No	
18		2019-10-15	13:26:26	71.9	103.6	79.7	58.5	No	No	
19		2019-10-15	13:27:26	70.5	97.3	76.0	62.1	No	No	
20		2019-10-15	13:28:26	68.9	97.1	76.4	57.7	No	No	
21		2019-10-15	13:29:26	70.4	102.5	74.3	61.0	No	No	
22		2019-10-15	13:30:26	69.0	93.7	74.7	58.4	No	No	
23		2019-10-15	13:31:26	72.5	101.1	79.8	61.6	No	No	
24		2019-10-15	13:32:26	72.1	97.5	77.7	66.6	No	No	
25	Stop	2019-10-15	13:32:52							

Summary			
File Name on Meter	LxT_Data.030		
File Name on PC	SLM_0004435_LxT_Data_030.01.ldbin		
Serial Number	0004435		
Model	SoundTrack LxT®		
Firmware Version	2.302		
User	C. Sanchez		
	ST-2 SFO Grand Hyatt		
Location	Hotel		
Job Description	SFO		
Note			

Measurement			
Description			
Start	2019-10-15 10:16:50		
Stop	2019-10-15 10:36:52		
Duration	00:20:02.3		
Run Time	00:20:02.3		
Pause	00:00:00.0		
Pre Calibration	2019-10-15 10:16:05		
Post Calibration	None		
Calibration Deviation	---		

Overall Settings				
RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRMLxT2B			
Microphone Correction	Off			
Integration Method	Linear			
Overload	142.7 dB			
	A	**C**	**Z**	
Under Range Peak	98.9	95.9	**100.9**	dB
Under Range Limit	**47.9**	45.9	53.9	dB
Noise Floor	34.8	35.4	43.0	dB

Results		
LAeq	65.5 dB	
LAE	96.3 dB	
EA	478.184 µPa²h	
EA8	11.454 mPa²h	
EA40	57.272 mPa²h	
LZpeak (max)	2019-10-15 10:17:07	96.2 dB
LASmax	2019-10-15 10:17:08	70.4 dB
LASmin	2019-10-15 10:19:04	62.4 dB
SEA	-99.9 dB	
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s
LCeq	75.3 dB	
LAeq	65.5 dB	
LCeq - LAeq	9.7 dB	
LAIeq	66.1 dB	
LAeq	65.5 dB	
LAIeq - LAeq	0.6 dB	

Record #	Record Type	Date	Time	LAeq	LZpeak	LASmax	LASmin	OVLD	OBA OVLD	Marker
1	alibration Chang	2019-10-15	10:16:05							
2	Run	2019-10-15	10:16:49							
3		2019-10-15	10:16:50	65.0	96.2	70.4	62.5	No	No	
4		2019-10-15	10:17:50	64.0	88.1	66.1	62.4	No	No	
5		2019-10-15	10:18:50	63.8	90.5	66.1	62.4	No	No	
6		2019-10-15	10:19:50	64.7	90.0	66.8	62.6	No	No	
7		2019-10-15	10:20:50	66.5	93.5	70.4	63.8	No	No	
8		2019-10-15	10:21:50	64.8	92.2	66.5	63.2	No	No	
9		2019-10-15	10:22:50	64.7	94.0	66.9	63.4	No	No	
10		2019-10-15	10:23:50	64.8	89.8	67.0	63.0	No	No	
11		2019-10-15	10:24:50	64.6	91.3	66.8	63.7	No	No	
12		2019-10-15	10:25:50	65.2	90.5	67.3	63.6	No	No	
13		2019-10-15	10:26:50	66.4	91.4	69.7	64.3	No	No	
14		2019-10-15	10:27:50	65.3	90.3	66.6	64.4	No	No	
15		2019-10-15	10:28:50	66.2	94.3	68.0	64.7	No	No	
16		2019-10-15	10:29:50	66.2	90.3	68.2	64.6	No	No	
17		2019-10-15	10:30:50	65.7	93.3	68.1	63.8	No	No	
18		2019-10-15	10:31:50	65.3	92.2	66.9	64.0	No	No	
19		2019-10-15	10:32:50	66.7	95.3	69.5	64.8	No	No	
20		2019-10-15	10:33:50	65.4	92.9	68.5	63.5	No	No	
21		2019-10-15	10:34:50	65.7	90.5	67.3	64.8	No	No	
22		2019-10-15	10:35:50	67.5	95.4	69.1	65.2	No	No	
23		2019-10-15	10:36:50	68.8	92.2	68.8	68.6	No	No	
24	Stop	2019-10-15	10:36:52							

Summary

File Name on Meter	LxT_Data.031
File Name on PC	SLM_0004435_LxT_Data_031.00.ldbin
Serial Number	0004435
Model	SoundTrack LxT®
Firmware Version	2.302
User	C. Sanchez
Location	ST-3 ALoft Hotel
Job Description	SFO
Note	

Measurement

Description	
Start	2019-10-15 11:01:29
Stop	2019-10-15 11:21:30
Duration	00:20:01.0
Run Time	00:20:01.0
Pause	00:00:00.0
Pre Calibration	2019-10-15 10:16:03
Post Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting		
Peak Weight	Z Weighting		
Detector	Slow		
Preamp	PRMLxT2B		
Microphone Correction	Off		
Integration Method	Linear		
Overload	142.7 dB		
	A	**C**	**Z**
Under Range Peak	98.9	95.9	**100.9** dB
Under Range Limit	**47.9**	45.9	53.9 dB
Noise Floor	34.8	35.4	43.0 dB

Results

LAeq	68.0 dB	
LAE	98.8 dB	
EA	841.856 µPa²h	
EA8	20.188 mPa²h	
EA40	100.939 mPa²h	
LZpeak (max)	2019-10-15 11:11:16	107.3 dB
LASmax	2019-10-15 11:18:04	81.7 dB
LASmin	2019-10-15 11:06:07	60.8 dB
SEA	-99.9 dB	
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s
LCeq	81.9 dB	
LAeq	68.0 dB	
LCeq - LAeq	13.9 dB	
LAIeq	68.8 dB	
LAeq	68.0 dB	
LAIeq - LAeq	0.8 dB	

Record #	Record Type	Date	Time	LAeq	LZpeak	LASmax	LASmin	OVLD	OBA OVLD	Marker
1	Run	2019-10-15	11:01:29							
2		2019-10-15	11:01:29	67.7	98.8	73.0	65.6	No	No	
3		2019-10-15	11:02:29	69.0	104.0	74.2	64.6	No	No	
4		2019-10-15	11:03:29	65.4	91.1	66.5	63.9	No	No	
5		2019-10-15	11:04:29	68.6	103.3	74.5	64.1	No	No	
6		2019-10-15	11:05:29	63.2	97.7	65.2	60.8	No	No	
7		2019-10-15	11:06:29	63.1	90.0	64.1	61.9	No	No	
8		2019-10-15	11:07:29	70.7	106.6	77.9	63.5	No	No	
9		2019-10-15	11:08:29	66.0	97.4	67.2	65.1	No	No	
10		2019-10-15	11:09:29	65.1	89.8	66.2	64.2	No	No	
11		2019-10-15	11:10:29	72.3	107.3	78.4	65.5	No	No	
12		2019-10-15	11:11:29	65.0	98.7	66.4	64.0	No	No	
13		2019-10-15	11:12:29	69.3	99.5	76.1	64.9	No	No	
14		2019-10-15	11:13:29	64.9	88.7	66.3	63.4	No	No	
15		2019-10-15	11:14:29	66.2	93.4	68.3	64.5	No	No	
16		2019-10-15	11:15:29	66.5	94.5	69.8	64.4	No	No	
17		2019-10-15	11:16:29	66.4	88.4	68.0	64.5	No	No	
18		2019-10-15	11:17:29	71.0	99.5	81.7	65.6	No	No	
19		2019-10-15	11:18:29	66.5	95.5	70.2	65.4	No	No	
20		2019-10-15	11:19:29	66.6	92.7	68.6	65.1	No	No	
21		2019-10-15	11:20:29	70.9	102.8	78.7	64.6	No	No	
22		2019-10-15	11:21:29	66.2	90.8	66.1	66.0	No	No	
23	Stop	2019-10-15	11:21:30							

Summary

File Name on Meter	LxT_Data.032			
File Name on PC	SLM_0004435_LxT_Data_032.00.ldbin			
Serial Number	0004435			
Model	SoundTrack LxT®			
Firmware Version	2.302			
User	C. Sanchez			
Location	ST-4 ECR Milbrae Ave			
Job Description	SFO			
Note				

Measurement

Description				
Start	2019-10-15 11:40:57			
Stop	2019-10-15 12:00:58			
Duration	00:20:01.0			
Run Time	00:20:01.0			
Pause	00:00:00.0			
Pre Calibration	2019-10-15 10:16:03			
Post Calibration	None			
Calibration Deviation	---			

Overall Settings

RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRMLxT2B			
Microphone Correction	Off			
Integration Method	Linear			
Overload	142.7 dB			
	A	**C**	**Z**	
Under Range Peak	98.9	95.9	**100.9**	dB
Under Range Limit	**47.9**	45.9	53.9	dB
Noise Floor	34.8	35.4	43.0	dB

Results

LAeq	68.1 dB			
LAE	98.9 dB			
EA	863.143 µPa²h			
EA8	20.698 mPa²h			
EA40	103.491 mPa²h			
LZpeak (max)	2019-10-15 11:44:55	101.2 dB		
LASmax	2019-10-15 11:44:56	79.6 dB		
LASmin	2019-10-15 11:56:23	57.6 dB		
SEA	-99.9 dB			
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s		
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s		
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s		
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s		
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s		
LCeq	75.7 dB			
LAeq	68.1 dB			
LCeq - LAeq	7.5 dB			
LAIeq	69.2 dB			
LAeq	68.1 dB			
LAIeq - LAeq	1.1 dB			

Record #	Record Type	Date	Time	LAeq	LZpeak	LASmax	LASmin	OVLD	OBA OVLD	Marker
1	Run	2019-10-15	11:40:57							
2		2019-10-15	11:40:57	66.5	92.3	71.6	58.3	No	No	
3		2019-10-15	11:41:57	67.3	93.5	73.3	59.8	No	No	
4		2019-10-15	11:42:57	67.8	94.0	73.6	59.2	No	No	
5		2019-10-15	11:43:57	70.8	101.2	79.6	58.7	No	No	
6		2019-10-15	11:44:57	64.4	94.4	77.8	57.8	No	No	
7		2019-10-15	11:45:57	67.5	95.4	72.1	57.9	No	No	
8		2019-10-15	11:46:57	69.9	94.4	76.1	61.1	No	No	
9		2019-10-15	11:47:57	68.9	95.6	74.0	57.7	No	No	
10		2019-10-15	11:48:57	66.8	96.0	74.4	59.4	No	No	
11		2019-10-15	11:49:57	69.5	94.9	76.7	60.7	No	No	
12		2019-10-15	11:50:57	66.2	95.1	71.8	58.1	No	No	
13		2019-10-15	11:51:57	68.9	97.4	79.2	58.3	No	No	
14		2019-10-15	11:52:57	66.9	92.6	73.5	58.2	No	No	
15		2019-10-15	11:53:57	68.5	93.7	75.1	59.7	No	No	
16		2019-10-15	11:54:57	64.7	92.8	72.3	58.1	No	No	
17		2019-10-15	11:55:57	67.8	94.7	74.9	57.6	No	No	
18		2019-10-15	11:56:57	68.8	98.0	77.3	57.7	No	No	
19		2019-10-15	11:57:57	69.1	94.4	74.5	59.1	No	No	
20		2019-10-15	11:58:57	66.9	96.6	74.6	58.7	No	No	
21		2019-10-15	11:59:57	69.3	96.7	73.8	60.5	No	No	
22		2019-10-15	12:00:57	63.6	88.6	68.4	66.0	No	No	
23	Stop	2019-10-15	12:00:58							

Summary

File Name on Meter	LxT_Data.099		
File Name on PC	SLM_0004435_LxT_Data_099.00.ldbin		
Serial Number	0004435		
Model	SoundTrack LxT®		
Firmware Version	2.402		
User	C. Sanchez		
Location	ST-4 Milbrae Ave at ECR 2021 update		
Job Description	SFO SPP		
Note			

Measurement

Description			
Start	2021-02-08 11:43:51		
Stop	2021-02-08 11:58:53		
Duration	00:15:01.6		
Run Time	00:15:01.6		
Pause	00:00:00.0		
Pre Calibration	2021-02-08 11:41:29		
Post Calibration	None		
Calibration Deviation	---		

Overall Settings

RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRMLxT2B			
Microphone Correction	Off			
Integration Method	Exponential			
Overload	143.4 dB			
	A	**C**	**Z**	
Under Range Peak	99.6	96.6	**101.6**	dB
Under Range Limit	**37.9**	37.5	44.3	dB
Noise Floor	28.8	28.4	35.2	dB

Results

LASeq	67.5	
LASE	97.1	
EAS	565.293 µPa²h	
EAS8	18.057 mPa²h	
EAS40	90.286 mPa²h	
LZSpeak (max)	2021-02-08 11:49:47	98.1 dB
LASmax	2021-02-08 11:49:48	76.6 dB
LASmin	2021-02-08 11:52:43	55.5 dB
SEA	-99.9 dB	
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0 s
LZSpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0 s
LCSeq	75.4 dB	
LASeq	67.5 dB	
LCSeq - LASeq	7.9 dB	
LAIeq	68.3 dB	
LAeq	67.5 dB	
LAIeq - LAeq	0.8 dB	

Record #	Record Type	Date	Time	LASeq	LASmax	LASmin	OVLD	Marker
1	Calibration Change	2021-02-08	11:41:29					
2	Run	2021-02-08	11:43:51					
3		2021-02-08	11:43:51	65.6	72.6	56.6	No	
4		2021-02-08	11:44:51	70.5	75.3	57.4	No	
5		2021-02-08	11:45:51	65.8	72.3	58.0	No	
6		2021-02-08	11:46:51	64.2	71.3	58.7	No	
7		2021-02-08	11:47:51	68.7	72.5	59.2	No	
8		2021-02-08	11:48:51	68.6	76.6	59.9	No	
9		2021-02-08	11:49:51	63.7	72.6	55.7	No	
10		2021-02-08	11:50:51	67.8	73.1	58.5	No	
11		2021-02-08	11:51:51	66.1	73.0	55.5	No	
12		2021-02-08	11:52:51	69.0	73.1	57.6	No	
13		2021-02-08	11:53:51	66.1	73.2	57.4	No	
14		2021-02-08	11:54:51	69.5	75.9	56.6	No	
15		2021-02-08	11:55:51	65.4	70.9	59.1	No	
16		2021-02-08	11:56:51	68.3	73.3	59.5	No	
17		2021-02-08	11:57:51	67.2	72.8	58.5	No	
18		2021-02-08	11:58:51	70.2	71.8	68.5	No	
19	Stop	2021-02-08	11:58:53					

Summary

File Name on Meter	831_Data.049
File Name on PC	SLM_0002783_831_Data_049.00.ldbin
Serial Number	0002783
Model	Model 831
Firmware Version	2.403
User	C. Sanchez
Location	Safe Harbor Shelter
Job Description	SFO SPP
Note	

Measurement

Description	
Start	2021-05-21 10:05:27
Stop	2021-05-21 10:25:28
Duration	00:20:01.1
Run Time	00:20:01.1
Pause	00:00:00.0
Pre Calibration	2021-05-21 08:58:57
Post Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting			
Peak Weight	Z Weighting			
Detector	Slow			
Preamp	PRM831			
Microphone Correction	Off			
Integration Method	Linear			
OBA Range	Low			
OBA Bandwidth	1/1 and 1/3			
OBA Freq. Weighting	Z Weighting			
OBA Max Spectrum	Bin Max			
Gain	0.0	dB		
Overload	144.4	dB		
	A	**C**	**Z**	
Under Range Peak	76.9	73.9	**78.9**	dB
Under Range Limit	**26.6**	27.0	32.9	dB
Noise Floor	17.4	17.9	23.3	dB

Results

LAeq	58.6		
LAE	89.4		
EA	97.539 µPa²h		
LZpeak (max)	2021-05-21 10:22:41	118.7	dB
LASmax	2021-05-21 10:08:10	72.2	dB
LASmin	2021-05-21 10:14:14	52.9	dB
SEA	-99.9 dB		
LAS > 65.0 dB (Exceedance Counts / Duration)	6	40.0	s
LAS > 85.0 dB (Exceedance Counts / Duration)	0	0.0	s
LZpeak > 135.0 dB (Exceedance Counts / Duration)	0	0.0	s
LZpeak > 137.0 dB (Exceedance Counts / Duration)	0	0.0	s
LZpeak > 140.0 dB (Exceedance Counts / Duration)	0	0.0	s

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**
	58.6	58.6	-99.9	58.6	58.6	-99.9

LCeq	80.2 dB
LAeq	58.6 dB
LCeq - LAeq	21.6 dB
LAIeq	62.4 dB
LAeq	58.6 dB
LAIeq - LAeq	3.8 dB

Record #	Record Type	Date	Time	LAeq	LASmax	LASmin	OVLD	Marker
1	Run	2021-05-21	10:05:27					
2		2021-05-21	10:05:27	60.0	70.2	55.3	No	
3		2021-05-21	10:06:27	56.5	61.1	53.3	No	
4		2021-05-21	10:07:27	64.6	72.2	55.2	No	
5		2021-05-21	10:08:27	58.8	65.5	53.5	No	
6		2021-05-21	10:09:27	58.0	64.5	55.3	No	
7		2021-05-21	10:10:27	58.1	63.5	55.0	No	
8		2021-05-21	10:11:27	57.9	63.6	54.5	No	
9		2021-05-21	10:12:27	57.5	64.3	53.1	No	
10		2021-05-21	10:13:27	54.8	58.4	52.9	No	
11		2021-05-21	10:14:27	55.5	58.8	53.6	No	
12		2021-05-21	10:15:27	58.5	62.6	54.2	No	
13		2021-05-21	10:16:27	57.3	61.8	54.2	No	
14		2021-05-21	10:17:27	56.2	58.6	53.6	No	
15		2021-05-21	10:18:27	56.0	60.3	53.8	No	
16		2021-05-21	10:19:27	57.3	60.3	54.9	No	
17		2021-05-21	10:20:27	58.2	63.2	54.3	No	
18		2021-05-21	10:21:27	56.1	59.9	54.0	No	
19		2021-05-21	10:22:27	56.9	60.1	53.5	No	
20		2021-05-21	10:23:27	62.5	70.0	54.3	No	
21		2021-05-21	10:24:27	56.8	65.5	53.3	No	
22		2021-05-21	10:25:27	61.1	61.4	60.3	No	
23	Stop	2021-05-21	10:25:28					

A.4 Vibration Calculations

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 1

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 200 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.028726
	Vibratory Roller	0.009281
	Caisson Drill	0.003933
	Truck(loaded)	0.003359
	Jackhammer	0.001547

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	76.9073
	Vibratory Roller	66.9073
	Caisson Drill	59.9073
	Truck(loaded)	58.9073
	Jackhammer	51.9073

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 2

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 90 Nearest Buildings

Resultant PPV =		
	pile driver (impact)	0.095161
	Vibratory Roller	0.030744
	Caisson Drill	0.01303
	Truck(loaded)	0.011127
	Jackhammer	0.005124

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	87.31092
	Vibratory Roller	77.31092
	Caisson Drill	70.31092
	Truck(loaded)	69.31092
	Jackhammer	62.31092

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 3

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =

	PPV@25ft
pile driver (impact)	0.65
Vibratory Roller	0.21
Caisson Drill	0.089
Truck(loaded)	0.076
Jackhammer	0.035

Enter distance = 55 Nearest Buildings

Resultant PPV =

pile driver (impact)	0.199195
Vibratory Roller	0.064355
Caisson Drill	0.027274
Truck(loaded)	0.023291
Jackhammer	0.010726

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	93.72732
Vibratory Roller	83.72732
Caisson Drill	76.72732
Truck(loaded)	75.72732
Jackhammer	68.72732

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 4

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 30 Nearest Buildings

Resultant PPV =		
	pile driver (impact)	0.494472
	Vibratory Roller	0.162692
	Caisson Drill	0.06895
	Truck(loaded)	0.058879
	Jackhammer	0.027115

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	101.6246
	Vibratory Roller	91.62456
	Caisson Drill	84.62456
	Truck(loaded)	83.62456
	Jackhammer	76.62456

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 5

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Bulldozer (large)	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 100 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.08125
	Vibratory Roller	0.02625
	Caisson Drill	0.011125
	Truck(loaded)	0.0095
	Jackhammer	0.004375

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	85.9382
	Vibratory Roller	75.9382
	Caisson Drill	68.9382
	Truck(loaded)	67.9382
	Jackhammer	60.9382

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 6

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 100 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.08125
	Vibratory Roller	0.02625
	Caisson Drill	0.011125
	Truck(loaded)	0.0095
	Jackhammer	0.004375

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	85.9382
	Vibratory Roller	75.9382
	Caisson Drill	68.9382
	Truck(loaded)	67.9382
	Jackhammer	60.9382

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 7

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =

	PPV@25ft
pile driver (impact)	0.65
Vibratory Roller	0.21
Caisson Drill	0.089
Truck(loaded)	0.076
Jackhammer	0.035

Enter distance = 560 Nearest Buildings

Resultant PPV =

pile driver (impact)	0.006131
Vibratory Roller	0.001981
Caisson Drill	0.000839
Truck(loaded)	0.000717
Jackhammer	0.00033

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	63.49256
Vibratory Roller	53.49256
Caisson Drill	46.49256
Truck(loaded)	45.49256
Jackhammer	38.49256

Enter distance = 8200 Nearest Receptor

Resultant PPV =

pile driver (impact)	0.000109421
Vibratory Roller	3.53516E-05
Caisson Drill	1.49823E-05
Truck(loaded)	1.27939E-05
Jackhammer	5.89193E-06

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	28.52378
Vibratory Roller	18.52378
Caisson Drill	11.52378
Truck(loaded)	10.52378
Jackhammer	3.523785

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 8

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 2700 Nearest Buildings

Resultant PPV =		
	pile driver (impact)	0.000579132
	Vibratory Roller	0.000187104
	Caisson Drill	7.92966E-05
	Truck(loaded)	6.77139E-05
	Jackhammer	3.1184E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	42.99729
	Vibratory Roller	32.99729
	Caisson Drill	25.99729
	Truck(loaded)	24.99729
	Jackhammer	17.99729

Enter distance = 6700 Nearest Receptor

Resultant PPV =		
	pile driver (impact)	0.000148153
	Vibratory Roller	4.78649E-05
	Caisson Drill	2.02856E-05
	Truck(loaded)	1.73225E-05
	Jackhammer	7.97748E-06

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	31.15596
	Vibratory Roller	21.15596
	Caisson Drill	14.15596
	Truck(loaded)	13.15596
	Jackhammer	6.155956

Vibration propogation from Construction Equipment

Project: SFO SPP
Reach 9 & 10

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 2800 Nearest Buildings

Resultant PPV =		
	pile driver (impact)	0.000548386
	Vibratory Roller	0.000177171
	Caisson Drill	7.50867E-05
	Truck(loaded)	6.4119E-05
	Jackhammer	2.95285E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	42.52346
	Vibratory Roller	32.52346
	Caisson Drill	25.52346
	Truck(loaded)	24.52346
	Jackhammer	17.52346

Enter distance = 6500 Nearest Receptor

Resultant PPV =		
	pile driver (impact)	0.000155043
	Vibratory Roller	5.0091E-05
	Caisson Drill	2.1229E-05
	Truck(loaded)	1.81282E-05
	Jackhammer	8.34849E-06

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	31.5508
	Vibratory Roller	21.5508
	Caisson Drill	14.5508
	Truck(loaded)	13.5508
	Jackhammer	6.5508

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 11

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 6400 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.000158691
	Vibratory Roller	5.12695E-05
	Caisson Drill	2.17285E-05
	Truck(loaded)	1.85547E-05
	Jackhammer	8.54492E-06

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	31.7528
	Vibratory Roller	21.7528
	Caisson Drill	14.7528
	Truck(loaded)	13.7528
	Jackhammer	6.752801

Enter distance = 6400 Nearest Receptor

Resultant PPV =	pile driver (impact)	0.000158691
	Vibratory Roller	5.12695E-05
	Caisson Drill	2.17285E-05
	Truck(loaded)	1.85547E-05
	Jackhammer	8.54492E-06

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	31.7528
	Vibratory Roller	21.7528
	Caisson Drill	14.7528
	Truck(loaded)	13.7528
	Jackhammer	6.752801

Vibration propogation from Construction Equipment

Project: SFO SPP
Reach 12

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 5400 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.000204754
	Vibratory Roller	6.61513E-05
	Caisson Drill	2.80356E-05
	Truck(loaded)	2.39405E-05
	Jackhammer	1.10252E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	33.96639
	Vibratory Roller	23.96639
	Caisson Drill	16.96639
	Truck(loaded)	15.96639
	Jackhammer	8.966387

Enter distance = 5400 Nearest Receptor

Resultant PPV =	pile driver (impact)	0.000204754
	Vibratory Roller	6.61513E-05
	Caisson Drill	2.80356E-05
	Truck(loaded)	2.39405E-05
	Jackhammer	1.10252E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	33.96639
	Vibratory Roller	23.96639
	Caisson Drill	16.96639
	Truck(loaded)	15.96639
	Jackhammer	8.966387

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 13

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

		PPV@25ft
PPV refs @ 25 ft =	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 4000 Nearest Buildings

Resultant PPV =	pile driver (impact)	0.000321169
	Vibratory Roller	0.000103762
	Caisson Drill	4.39754E-05
	Truck(loaded)	3.7552E-05
	Jackhammer	1.72937E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	37.8764
	Vibratory Roller	27.8764
	Caisson Drill	20.8764
	Truck(loaded)	19.8764
	Jackhammer	12.8764

Enter distance = 4000 Nearest Receptor

Resultant PPV =	pile driver (impact)	0.000321169
	Vibratory Roller	0.000103762
	Caisson Drill	4.39754E-05
	Truck(loaded)	3.7552E-05
	Jackhammer	1.72937E-05

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =	pile driver (impact)	37.8764
	Vibratory Roller	27.8764
	Caisson Drill	20.8764
	Truck(loaded)	19.8764
	Jackhammer	12.8764

Vibration propogation from Construction Equipment

Project: SFO SPP
Reach 14

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5
where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =		PPV@25ft
	pile driver (impact)	0.65
	Vibratory Roller	0.21
	Caisson Drill	0.089
	Truck(loaded)	0.076
	Jackhammer	0.035

Enter distance = 700 Nearest Buildings

Resultant PPV =		
	pile driver (impact)	0.004387
	Vibratory Roller	0.001417
	Caisson Drill	0.000601
	Truck(loaded)	0.000513
	Jackhammer	0.000236

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	60.58526
	Vibratory Roller	50.58526
	Caisson Drill	43.58526
	Truck(loaded)	42.58526
	Jackhammer	35.58526

Enter distance = 700 Nearest Receptor

Resultant PPV =		
	pile driver (impact)	0.004387
	Vibratory Roller	0.001417
	Caisson Drill	0.000601
	Truck(loaded)	0.000513
	Jackhammer	0.000236

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =		
	pile driver (impact)	60.58526
	Vibratory Roller	50.58526
	Caisson Drill	43.58526
	Truck(loaded)	42.58526
	Jackhammer	35.58526

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 15

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =

	PPV@25ft
pile driver (impact)	0.65
Vibratory Roller	0.21
Caisson Drill	0.089
Truck(loaded)	0.076
Jackhammer	0.035

Enter distance = 350 Nearest Buildings

Resultant PPV =

pile driver (impact)	0.012409
Vibratory Roller	0.004009
Caisson Drill	0.001699
Truck(loaded)	0.001451
Jackhammer	0.000668

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	69.61616
Vibratory Roller	59.61616
Caisson Drill	52.61616
Truck(loaded)	51.61616
Jackhammer	44.61616

Enter distance = 350 Nearest Receptor

Resultant PPV =

pile driver (impact)	0.012409
Vibratory Roller	0.004009
Caisson Drill	0.001699
Truck(loaded)	0.001451
Jackhammer	0.000668

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	69.61616
Vibratory Roller	59.61616
Caisson Drill	52.61616
Truck(loaded)	51.61616
Jackhammer	44.61616

Vibration propogation from Construction Equipment

Project: SFO SPP

Reach 16

Formula from FTA 2018 Equation 7.2 = PPVequip = PPVref x (25/D)^1.5

where 1.5 = Measured vibation attenuation rate through Class II soils (Caltrans 2020)

PPV refs @ 25 ft =

	PPV@25ft
pile driver (impact)	0.65
Vibratory Roller	0.21
Caisson Drill	0.089
Truck(loaded)	0.076
Jackhammer	0.035

Enter distance = 15 Nearest Buildings

Resultant PPV =

pile driver (impact)	1.398577
Vibratory Roller	0.451848
Caisson Drill	0.191498
Truck(loaded)	0.163526
Jackhammer	0.075308

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	110.6555
Vibratory Roller	100.6555
Caisson Drill	93.65546
Truck(loaded)	92.65546
Jackhammer	85.65546

Enter distance = 150 Nearest Receptor

Resultant PPV =

pile driver (impact)	0.044227
Vibratory Roller	0.014289
Caisson Drill	0.006056
Truck(loaded)	0.005171
Jackhammer	0.002381

	Lv@25 ft
pile driver (impact)	104
Vibratory Roller	94
Caisson Drill	87
Truck(loaded)	86
Jackhammer	79

Formula from FTA 2018 = Lv(D) = Lv(25 ft) – 30log(D/25)

Resultant Lv =

pile driver (impact)	80.65546
Vibratory Roller	70.65546
Caisson Drill	63.65546
Truck(loaded)	62.65546
Jackhammer	55.65546

Appendix B
Regulatory Setting

Appendix B: Regulatory Setting

Federal Noise Standards

The primary federal noise standards that directly regulate noise related to the operation of the proposed Project are with regard to noise exposure and workers. The Office of Safety and Health Administration (OSHA) enforce regulations to safeguard the hearing of workers exposed to occupational noise. OSHA has established worker noise exposure limits that vary with the duration of the exposure and require implementation of a hearing conservation program if employees are exposed to noise levels in excess of 85 dBA.

Federal regulations also establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205, Subpart B. The federal truck pass-by noise standard is 80 dB at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

Federal Transit Authority Vibration Standards

The FTA has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. The vibration damage criteria adopted by the FTA are shown in **Table B1**.

TABLE B1
CONSTRUCTION VIBRATION DAMAGE CRITERIA

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

SOURCE: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006.

In addition, the FTA has also adopted standards associated with human annoyance for groundborne vibration impacts for the following three land-use categories: Vibration Category 1 – High Sensitivity, Vibration Category 2 – Residential, and Vibration Category 3 – Institutional. The FTA defines Category 1 as buildings where vibration would interfere with operations within the building, including vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. Vibration-sensitive equipment includes, but is not limited to, electron microscopes, high-resolution lithographic equipment, and normal optical microscopes. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference.

Under conditions where there are an infrequent number of events per day, the FTA has established thresholds of 65 VdB for Category 1 buildings, 80 VdB for Category 2 buildings, and 83 VdB for

Category 3 buildings.[1] Under conditions where there are an occasional number of events per day, the FTA has established thresholds of 65 VdB for Category 1 buildings, 75 VdB for Category 2 buildings, and 78 VdB for Category 3 buildings.[2] No thresholds have been adopted or recommended for commercial and office uses.

California Department of Health Services Noise Standards

The California Department of Health Services (DHS) has established guidelines for evaluating the compatibility of various land uses as a function of community noise exposure. These guidelines for land use and noise exposure compatibility are shown in **Table B2**. In addition, Section 65302(f) of the California Government Code requires each county and city in the State to prepare and adopt a comprehensive long-range general plan for its physical development, with Section 65302(g) requiring a noise element to be included in the general plan. The noise element must: (1) identify and appraise noise problems in the community; (2) recognize Office of Noise Control guidelines; and (3) analyze and quantify current and projected noise levels.

The State of California also establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the State pass-by standard is consistent with the federal limit of 80 dB. The State pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dB at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

TABLE B2
COMMUNITY NOISE EXPOSURE (L_{DN} OR CNEL)

Land Use	Normally Acceptable[a]	Conditionally Acceptable[b]	Normally Unacceptable[c]	Clearly Unacceptable[d]
Single-family, Duplex, Mobile Homes	50 - 60	55 - 70	70 - 75	above 75
Multi-Family Homes	50 - 65	60 - 70	70 - 75	above 75
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 - 70	60 - 70	70 - 80	above 80
Transient Lodging – Motels, Hotels	50 - 65	60 - 70	70 - 80	above 75
Auditoriums, Concert Halls, Amphitheaters	---	50 - 70	---	above 70
Sports Arena, Outdoor Spectator Sports	---	50 - 75	---	above 75
Playgrounds, Neighborhood Parks	50 - 70	---	67 - 75	above 75
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50 - 75	---	70 - 80	above 80
Office Buildings, Business and Professional Commercial	50 - 70	67 - 77	above 75	---
Industrial, Manufacturing, Utilities, Agriculture	50 - 75	70 - 80	above 75	---

NOTES:

1 "Infrequent events" is defined by the Federal Transit Administration as being fewer than 30 vibration events of the same kind per day.

2 "Occasional events" is defined by the Federal Transit Administration as between 30 and 70 vibration events of the same source per day.

[a] Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

[b] Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

[c] Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

[d] Clearly Unacceptable: New construction or development should generally not be undertaken.

SOURCE: Office of Planning and Research, State of California Genera Plan Guidelines, October 2003 (in coordination with the California Department of Health Services).

The State has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of 45 dB CNEL in any habitable room. They require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than 60 dB CNEL. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

State Vibration Standards

There are no State vibration standards applicable to the proposed Project. Moreover, according to the California Department of Transportation's (Caltrans) *Transportation and Construction Vibration Guidance Manual* (2013), there are no official Caltrans standards for vibration. However, this manual provides guidelines for assessing vibration damage potential to various types of buildings, ranging from 0.08-0.12 in/sec PPV for extremely fragile historic buildings, ruins, and ancient monuments to 0.50-2.0 in/sec PPV for modern industrial/commercial buildings.

San Mateo County Code

The San Mateo County Noise Ordinance (chapter 4.88) specifies exterior noise standards for uses located adjacent to residences, schools, hospitals, churches, or public libraries. The ordinance specifies standards for maximum allowable exterior and interior noise levels. The ordinance exempts construction noise from its noise standards, provided that noise sources associated with demolition, construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 6 p.m. and 7 a.m. on weekdays, 5 p.m. and 9 a.m. on Saturdays, or at any time on Sundays, Thanksgiving, and Christmas.[3]

For operational noise sources within the unincorporated area of the county, including the project area, the ordinance establishes exterior noise standards at any single or multiple-family residence, school, hospital, church, public library situated in either the incorporated or unincorporated area. These exterior standards are presented in **Table B3**.

---

3 San Mateo County, *San Mateo County Noise Ordinance*, Chapter 4.88, Noise Control,1982. *https://www.municode.com/library/ca/san_mateo_county/codes/code_of_ordinances?nodeId=TIT4SAHE_CH4.88NOCO_4.88.300LEOF*, accessed April 24, 2017.

TABLE B3
EXTERIOR NOISE STANDARDS AT RECEIVING LAND USES:
RESIDENTIAL SCHOOL, HOSPITAL, CHURCH OR PUBLIC LIBRARY PROPERTIES

Cumulative Number of Minutes in any one hour time period	Noise Level Standards, dBA	
	Daytime 7 a.m.— 10 p.m.	Nighttime 10 p.m.— 7 a.m.
30	55	50
15	60	55
5	65	60
1	70	65
0	75	70

NOTES:
a) In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in five (5) dBA increments so as to encompass the background noise level.
b) Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.
c) If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in Table 4.5-3

SOURCE: San Mateo County, 1982.

City of Millbrae

City of Millbrae General Plan

The Aviador Staging Area lies within the City of Millbrae. The City of Millbrae's General Plan includes goals and policies related to noise. The Noise Element establishes land use compatibility categories for community noise exposure. For residential uses, hotels, and motels, the City identifies noise levels up to 60 dBA L_{dn} as normally acceptable and noise levels between 60 and 75 dBA L_{dn} as conditionally acceptable (City of Millbrae 1998). In addition, the General Plan includes California's interior noise standard of 45 dBA L_{dn} for interior habitable rooms of hotels.

City of Millbrae Municipal Code

Chapter 6.25, Section 6-5.05.F.9.b of the municipal Code prohibits emanation of noise or vibrations on a continuous and regular basis of such a loud, unusual, unnecessary, penetrating, lengthy or untimely nature as to unreasonably disturb, annoy, injure or interfere with or endanger the comfort, repose, health, peace, safety or welfare of users of neighboring property restricts hours of construction. Construction, alteration, or repair work are to occur only during the following hours: Monday through Friday 7:30 a.m. to 7:00 p.m., Saturday 8:00 a.m. to 6:00 p.m., and Sunday and Holidays 9:00 a.m. to 6:00 p.m. Any work outside these hours is prohibited without prior written permission of the Administrative Authority.

APPENDIX D.2
Aircraft Noise Assessment Technical Memorandum

Shoreline Protection Program Aircraft Noise Assessment

Technical Memorandum

August 2022

PREPARED FOR
San Francisco Planning Department

PRESENTED BY
Landrum & Brown, Incorporated

Contents

List of Tables — Page

List of Figures

1 Noise Modeling Methodology

For aviation noise analyses, the Federal Aviation Administration (FAA) has determined that the cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of annual Day-Night Level (DNL) or annual Community Noise Equivalent Level (CNEL) in California. To evaluate aircraft noise, the FAA requires the use of the Aviation Environmental Design Tool (AEDT) computer model that simulates aircraft activity and estimates aircraft fuel consumption, air quality emissions, and aircraft noise exposure at an airport. AEDT is used to determine whether an airport project would result in significant noise impacts. The analysis of the noise exposure for the baseline conditions and the proposed project around San Francisco International Airport (SFO) was prepared using the AEDT Version 3d.

The noise exposure calculated by the AEDT for an airport is a function of several factors, including: the number of aircraft operations during the period evaluated, the types of aircraft flown, the time of day when they are flown, the way they are flown, how frequently each runway is used for landing and takeoff, and the routes of flight used to and from the runways. Substantial variations in any one of these factors may, when extended over a long period of time, cause marked changes to the noise exposure.

The following sections describe the methodology to perform a noise analysis for:

- **Section 1.1: Baseline (2019) Condition** - The most recent full calendar year not affected by the COVID-19 pandemic air travel downturn and reflective of normal aircraft operations at SFO was 2019, and therefore that year was selected as the baseline year for this analysis. The number of aircraft operations during the years in which the proposed Shoreline Protection Program (SPP) would take place is forecast to be lower than 2019. Therefore, modeling 2019 airport operational levels would render higher noise exposure compared to the proposed project years and represent the most conservative scenario for all future years with runway closures.

- **Section 1.2: Runway 1L-19R and 1R-19L Closure Scenario** - Estimate the changes in noise exposure resulting from closure of Runways 1L-19R and 1R-19L for 12 months during the nighttime hours between 12:00 a.m. and 6:00 a.m. to construct Reaches 7, 8, and 14.

- **Section 1.3: Runway 10R-28L Closure Scenario** - Estimate the changes in noise exposure resulting from closure of Runway 10R-28L for 12 months during the nighttime hours between 12:00 a.m. and 6:00 a.m. to construct Reach 13.

Only partial runway closures occurring in nighttime hours would be permissible to minimize any effects to the national airspace system and aircraft operations.

1.1 Baseline (2019) Condition

The Baseline (2019) Condition CNEL was prepared using actual aircraft activity information for SFO from January 1, 2019 through December 31, 2019. The data used was derived from the SFO Airport Noise and Operations Monitoring System (ANOMS) data provided by SFO and the FAA’s Air Traffic Activity Data System (ATADS) data. The SFO ANOMS data included specific detailed information about aircraft operations that assisted in developing the Baseline (2019) Condition CNEL. A detailed discussion of the model inputs for the Baseline (2019) Condition are included in **Appendix A, Section A.1**.

The annual average daily number of aircraft arrivals and departures for the Baseline (2019) Condition are calculated by determining the total annual operations and dividing by 365 (days in a year). The Baseline (2019) Condition annual average day included approximately 1,257 total operations. **Table 1.1** presents the Baseline (2019) Condition average daily daytime (7:00 a.m. – 6:59 p.m.), evening (7:00 p.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) arrival and departure aircraft operations per aircraft category.

Table 1.1 SFO Baseline (2019) Condition Average Daily Operations Summary

AIRCRAFT CATEGORY	AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Air Carrier	332.65	106.87	91.46	351.01	62.94	117.82	1,062.75
GA Jet / Air Taxi / RJ	61.65	12.02	8.28	63.82	11.59	6.82	164.17
GA Prop	1.07	0.23	0.35	1.06	0.20	0.40	3.30
GA Helicopter	3.48	0.35	0.61	3.48	0.35	0.61	8.90
Military	5.96	1.46	1.64	5.54	1.3	2.21	18.12
Total	**404.81**	**120.94**	**102.33**	**424.93**	**76.37**	**127.86**	**1,257.25**

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Notes: Totals may not sum due to rounding.
Table values include missed approach operations.

1.2 Runways 1L-19R and 1R-19L Closure Scenario

The duration to construct Reaches 7, 8, and 14 will be longer than 12 months. However, as described above, using the 12-month Baseline (2019) Condition to develop Proposed Project scenarios would represent the most conservative scenario for all future years with runway closures. The Proposed Project scenario that would close Runways 1L-9R and 1R-19L between 12:00 a.m. and 6:00 a.m. would shift aircraft operations to Runways 10L-28R and 10R-28L. By using SFO ANOMS data, the aircraft operations that would occur on Runways 1L-19R and 1R-19L between 12:00 a.m. and 6:00 a.m. during the modeled 12-month period were identified. The Baseline (2019) Condition model was then adjusted to account for the shift of aircraft operations to Runways 10L-28R and 10R-28L. Additionally, SFO ANOMS flight radar tracks identified the appropriate flight paths (and AEDT flight tracks) to which flights would be distributed. A detailed discussion of the model inputs for the Baseline (2019) Condition are included in **Appendix A, Section A.2**.

Input data such as aircraft activity levels, fleet mix, flight track locations, operational profiles, stage lengths, engine run-ups, weather and terrain data all remain static. While the runway definitions did not change the utilization of those runways changed during the nighttime closure period.

1.3 Runway 10R-28L Closure Scenario

The duration to construct Reach 13 will be longer than 12 months. However, as described above, using the 12-month Baseline (2019) Condition to develop Proposed Project scenarios would represent the most conservative scenario for all future years with runway closures. The Proposed Project scenario that would close Runway 10R-28L between 12:00 a.m. and 6:00 a.m. would shift aircraft operations from Runway 10R-28L to Runway 10L-28R. By using SFO ANOMS data, the aircraft operations that occurred on Runway 10R-28L during the closure period were identified and, in AEDT, shifted to Runway 10L-28R. Additionally, SFO ANOMS flight radar tracks identified the appropriate flight paths (and AEDT flight tracks) to which flights would be distributed. A detailed discussion of the model inputs for the Baseline (2019) Condition are included in **Appendix A, Section A.3**.

Input data such as aircraft activity levels, fleet mix, flight track locations, operational profiles, stage lengths, engine run-ups, weather and terrain data all remain static. While the runway definitions did not change the utilization of those runways changed during the nighttime closure period.

2 Summary of Analysis

Based on FAA Order 1050.1F, a significant noise impact would occur if the analysis shows that the Proposed Project would result in noise-sensitive areas experiencing an increase in noise of CNEL 1.5 dB or more, at or above CNEL 65 dB noise exposure when compared to the Baseline (2019) Condition for the same timeframe. Results from this analysis show that there would be no noise-sensitive areas at or above CNEL 65 dB that would experience an increase in noise of CNEL 1.5 dB or more. This analysis is based on AEDT studies developed for the Baseline (2019) Condition and the runway closure scenarios. To calculate aircraft noise exposure, AEDT uses a grid of receptors located within a study area. These receptors are located at closely spaced 0.05-nautical-mile (303-foot) intervals on the ground. **Figure 2.1** shows the AEDT study area grid. **Figure 2.2** shows a close-up of the grid receptors near SFO.

2.1 Runways 1L-19R and 1R-19L Closure Scenario

To establish the location of significant noise impact as a result of the Runways 1L-19R and 1R-19L Closure Scenario, the noise exposure at each grid receptor from the Baseline (2019) Condition was subtracted from the noise exposure from the corresponding grid receptor from the Runways 1L-19R and 1R-19L Closure Scenario. **Figure 2.3** shows the grid receptors, with a noise exposure value of CNEL 65 dB or more, that increased by CNEL 1.5 dB or more as a result of Runways 1L-19R and 1R-19L Closure Scenario. The noise increase of CNEL 1.5 dB or more within areas that are exposed to noise at or above the CNEL 65 dB is located on airport property just west of Runway 10R-28L. The noise exposure increase in this area is primarily due to both the 77% increase in nighttime departures on Runway 28L and the increase in Runways 28L and 28R departures that turn east towards the San Francisco Bay soon after aircraft become airborne. Higher noise levels result on the outside of the turn (i.e., towards the terminal buildings) compared to the inside of the turn due to Lateral Attenuation.[1]

[1] The AEDT Technical Manual explains Lateral Attenuation as follows:

> The difference in level between the sound directly under the aircraft's flight path and at a location to the side of the aircraft at the time of closest approach is termed lateral attenuation. The lateral attenuation adjustment takes into account the following effects on aircraft sound due to over-ground propagation:
>
> • Ground reflection effects,
> • Refraction effects,
> • Airplane shielding and engine installation effects.
>
> The engine-installation effect component of the lateral attenuation adjustment accounts for any lateral directional effects due to noise shielding attributed to the location of the engines on the aircraft wing or fuselage.

While aircraft turn east after departing from Runways 28L and 28R, aircraft lower the right wing (inside of the turn) and raise the left wing (outside of the turn) resulting in Lateral Attenuation on the inside of the turn caused by airplane fuselage shielding. This effectively results in higher noise levels on the outside of the turn compared to the inside of the turn.

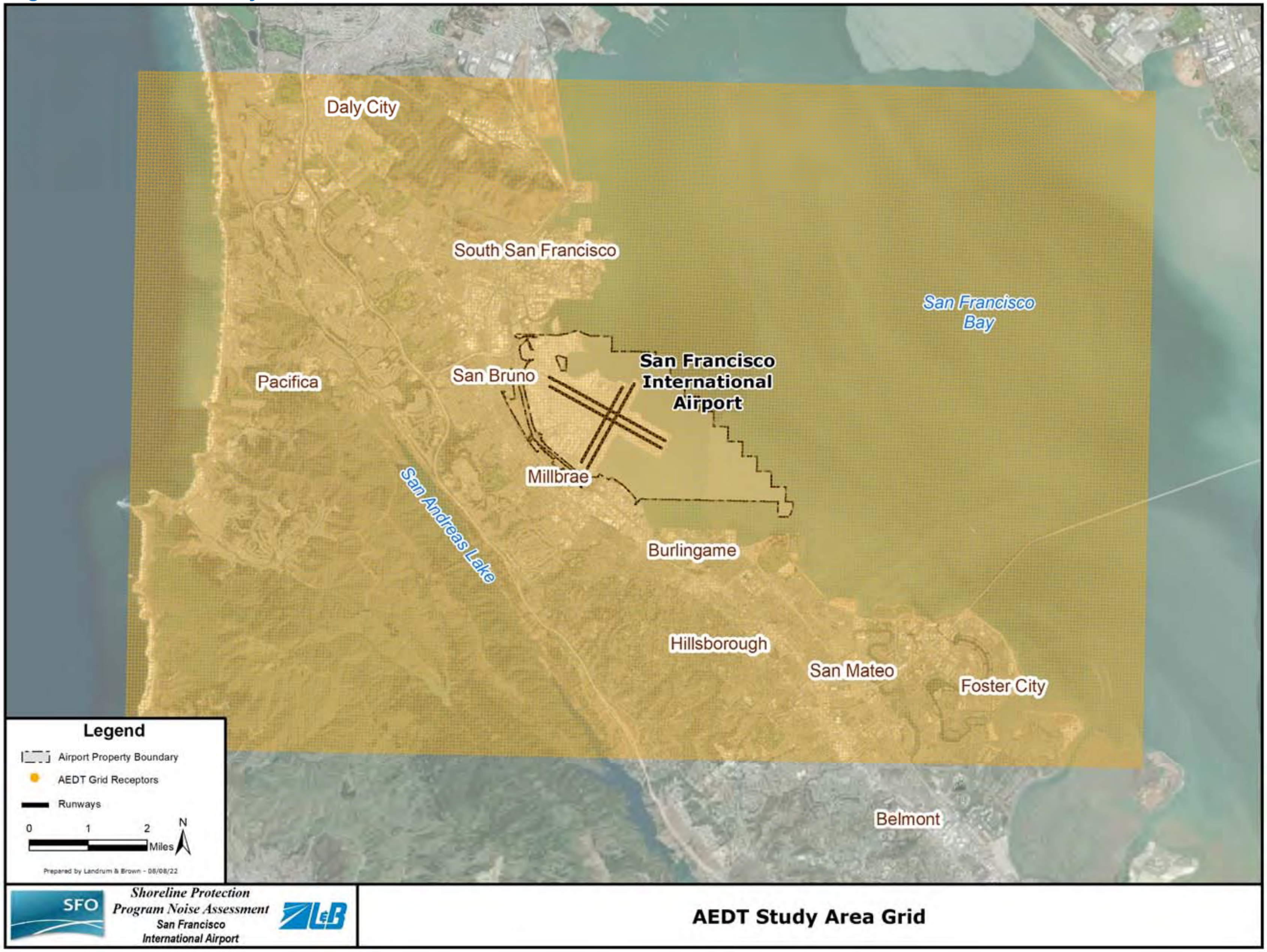
2.2 Runway 10R-28L Closure Scenario

The process described above was also applied to establish the location of significant noise impacts as a result of the Runway 10R-28L Closure Scenario. **Figure 2.4** shows the grid receptors, with a noise exposure value of CNEL 65 dB or more, that increased by CNEL 1.5 dB or more as a result of the Runway 10R-28L Closure Scenario. The noise increases of CNEL 1.5 dB or more within areas that are exposed to noise at or above the CNEL 65 dB is located primarily over Runway 10L-28R. This corresponds to a shift of arrivals and departures from Runway 10R-28L to 10L-28R.

2.3 Conclusion

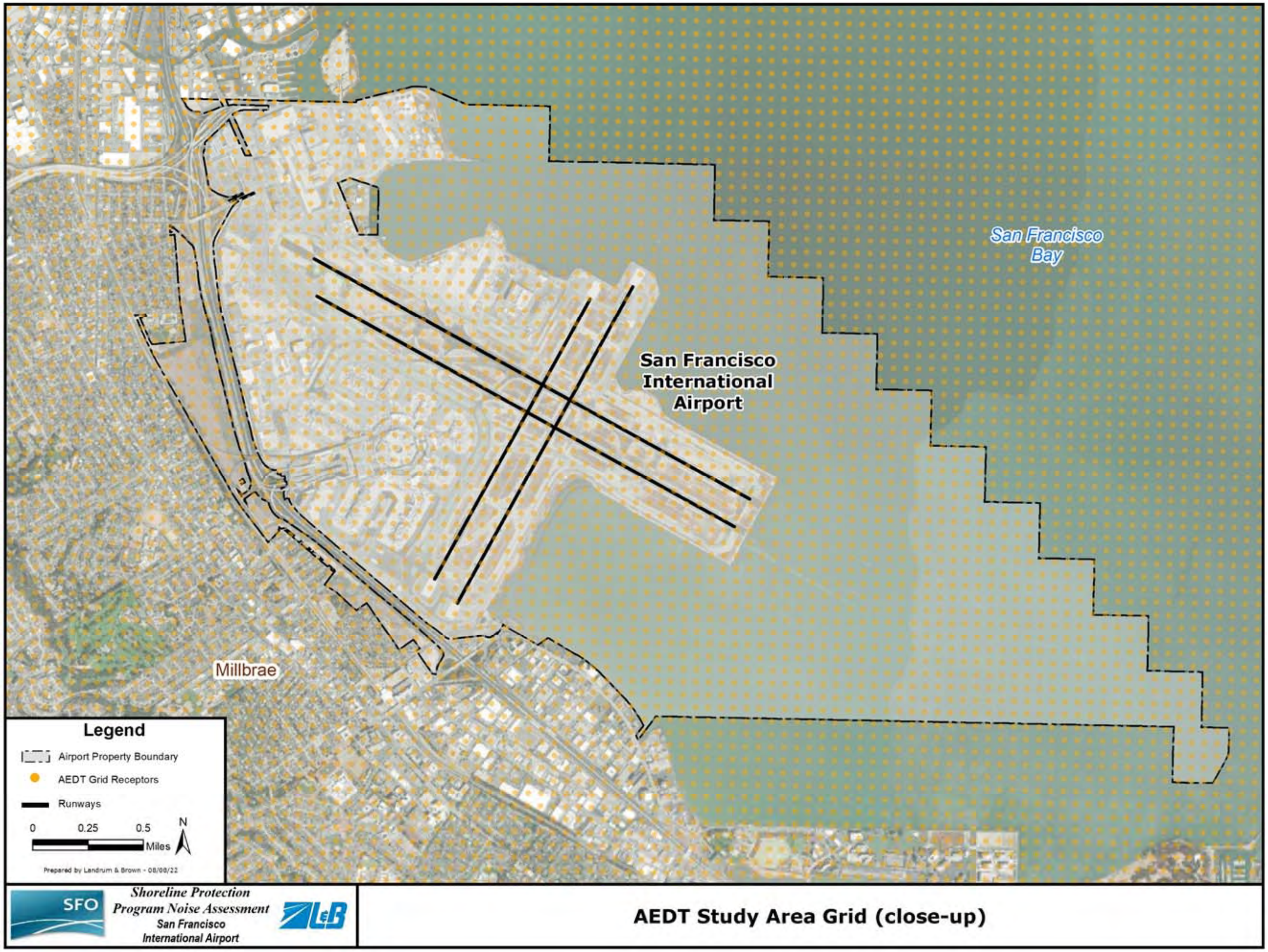
Figures 2.3 and **2.4** show that for both runway closure scenarios, the increase of CNEL 1.5 dB or more is located within the airport boundary.

Figure 2.1 AEDT Study Area Grid



Source: Landrum & Brown, 2022.

Figure 2.2 AEDT Study Area Grid (close-up)



Source: Landrum & Brown, 2022.

Figure 2.3 SFO Runways 1L-19R and 1R-19L Closure Scenario +1.5 dB Difference Grid Receptors

Source: Landrum & Brown, 2022.

Figure 2.4 SFO Runway 10R-28L Closure Scenario +1.5 dB Difference Grid Receptors

Source: Landrum & Brown, 2022.

Appendix A Noise Modeling Input Data

A.1 Baseline (2019) Condition Input Data

A.1.1 Aircraft Activity Levels and Fleet Mix

The Baseline (2019) Condition annual average day included approximately 1,257 total aircraft operations.

Aircraft categories were determined based on the aircraft type and carrier information included in the SFO ANOMS data. The aircraft types were grouped into categories and sub-categories as presented in **Table A.1**.

Table A.1 SFO Aircraft Categories

AIRCRAFT CATEGORY	SUBCATEGORY
Air Carrier	Long Haul (LH)
	Wide Body (WB)
	Narrow Body (NB)
Air Taxi / Regional Jet (RJ)	N/A
General Aviation (GA)	Jet
	Prop
	Helicopter
Military	Fixed Wing (FW)
	Helicopter

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Note: "N/A" denotes "Not Available".

Table A.2 presents the Baseline (2019) Condition average daily daytime (7:00 a.m. – 6:59 p.m.), evening (7:00 p.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) arrival and departure aircraft operations. **Table A.3** presents the Baseline (2019) Condition average daily daytime, evening and nighttime arrival and departure aircraft operations for each representative category and specific aircraft type, based on the SFO ANOMS data.

Table A.2 SFO Baseline (2019) Condition Average Daily Operations Summary

AIRCRAFT CATEGORY	AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Air Carrier LH	42.71	11.58	9.49	35.11	7.85	20.94	127.68
Air Carrier WB	26.40	6.83	4.40	24.33	6.71	6.65	75.32
Air Carrier NB	263.54	88.46	77.57	291.57	48.38	90.23	859.75
Air Taxi / RJ	51.18	10.28	7.30	52.81	10.46	5.71	137.74
GA Jet	10.47	1.74	0.98	11.01	1.13	1.11	26.43
GA Prop	1.07	0.23	0.35	1.06	0.20	0.40	3.30

AIRCRAFT CATEGORY	AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
GA Helicopter	3.48	0.35	0.61	3.48	0.35	0.61	8.90
Military FW	1.75	0.71	1.26	1.33	0.55	1.83	7.44
Military Helicopter	4.21	0.75	0.38	4.21	0.75	0.38	10.68
Total	**404.81**	**120.94**	**102.33**	**424.93**	**76.37**	**127.86**	**1,257.25**

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Notes: Totals may not sum due to rounding.
Table values include missed approach operations.

Table A.3 SFO Baseline (2019) Condition Average Daily Operations by Aircraft Type

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Air Carrier LH									
Airbus A350-1000 Series	18RR080	A350-941	0.34	0.01		0.08		0.28	0.70
Airbus A350-900 series	01P18RR124	A350-941	4.65	0.52	0.04	1.78	0.64	2.79	10.43
Airbus A380-800 Series	01P18RR103	A380-841	1.50	0.47	0.01	0.67	0.88	0.43	3.97
Airbus A380-800 Series	01P18RR104	A380-841	<0.00			<0.00			0.01
Airbus A380-800 Series	9EA001	A380-861	1.63	<0.00	<0.00	1.62	0.02	0.01	3.28
Boeing 747-400 ER	01P03GE187	747400	0.96			0.01	0.33	0.63	1.93
Boeing 747-400 Series	1GE024	747400	1.55	0.03	0.59	1.49	0.12	0.57	4.36
Boeing 747-400 Series	1PW042	747400	<0.00		0.02	<0.00		0.02	0.05
Boeing 747-400 Series	4RR036	747400	1.12	<0.00	<0.00	1.09	0.03	0.01	2.26
Boeing 747-400 Series Freighter	01P03GE187	747400	0.05		0.09	0.05	0.01	0.08	0.28
Boeing 747-400 Series Freighter	1GE024	747400	0.28	0.01	0.22	0.33	0.02	0.16	1.02
Boeing 747-400 Series Freighter	1PW041	747400	0.07		0.02	0.02	<0.00	0.07	0.18
Boeing 747-8	11GE139	7478				<0.00			<0.00
Boeing 747-8	8GENX1	7478	0.95	0.01	0.93	0.97	0.01	0.91	3.78
Boeing 747-8F	11GE139	7478	0.01		<0.00	0.01		<0.00	0.02
Boeing 777 Freighter	01P21GE216	777200			0.04			0.04	0.08
Boeing 777-200 Series	2PW061	777200	8.22	5.27	3.15	10.61	2.04	3.99	33.27
Boeing 777-200-ER	10PW099	777200	0.13	0.06	0.02	0.12	0.06	0.04	0.43
Boeing 777-200-ER	2RR027	777200	0.10	<0.00	<0.00	0.02	0.07	0.02	0.22
Boeing 777-200-ER	3GE060	777200	0.67	0.10	0.09	0.35	0.31	0.20	1.73

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Boeing 777-200-ER	8GE100	777200	0.35			0.34	0.01		0.70
Boeing 777-200-ER	9GE122	777200	0.21	0.04			0.23	0.03	0.51
Boeing 777-200-LR	01P21GE216	777300	0.01	<0.00		0.01		<0.00	0.03
Boeing 777-200-LR	01P21GE217	777300	0.31	0.40	0.62	0.91		0.41	2.64
Boeing 777-300 ER	01P21GE217	7773ER	19.58	4.65	3.62	14.62	3.07	10.24	55.79
Subtotal			***42.71***	***11.58***	***9.49***	***35.11***	***7.85***	***20.94***	***127.68***
Air Carrier WB									
Airbus A330-200 Series	2RR023	A330-343	1.84	1.68	0.62	3.24	0.48	0.43	8.29
Airbus A330-200 Series	4GE080	A330-301	0.60	0.02		0.27	0.35	0.01	1.24
Airbus A330-300 Series	2RR023	A330-343	0.04	0.05	0.03	0.02	0.01	0.09	0.24
Airbus A330-300 Series	4GE080	A330-301	1.31	0.01		0.90	0.41	0.01	2.63
Airbus A330-300 Series	5GE085	A330-301	0.02	0.05			0.03	0.04	0.13
Airbus A330-300 Series	7PW082	A330-343	<0.00				<0.00		0.01
Airbus A330-900N Series (Neo)	01P19RR119	A330-343	0.43	<0.00		0.42	0.01	<0.00	0.86
Airbus A340-300 Series	2CM015	A340-211	1.10			1.06	0.04		2.20
Airbus A340-600 Series	8RR045	A340-642	0.84	0.41	0.01	0.49	0.68	0.09	2.52
Antonov 124 Ruslan	4RR036	74720B			<0.00	<0.00			0.01
Boeing 767-200 ER	1RR011	767300				<0.00	0.01		0.01
Boeing 767-200 Series Freighter	1PW026	767JT9	<0.00		<0.00		0.01		0.01
Boeing 767-200 Series Freighter	2GE047	767CF6	0.01		<0.00	<0.00	<0.00		0.02
Boeing 767-300 ER	1GE030	7673ER	0.89	0.44	0.05	1.26	0.01	0.11	2.76
Boeing 767-300 ER	1PW043	7673ER	0.16	0.05	0.04	0.17	0.04	0.05	0.52

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Boeing 767-300 ER	2GE055	7673ER	<0.00			<0.00			0.01
Boeing 767-300 ER Freighter	1GE030	7673ER	0.80	0.01	1.42	0.54	1.14	0.55	4.45
Boeing 767-300 ER Freighter	2GE054	7673ER	0.19		0.14	0.01	0.30	0.01	0.65
Boeing 767-300 Series	3GE058	767300	0.03		0.03	0.03	0.01	0.02	0.11
Boeing 767-300BCF	2GE047	767300	0.36	<0.00	0.30	0.02	0.61	0.03	1.32
Boeing 767-400 ER	2GE054	767400	0.35	0.03	0.02	0.36	0.02	0.02	0.79
Boeing 787-10 Dreamliner	01P17GE214	7878R	<0.00			<0.00			0.01
Boeing 787-10 Dreamliner	17GE179	7878R	0.97	0.26	0.15	1.19	0.04	0.15	2.76
Boeing 787-8 Dreamliner	01P17GE209	7878R	4.16	0.62	0.26	3.72	0.04	1.32	10.12
Boeing 787-8 Dreamliner	01P19RR106	7878R	0.01			0.01			0.01
Boeing 787-9 Dreamliner	01P17GE211	7878R	9.75	2.99	1.07	9.21	1.09	3.51	27.62
Boeing 787-9 Dreamliner	01P19RR106	7878R	1.85	0.20	0.26	0.92	1.16	0.22	4.61
Boeing 787-9 Dreamliner	12RR063	7878R	0.70	<0.00		0.48	0.22	<0.00	1.41
Subtotal			***26.40***	***6.83***	***4.40***	***24.33***	***6.71***	***6.65***	***75.32***
Air Carrier NB									
Airbus A319-100 Series	01P08CM107	A319-131	0.12	0.01			0.13		0.26
Airbus A319-100 Series	01P08CM108	A319-131	0.07	0.02		0.01	0.08	0.01	0.19
Airbus A319-100 Series	3CM021	A319-131	0.51	0.14	0.10	0.58	0.09	0.08	1.52
Airbus A319-100 Series	3CM027	A319-131	2.89	0.35	0.71	2.58	0.47	0.91	7.90
Airbus A319-100 Series	3CM028	A319-131	<0.00	<0.00	<0.00	0.01			0.02
Airbus A319-100 Series	3IA006	A319-131	12.67	4.36	1.44	12.57	2.12	3.78	36.94
Airbus A319-100 Series	3IA007	A319-131	3.34	1.05	0.42	3.19	0.65	1.00	9.64
Airbus A319-100 Series	6CM044	A319-131	<0.00		0.01	<0.00	<0.00	<0.00	0.02
Airbus A319-100 X/LR	3CM028	A319-131	5.39	1.25	1.48	5.97	0.92	1.23	16.23

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Airbus A320-200 Series	01P08CM105	A320-211	5.78	2.08	1.50	6.50	1.51	1.36	18.73
Airbus A320-200 Series	1CM008	A320-211	2.41	0.84	0.77	3.04	0.10	0.89	8.05
Airbus A320-200 Series	1IA003	A320-232	26.16	8.10	3.52	25.31	5.98	6.55	75.61
Airbus A320-200 Series	2CM014	A320-211	13.69	5.24	3.77	16.05	3.50	3.20	45.44
Airbus A320-200 Series	3CM026	A320-211	7.83	2.32	1.96	8.64	1.63	1.84	24.21
Airbus A320-200 Series	8IA010	A320-232	0.20	0.33	0.69	0.16		1.05	2.43
Airbus A320-NEO	01P18PW153	A320-271N			<0.00			<0.00	0.01
Airbus A320-NEO	01P20CM128	A320-271N	1.72	0.78	1.12	1.60	0.28	1.74	7.25
Airbus A321-200 Series	01P08CM104	A321-232	0.54	0.24	0.25	0.46	0.25	0.33	2.07
Airbus A321-200 Series	3CM025	A321-232	3.16	1.64	1.25	4.14	0.33	1.59	12.10
Airbus A321-200 Series	3IA008	A321-232	21.11	7.56	10.98	23.81	3.60	12.30	79.36
Airbus A321-NEO	01P18PW157	A321-232	0.04	0.29	0.34	0.67			1.34
Airbus A321-NEO	01P20CM132	A321-232	1.94	2.39	0.67	4.32	0.23	0.46	10.02
Boeing 717-200 Series	4BR002	717200	3.73	1.09	0.69	3.81	0.68	1.04	11.02
Boeing 717-200 Series	4BR004	717200	0.01		<0.00	0.01		<0.00	0.02
Boeing 737-300 Series	1CM007	737300	0.01			0.01			0.02
Boeing 737-600 Series	3CM031	737700	0.09	0.05		0.13			0.27
Boeing 737-700 Series	3CM030	737700	0.11	0.03	0.04	0.15	0.02	0.06	0.40
Boeing 737-700 Series	3CM031	737700	1.66	0.51	0.35	1.82	0.32	0.37	5.02
Boeing 737-700 Series	3CM032	737700	19.56	5.91	4.84	21.10	4.12	5.09	60.62
Boeing 737-700 Series	8CM051	737700	0.01		<0.00	0.01			0.02
Boeing 737-700 Series	8CM064	737700	1.75	0.50	0.45	1.84	0.42	0.45	5.41
Boeing 737-8	01P20CM135	7378MAX	<0.00			<0.00	<0.00		0.01
Boeing 737-8	01P20CM136	7378MAX	<0.00	0.01	0.01	0.01	<0.00	0.01	0.04
Boeing 737-8	01P20CM140	7378MAX	0.37	0.42	0.07	0.78	0.03	0.05	1.74

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Boeing 737-800 Series	01P11CM122	737800	8.10	2.36	3.86	9.86	1.30	3.16	28.64
Boeing 737-800 Series	3CM032	737800	4.86	1.42	1.12	6.13	0.39	0.88	14.80
Boeing 737-800 Series	3CM034	737800	4.81	2.51	2.33	6.99	0.71	2.25	19.61
Boeing 737-800 Series	8CM051	737800	20.55	5.15	5.23	20.62	4.27	6.04	61.86
Boeing 737-800 Series	8CM064	737800	0.54	0.54	0.53	1.10	0.06	0.46	3.23
Boeing 737-800 Series	8CM065	737800	10.25	2.12	2.56	11.08	1.74	2.12	29.87
Boeing 737-800 Series	8CM066	737800	0.73	0.39	0.39	1.13	0.11	0.26	3.01
Boeing 737-9	01P20CM136	7378MAX	0.13		0.12		0.12	0.13	0.49
Boeing 737-9	01P20CM140	7378MAX	0.57	0.01	0.30	0.65	0.01	0.22	1.77
Boeing 737-900 Series	3CM032	737800	1.08	0.18	0.09	1.10	0.13	0.12	2.70
Boeing 737-900 Series	8CM051	737800	0.16	0.02	0.03	0.14	0.04	0.03	0.41
Boeing 737-900-ER	01P11CM116	737800	4.34	1.41	1.04	4.39	0.91	1.48	13.58
Boeing 737-900-ER	01P11CM121	737800	33.34	11.40	9.22	36.70	5.64	11.63	107.93
Boeing 737-900-ER	01P11CM122	737800	1.47	0.44	0.45	1.65	0.13	0.58	4.71
Boeing 737-900-ER	3CM034	737800	1.97	0.63	0.71	2.18	0.19	0.95	6.62
Boeing 737-900-ER	8CM051	737800	2.85	0.90	0.72	2.93	0.61	0.92	8.92
Boeing 737-900-ER	8CM065	737800	4.03	1.31	1.06	4.18	0.86	1.37	12.80
Boeing 737-900-ER	8CM066	737800	0.49	0.16	0.09	0.50	0.09	0.15	1.49
Boeing 757-200 Series	3RR028	757RR					0.01	<0.00	0.01
Boeing 757-200 Series	4PW072	757PW	8.93	3.71	3.82	10.96	1.08	4.42	32.94
Boeing 757-200 Series	4PW073	757PW	2.77	1.01	1.62	3.84	0.35	1.22	10.81
Boeing 757-200 Series	5RR038	757RR	6.28	2.56	1.85	6.89	1.22	2.59	21.39
Boeing 757-300 Series	3RR034	757300				0.01	0.01		0.02
Boeing 757-300 Series	4PW073	757300	2.00	0.51	0.77	1.97	<0.00	1.31	6.56
Boeing 757-300 Series	5RR038	757300	5.81	2.07	1.97	6.64	0.87	2.35	19.73

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Boeing 757-300 Series	5RR039	757300	0.55	0.19	0.22	0.65	0.09	0.23	1.92
Boeing MD-83	4PW071	MD83	0.01			0.01			0.02
Boeing MD-88	4PW071	MD83	<0.00			<0.00			0.01
Subtotal			***263.54***	***88.46***	***77.57***	***291.57***	***48.38***	***90.23***	***859.75***
Air Taxi / RJ									
Bombardier CRJ-200	01P05GE189	CL600	0.02		<0.00	0.02	<0.00	<0.00	0.04
Bombardier CRJ-200-ER	01P05GE189	CL600	19.14	3.83	2.88	19.52	4.19	2.23	51.79
Bombardier CRJ-700	01P08GE192	CRJ9-ER	1.98	0.61	0.25	2.08	0.48	0.28	5.69
Bombardier CRJ-900	01P08GE190	CRJ9-ER	1.74	0.52	0.09	1.58	0.75	0.02	4.70
Bombardier CRJ-900-ER	01P08GE191	CRJ9-ER	0.09	<0.00	<0.00	0.09	0.01	0.01	0.19
Bombardier CS100	01P20PW183	737700	1.03	0.19	0.27	1.06	0.16	0.26	2.98
Embraer ERJ170-LR	01P08GE197	EMB170	26.98	5.10	3.82	28.21	4.81	2.87	71.78
Embraer ERJ175-LR	01P08GE197	EMB175	0.19	0.02	<0.00	0.26	0.05	0.02	0.54
Embraer ERJ190	11GE146	EMB190	0.01	<0.00		0.01	<0.00		0.03
Subtotal			***51.18***	***10.28***	***7.30***	***52.81***	***10.46***	***5.71***	***137.74***
General Aviation Jet									
Boeing 727-200 Series	1PW007	727EM2	<0.00					<0.00	<0.00
Bombardier Challenger 300	01P14HN011	CL600	1.08	0.16	0.09	1.15	0.10	0.09	2.66
Bombardier Challenger 300	11HN003	CL600	0.01	<0.00		0.01		<0.00	0.02
Bombardier Challenger 350	01P14HN011	CL600	0.63	0.15	0.04	0.70	0.07	0.05	1.65
Bombardier Challenger 600	01P05GE189	CL600	0.48	0.09	0.05	0.53	0.05	0.04	1.23
Bombardier Challenger 601	1GE035	CL601	0.01	<0.00	0.01	0.01	<0.00	<0.00	0.03
Bombardier Challenger 604	01P05GE189	CL600	0.03	0.01	<0.00	0.04	0.01	<0.00	0.09
Bombardier Challenger 650	01P05GE189	CL600	<0.00	<0.00		<0.00			0.01
Bombardier Global 5000	01P04BR013	BD-700-1A11	0.18	0.04	0.02	0.20	0.02	0.02	0.47

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Bombardier Global 7500	21GE185	BD-700-1A10	<0.00			<0.00		<0.00	0.01
Bombardier Global Express	01P04BR013	BD-700-1A10	0.50	0.11	0.06	0.54	0.07	0.06	1.32
Bombardier Global Express	4BR002	BD-700-1A10						<0.00	<0.00
Bombardier Learjet 31	1AS001	LEAR35	0.01	0.01		0.01	0.01	<0.00	0.03
Bombardier Learjet 35	1AS001	LEAR35	<0.00	<0.00		0.01			0.02
Bombardier Learjet 35A/36A (C-21A)	1AS001	LEAR35	0.06	0.01	0.01	0.06	<0.00	0.01	0.15
Bombardier Learjet 36	1AS001	LEAR35	<0.00		<0.00	<0.00	<0.00	<0.00	0.01
Bombardier Learjet 45	1AS001	LEAR35	0.19	0.03	0.01	0.19	0.02	0.01	0.44
Bombardier Learjet 45	TFE731	LEAR35	<0.00			<0.00			<0.00
Bombardier Learjet 55	1AS002	LEAR35	0.01	<0.00	<0.00	0.01	<0.00	<0.00	0.02
Bombardier Learjet 60	7PW077	LEAR35	0.14	0.02	0.01	0.13	0.02	0.02	0.33
Cessna 500 Citation I	1PW035	CNA500				<0.00			<0.00
Cessna 500 Citation I	PW530	CNA500	0.03	<0.00		0.02	<0.00	<0.00	0.06
Cessna 501 Citation ISP	1PW035	CNA500	0.02	0.01	0.02	0.03	0.01	0.02	0.11
Cessna 525 CitationJet	1PW035	CNA500	0.07	0.01	0.01	0.07	0.01	0.01	0.17
Cessna 525C CitationJet	PW610F	CNA525C	0.04	0.01	<0.00	0.04	<0.00	<0.00	0.10
Cessna 550 Citation Bravo	PW530	CNA55B	0.02	<0.00	<0.00	0.02	<0.00	<0.00	0.05
Cessna 550 Citation II	1PW036	CNA55B				0.01			0.01
Cessna 560 Citation Encore	PW530	CNA560E	0.02		<0.00	0.02	<0.00	<0.00	0.05
Cessna 560 Citation V	1PW037	CNA560U	0.10	0.02	0.05	0.10	0.03	0.05	0.35
Cessna 560 Citation XLS	PW530	CNA560XL	0.71	0.11	0.05	0.77	0.05	0.06	1.76
Cessna 650 Citation III	TFE731	CIT3	0.01			0.01		<0.00	0.03
Cessna 680 Citation Sovereign	14PW103	CNA680	<0.00			<0.00			<0.00

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Cessna 680 Citation Sovereign	7PW078	CNA680	0.35	0.05	0.01	0.36	0.03	0.03	0.83
Cessna 680-A Citation Latitude	7PW078	CNA680	0.51	0.08	0.04	0.54	0.04	0.04	1.25
Cessna 700 Citation Longitude	11HN003	CNA680	<0.00			<0.00			<0.00
Cessna 750 Citation X	6AL022	CNA750	<0.00			0.02			0.02
Cessna 750 Citation X	6AL023	CNA750	0.60	0.08	0.03	0.61	0.05	0.05	1.44
CESSNA CITATION 510	PW610F	CNA510	0.01	<0.00	<0.00	0.02	<0.00	<0.00	0.04
Cessna CitationJet CJ2 (Cessna 525A)	PW610F	CNA500	0.10	0.01	0.01	0.10	0.01	0.01	0.23
Cessna CitationJet CJ3 (Cessna 525B)	1PW036	CNA500	0.17	0.03	0.01	0.17	0.02	0.01	0.41
Cessna S550 Citation S/II	1PW036	CNA55B	0.10	0.04	0.07	0.10	0.03	0.07	0.41
CIRRUS SF-50 Vision	PW610F	ECLIPSE500	<0.00			<0.00			<0.00
Dassault Falcon 10	1AS001	LEAR35	<0.00					<0.00	0.01
Dassault Falcon 2000	CF700D	CNA750	0.28	0.05	0.02	0.30	0.02	0.02	0.70
Dassault Falcon 2000-EX	14PW103	CNA750	0.03	0.01		0.03	0.01		0.08
Dassault Falcon 20-F	CF700D	FAL20	0.01	<0.00		<0.00	<0.00	<0.00	0.01
Dassault Falcon 20-G	TFE731	FAL20	<0.00			<0.00			<0.00
Dassault Falcon 50	TFE731	FAL900EX	0.04	<0.00	<0.00	0.04	<0.00	<0.00	0.10
Dassault Falcon 8X	01P15PW144	GIV	0.01	<0.00	<0.00	0.01		<0.00	0.03
Dassault Falcon 900	TFE731	FAL900EX	0.14	0.02	0.01	0.14	0.01	0.01	0.33
Dassault Falcon 900-EX	TFE731	FAL900EX	0.01	<0.00	<0.00	0.01	<0.00		0.03
Dornier 328 Jet	7PW078	CNA750	0.01		<0.00	<0.00		<0.00	0.01
Eclipse 500 / PW610F	PW610F-A	ECLIPSE500	0.01	<0.00		0.01		<0.00	0.03

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Embraer 500	PW610F	CNA510	0.17	0.03	0.01	0.17	0.02	0.01	0.41
Embraer 505	PW530	CNA55B	0.79	0.09	0.04	0.81	0.08	0.04	1.85
Embraer ERJ135	6AL012	EMB145	0.01	<0.00	<0.00	0.01	<0.00	<0.00	0.03
Embraer ERJ135 Legacy Business	01P06AL032	EMB145	0.01	<0.00	<0.00	0.01		<0.00	0.02
Embraer ERJ135 Legacy Business	01P10AL033	EMB145	<0.00		<0.00	<0.00			0.01
Embraer ERJ135 Legacy Business	6AL014	EMB145	<0.00			<0.00			<0.00
Embraer ERJ135-LR	6AL017	EMB145	<0.00			<0.00			<0.00
Embraer ERJ145-LR	4AL003	EMB14L	<0.00			<0.00			<0.00
Embraer Legacy	01P06AL032	EMB145	0.01	<0.00		0.01	0.01		0.03
Embraer Legacy 450 (EMB-545)	01P14HN014	CNA510	0.18	0.01	0.01	0.19	0.01	<0.00	0.40
Embraer Legacy 500 (EMB-550)	01P14HN015	CNA55B	0.05	0.01		0.05	0.01	<0.00	0.11
Falcon 7X	01P16PW143	GIV	0.15	0.04	0.03	0.17	0.01	0.03	0.43
Gulfstream G100	TFE731	IA1125	<0.00					<0.00	<0.00
Gulfstream G150	1AS002	IA1125	0.07	0.01	0.01	0.07	0.01	0.01	0.16
Gulfstream G200	7PW077	CNA750	0.05	<0.00	0.01	0.05	<0.00	0.01	0.12
Gulfstream G200	TFE731	CL600	<0.00	<0.00	<0.00	<0.00	<0.00		0.01
Gulfstream G280	01P11HN012	CL601	0.08	0.01	<0.00	0.08	<0.00	0.01	0.17
Gulfstream G400	11RR048	GIV				0.01	<0.00		0.01
Gulfstream G400	1RR019	GIV	<0.00		<0.00	<0.00			0.01
Gulfstream G450	11RR048	GIV	0.20	0.03	0.02	0.21	0.01	0.02	0.48
Gulfstream G550	01P06BR014	GV	0.09	0.02	0.01	0.09	0.01	0.01	0.23

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Gulfstream G550	3BR001	GV	<0.00	<0.00		<0.00	<0.00		0.01
Gulfstream G650	01P11BR016	G650ER	0.22	0.06	0.03	0.25	0.03	0.03	0.61
Gulfstream G650ER	01P11BR016	G650ER	0.01		<0.00	0.01		<0.00	0.02
Gulfstream III (FAS)	1RR016	GIIB	0.04		<0.00	0.04	<0.00		0.09
Gulfstream II-SP	MK511	GIIB	0.01		<0.00	0.01			0.01
Gulfstream IV-SP	11RR048	GIV			<0.00			<0.00	<0.00
Gulfstream IV-SP	1RR019	GIV	0.46	0.09	0.06	0.48	0.08	0.06	1.23
Gulfstream V-SP	3BR001	GV	0.61	0.11	0.06	0.61	0.06	0.10	1.55
Hawker 900XP	TFE731	LEAR35	0.03	<0.00	0.01	0.03	<0.00	0.01	0.08
Hawker Beechcraft Corp Beechjet 400A	1PW038	CNA55B	0.09	0.01	<0.00	0.09	<0.00	0.01	0.22
Hawker HS-125 Series 700	1AS002	LEAR35	0.01			<0.00	<0.00	<0.00	0.01
Honda HA-420 Hondajet	1PW036	MU3001	0.01		<0.00	0.01		<0.00	0.03
Israel IAI-1124-A Westwind II	1AS002	IA1125	<0.00			<0.00			0.01
Israel IAI-1125 Astra	TFE731	IA1125	0.03	<0.00	0.01	0.03	0.01	0.01	0.09
Israel IAI-1126 Galaxy	7PW077	IA1125	0.09	0.02	0.01	0.09	0.01	0.01	0.22
Lockheed L-1329 Jetstar II	1AS002	LEAR35	<0.00	<0.00		<0.00	<0.00		0.01
Pilatus PC-24	PW610F	CNA55B	<0.00			<0.00			0.01
Raytheon Hawker 1000	7PW077	LEAR35	0.02	0.01	<0.00	0.02	0.01	<0.00	0.05
Raytheon Hawker 4000 Horizon	01P07PW145	CNA750	0.05	0.01		0.06	<0.00	<0.00	0.12
Raytheon Hawker 800	TFE731	LEAR35	0.14	0.01	0.01	0.13	0.02	0.01	0.32
Raytheon Premier I	1PW035	CNA55B	0.03	0.01	0.01	0.03	0.01	0.01	0.09
Rockwell Sabreliner 65	CJ6102	LEAR35	0.01			0.01			0.01
Subtotal			***10.47***	***1.74***	***0.98***	***11.01***	***1.13***	***1.11***	***26.43***

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
General Aviation Prop									
American Champion Cibrata (FAS)	O320	CNA172	<0.00			<0.00			<0.00
Aviat Husky A1B	IO360	CNA172	<0.00			<0.00			<0.00
Bellanca Viking (FAS)	TIO540	GASEPV	<0.00	<0.00		<0.00			0.01
Cessna 150 Series	O200	GASEPF	<0.00	<0.00		<0.00			0.01
Cessna 172 Skyhawk	IO360	CNA172	0.01	<0.00	<0.00	0.01			0.03
Cessna 182	IO360	CNA182	0.01	0.01	<0.00	0.02	<0.00	<0.00	0.04
Cessna 185 Skywagon	IO360	CNA182		<0.00	<0.00			<0.00	0.01
Cessna 210 Turbo (FAS)	TIO540	GASEPV		<0.00			<0.00		<0.00
Cessna 310	TIO540	BEC58P	<0.00			<0.00			0.01
Cessna 320 (FAS)	TIO540	BEC58P	<0.00			<0.00			<0.00
Cessna 340	TIO540	BEC58P	<0.00	<0.00		<0.00	<0.00		0.01
Cessna 421 Piston	TIO540	BEC58P	<0.00			<0.00			0.01
Cessna 441 Conquest II	TP10GT	CNA441	<0.00	<0.00	<0.00	<0.00		<0.00	0.01
Cessna T303 Crusader (FAS)	TIO540	BEC58P	<0.00			<0.00			<0.00
Cirrus SR22	TIO540	COMSEP	0.01			0.01	<0.00		0.02
Cirrus SR22 Turbo (FAS)	TIO540	COMSEP	<0.00			<0.00			<0.00
Columbia Aircraft Lancair (COL3/4 All Types) (FAS)	TIO540	GASEPV	0.01	<0.00	<0.00	0.01		<0.00	0.02
Diamond DA42 Twin Star	IO360	PA30	0.01			0.01			0.01
EADS Socata TBM-700	PT6A64	CNA208	0.01	<0.00		0.01	<0.00		0.02
Embraer EMB120 Brasilia	PW118	EMB120			<0.00	<0.00			<0.00
EPIC LT/Dynasty	PT667A	CNA208		<0.00			<0.00		<0.00
Fairchild SA-226-T Merlin III	TPE10U	DHC6	<0.00				<0.00		<0.00

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Glasair (FAS)	TIO540	GASEPV		<0.00		<0.00	<0.00		<0.00
Piaggio P.180 Avanti	PT6A66	DHC6		<0.00		<0.00			<0.00
Pilatus PC-12	PT67B	CNA208	0.13	0.02	0.08	0.13	0.02	0.08	0.46
Pilatus PC-12	PT6A67	CNA208	0.01		<0.00	0.01		<0.00	0.02
Piper PA-18-150 (FAS)	O320	GASEPF	<0.00			<0.00	<0.00		0.01
Piper PA-28 Cherokee Series	O320	GASEPF	<0.00			<0.00			<0.00
Piper PA-31 Navajo	TIO540	BEC58P	<0.00			<0.00			<0.00
Piper PA-32 Cherokee Six	TIO540	GASEPV	<0.00	<0.00		<0.00		<0.00	0.01
Piper PA-34 Seneca	TSIO36	BEC58P	<0.00			<0.00			0.01
Piper PA46 Malibu (FAS)	TIO540	GASEPV	<0.00	<0.00	<0.00	0.01			0.01
Piper PA46-TP Meridian	TIO540	CNA441	<0.00				<0.00		<0.00
Raytheon Beech 18	PT6A27	DHC6		<0.00			<0.00		<0.00
Raytheon Beech 99	TPE10A	DHC6	0.01	<0.00		0.01	<0.00	<0.00	0.02
Raytheon Beech Baron 58	TIO540	BEC58P	0.01		<0.00	0.01			0.01
Raytheon Beech Bonanza 36	TIO540	GASEPV	<0.00	<0.00		<0.00	<0.00	<0.00	0.01
Raytheon King Air 90	PT6A28	DHC6	0.13	0.05	0.10	0.12	0.03	0.13	0.56
Raytheon King Air 90	PT6A36	DHC6	<0.00			<0.00			<0.00
Raytheon Super King Air 200	PT6A40	DHC6	0.15	0.07	0.09	0.13	0.06	0.11	0.60
Raytheon Super King Air 200	PT6A41	DHC6	0.02	0.01	0.02	0.02	0.01	0.02	0.10
Raytheon Super King Air 200	PT6A42	DHC6	0.02	<0.00		0.01		<0.00	0.03
Raytheon Super King Air 200	PT6A61	DHC6	0.03	0.01	0.03	0.03	0.02	0.02	0.13
Raytheon Super King Air 300	P660AG	DHC6	<0.00	<0.00	<0.00	<0.00	<0.00		0.01
Raytheon Super King Air 300	PT660A	DHC6	0.46	0.04	0.02	0.45	0.05	0.02	1.05
Rockwell Twin Commander 690	TPE3	DHC6	<0.00			<0.00			<0.00

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
Ryan Navion B	TIO540	GASEPV	0.01		<0.00	0.01			0.02
Vans RV6 (FAS)	IO360	GASEPV	<0.00			<0.00			<0.00
Subtotal			***1.07***	***0.23***	***0.35***	***1.06***	***0.20***	***0.40***	***3.30***
General Aviation Helicopter									
Aerospatiale SA-350D Astar (AS-350)	TPE3	SA350D	0.07	0.02	0.02	0.07	0.02	0.02	0.22
Agusta A-109	250B17	A109	0.13	0.01	<0.00	0.13	0.01	<0.00	0.28
Agusta A119	250B17	A109	0.03	0.02	0.04	0.03	0.02	0.04	0.16
Bell 206 JetRanger	250B17	B206L	0.53	0.04	0.02	0.53	0.04	0.02	1.18
Bell 214B-1	T53L13	B212	0.01			0.01			0.02
Bell 407 / Rolls-Royce 250-C47B	250B17	B407	1.97	0.01	0.01	1.97	0.01	0.01	3.97
Bell 427	TPE1	B427	0.48	0.24	0.45	0.48	0.24	0.45	2.33
Bell 429	TPE1	B429	0.10	<0.00	0.01	0.10	<0.00	0.01	0.22
Bell 430	250B17	B430	0.03	0.01	0.05	0.03	0.01	0.05	0.19
Eurocopter EC-130	TPE3	EC130	0.04	0.01	0.01	0.04	0.01	0.01	0.13
Hughes 500D	250B17	H500D	0.01			0.01			0.01
Kaman SH-2 Seasprite	T70041	SA330J	<0.00			<0.00			0.01
Robinson R22B	IO320	R22	<0.00			<0.00			0.01
Robinson R44 Raven / Lycoming O-540-F1B5	TIO540	R44	0.02	<0.00		0.02	<0.00		0.04
Sikorsky S-76C	T70070	S76	0.07			0.07			0.13
Subtotal			***3.48***	***0.35***	***0.61***	***3.48***	***0.35***	***0.61***	***8.90***
Military Fixed Wing									
Antonov 12 Cub	1ZM001	C130	0.04					0.04	0.07

REPRESENTATIVE AIRCRAFT			AVERAGE DAILY ARRIVALS			AVAERAGE DAILY DEPARTURES			TOTAL AVERAGE DAILY OPERATIONS
AIRFRAME	ENGINE CODE	ANP ID	DAY	EVENING	NIGHT	DAY	EVENING	NIGHT	
McDonnell Douglas A-4 Skyhawk	J52P8B	A4C	0.02			0.02			0.04
Raytheon Super King Air 200	PT660A	C12	1.42	0.71	1.26	1.04	0.55	1.80	6.77
Raytheon Super King Air 200	PT6A50	C12	0.22			0.22			0.44
T-38 Talon	J855HA	T-38A	0.06			0.06			0.11
Subtotal			***1.75***	***0.71***	***1.26***	***1.33***	***0.55***	***1.83***	***7.44***
Military Helicopter									
Eurocopter EC-155B1	T70041	SA365N	4.21	0.75	0.38	4.21	0.75	0.38	10.68
Subtotal			***4.21***	***0.75***	***0.38***	***4.21***	***0.75***	***0.38***	***10.68***
Grand Total			**404.81**	**120.94**	**102.33**	**424.93**	**76.37**	**127.86**	**1,257.25**

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Notes: Totals may not sum due to rounding.
Table values include missed approach operations.

A.1.2 Runway Definition

The airfield layout consists of four runways, (1L-19R, 1R-19L, 10L-28R, 10R-28L) oriented primarily north/south and east/west. **Table A.4** provides the parameters of the current runways at SFO used in AEDT.

Table A.4 SFO Runway Definitions

RUNWAY	LENGTH (FEET)	WIDTH (FEET)
01L/19R	7,650	200
01R/19L	8,650	200
10L/28R	11,870	200
10R/28L	11,381	200

Source: AEDT Version 3d, 2022.

A.1.3 Runway End Utilization

Runway end utilization refers to the percent of time that a particular runway end is used for departures or arrivals. It is a principal element in the definition of the noise exposure pattern. Proportional use of a runway is based largely on conditions of wind direction and velocity and the length of the runway. Aircraft normally will take off and land into the wind. However, runway end utilization is also based on the type of aircraft, its activity, and if applicable, any airport runway use plans.

Table A.5 provides a summary of the total arrival and departure general runway use and the average daily arrival and departures utilizing the runways. **Table A.6** and **Table A.7** provide a summary of runway utilization by aircraft category as a percentage of the general runway use at SFO, broken down by daytime arrivals, evening arrivals, nighttime arrivals, daytime departures, evening departure and nighttime departures for the Baseline (2019) Condition. All GA helicopter operations were assigned to Helipad H01 while all Military helicopter operations were assigned to Helipad H02.

Table A.5 SFO Baseline (2019) Condition Runway Utilization Summary

RUNWAY ID	ARRIVAL OPERATIONS	ARRIVAL PERCENT	DEPARTURE OPERATIONS	DEPARTURE PERCENT	TOTAL OPERATIONS	PERCENT OF TOTAL
01L			164.67	26.17%	164.67	13.10%
01R			273.54	43.48%	273.54	21.76%
10L	0.41	0.06%	18.83	2.99%	19.23	1.53%
10R	0.09	0.01%	13.27	2.11%	13.36	1.06%
19L	31.14	4.96%	0.25	0.04%	31.40	2.50%
19R	2.23	0.36%	2.03	0.32%	4.26	0.34%
28L	244.66	38.95%	102.76	16.33%	347.42	27.63%
28R	339.75	54.09%	44.04	7.00%	383.80	30.53%
H01	4.45	0.71%	4.45	0.71%	8.90	0.71%
H02	5.34	0.85%	5.34	0.85%	10.68	0.85%
Total	**628.08**	**100.00%**	**629.17**	**100.00%**	**1257.25**	**100.00%**

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Notes: Totals may not sum due to rounding.

Table values include missed approach operations.

Table A.6 SFO Baseline (2019) Condition Arrival Runway Utilization Summary

AIRCRAFT CATEGORY	RUNWAY END							
	1L	1R	10L	10R	19L	19R	28L	28R
DAYTIME ARRIVALS (7:00:00 A.M. – 6:59:59 P.M.)								
Air Carrier LH			0.01%	0.02%	6.35%	0.01%	46.78%	46.84%
Air Carrier WB			0.01%		6.35%		43.32%	50.32%
Air Carrier NB			0.03%		4.92%	0.46%	39.47%	55.12%
Air Taxi / RJ			0.01%		3.78%	0.65%	54.93%	40.63%
GA Jet					3.23%	0.59%	18.87%	77.31%
GA Prop					2.84%	0.52%	11.27%	85.38%
Military FW					4.36%		2.10%	93.54%
EVENING ARRIVALS (7:00:00 P.M. – 9:59:59 P.M.)								
Air Carrier LH			0.08%	0.08%	4.60%	0.08%	48.58%	46.57%
Air Carrier WB			0.19%		5.35%	0.05%	50.20%	44.22%
Air Carrier NB			0.15%	0.05%	3.81%	0.37%	39.59%	56.04%
Air Taxi / RJ			0.12%	0.04%	2.87%	0.73%	63.03%	33.21%
GA Jet					2.76%	0.73%	20.79%	75.73%
GA Prop					2.41%	1.20%	7.85%	88.54%
Military FW					5.56%			94.44%
NIGHTTIME ARRIVALS (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH			0.07%		6.44%	0.03%	19.18%	74.28%
Air Carrier WB			0.15%	0.07%	7.92%		22.73%	69.14%
Air Carrier NB			0.15%	0.02%	6.77%	0.21%	29.19%	63.65%
Air Taxi / RJ			0.12%	0.06%	6.82%	0.29%	32.20%	60.50%
GA Jet					4.16%	0.57%	15.67%	79.60%
GA Prop					4.80%	0.78%	10.33%	84.09%
Military FW							3.13%	96.88%

Sources: Data from SFO ANOMS, FAA ATADS, analysis by Landrum & Brown, 2022.
Note: Totals may not sum due to rounding.

Table A.7 SFO Baseline (2019) Condition Departure Runway Utilization Summary

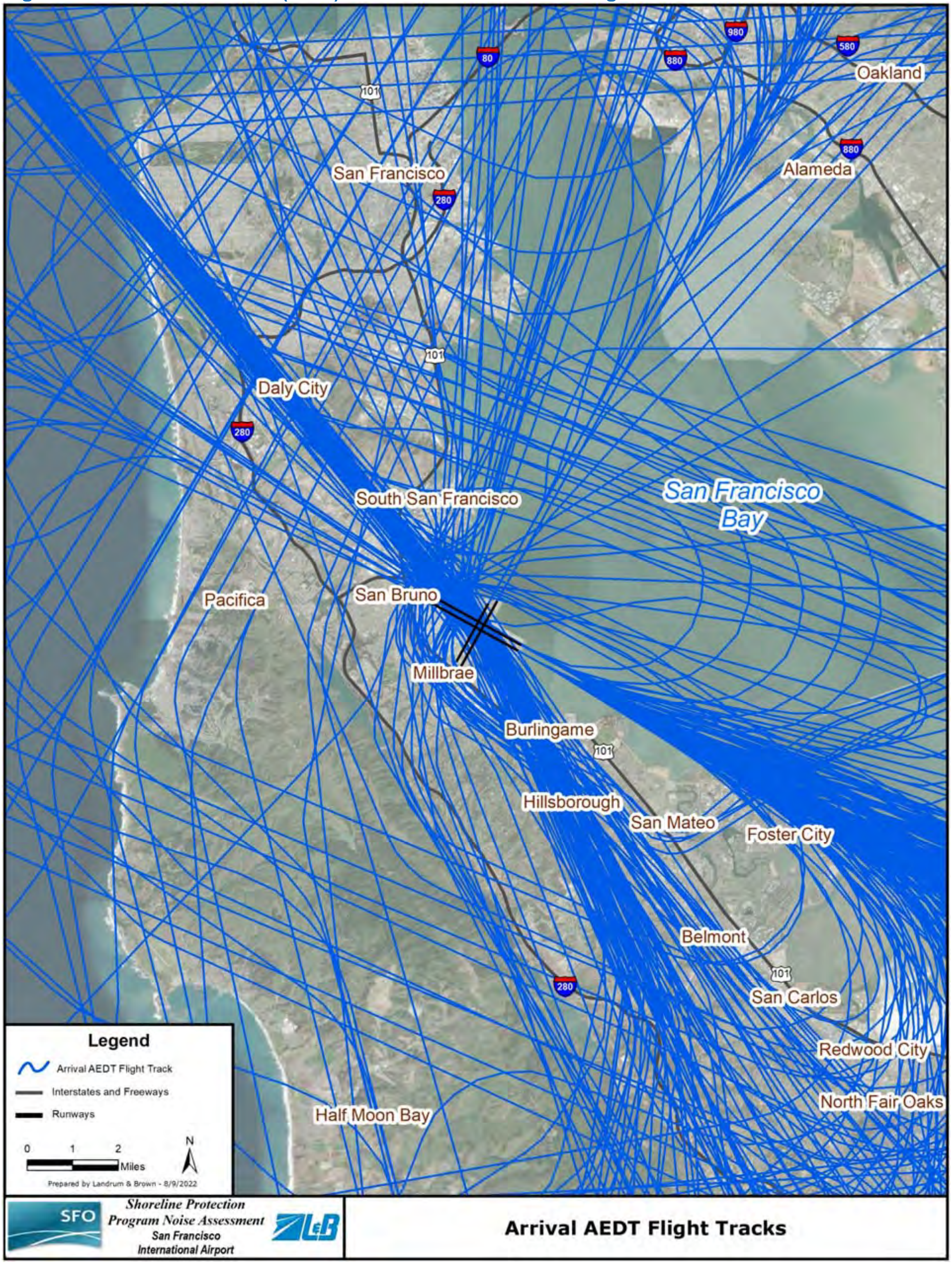
AIRCRAFT CATEGORY	RUNWAY END							
	1L	1R	10L	10R	19L	19R	28L	28R
DAYTIME DEPARTURES (7:00:00 A.M. – 6:59:59 P.M.)								
Air Carrier LH	1.02%	14.75%	2.96%	2.76%	0.10%	0.06%	61.70%	16.66%
Air Carrier WB	5.95%	28.66%	4.06%	2.21%	0.09%	0.14%	53.22%	5.65%
Air Carrier NB	31.90%	48.74%	3.16%	2.04%	0.04%	0.42%	10.11%	3.59%
Air Taxi / RJ	38.25%	48.16%	2.05%	2.23%	0.01%	0.41%	6.13%	2.76%
GA Jet	5.37%	31.86%	4.27%	0.10%		0.29%	2.60%	55.50%
GA Prop	2.42%	22.75%	3.60%	0.13%			4.23%	66.86%
Military FW	2.60%	2.77%	2.60%			2.77%		89.28%
EVENING DEPARTURES (7:00:00 P.M. – 9:59:59 P.M.)								
Air Carrier LH	0.45%	4.52%	4.06%	1.79%	0.12%	0.04%	68.33%	20.69%
Air Carrier WB	3.05%	36.45%	3.97%	1.37%		0.24%	30.43%	24.48%
Air Carrier NB	37.77%	42.80%	2.27%	2.46%	0.02%	0.38%	10.62%	3.67%
Air Taxi / RJ	44.88%	42.24%	1.54%	2.31%	0.00%	0.23%	5.54%	3.26%
GA Jet	4.30%	22.34%	3.92%		0.12%	0.36%	2.86%	66.10%
GA Prop	3.42%	14.20%	4.06%				2.79%	75.54%
Military FW							6.25%	93.75%
NIGHTTIME DEPARTURES (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	1.20%	14.25%	2.79%	3.19%	0.03%	0.02%	52.91%	25.61%
Air Carrier WB	1.63%	29.41%	3.50%	2.75%	0.05%	0.14%	51.98%	10.53%
Air Carrier NB	24.62%	60.55%	3.29%	2.07%	0.05%	0.22%	7.55%	1.66%
Air Taxi / RJ	54.42%	32.99%	2.09%	4.24%		0.23%	4.98%	1.04%
GA Jet	4.82%	20.24%	4.82%	0.12%		0.12%	6.08%	63.80%
GA Prop	1.68%	4.12%	8.18%			0.34%	6.86%	78.81%
Military FW		7.54%	3.77%				9.42%	79.27%

Sources: Data from SFO ANOMS, FAA ATADS, analysis by Landrum & Brown, 2022.
Notes: Totals may not sum due to rounding.
Table values include missed approach operations.

A.1.4 Flight Tracks

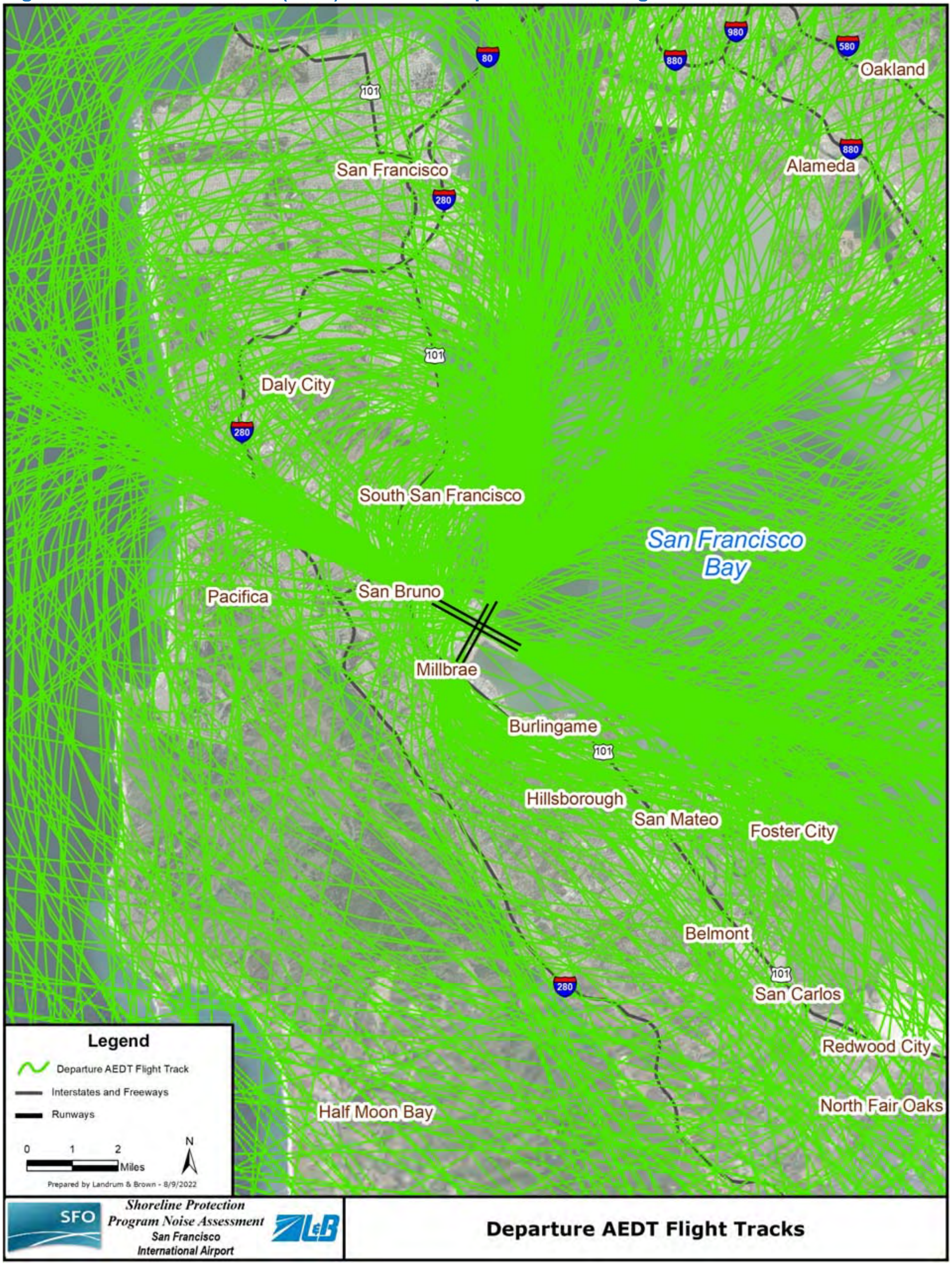
To determine the aircraft noise exposure levels on the ground, it is not only important to know how many aircraft operations occurred on what runways, but also to know where the aircraft were flown beyond the runways as they arrived and departed SFO. Flight tracks and flight track use percentages are key elements in the development of the CNEL. Using the ANOMS data, flight tracks were developed for all aircraft going to and from each runway end at SFO. The ANOMS data were used to determine the flight track location and flight track use percentages for the Baseline (2019) Condition. **Figure A.1** and **Figure A.2** present the Baseline (2019) Condition arrival and departure flight tracks for all aircraft operation types.

Figure A.1 SFO Baseline (2019) Condition Arrival AEDT Flight Tracks



Sources: Landrum & Brown, 2022.

Figure A.2 SFO Baseline (2019) Condition Departure AEDT Flight Tracks



Sources: Landrum & Brown, 2022.

A.1.5 Aircraft Operational Profiles and Trip Length

The AEDT includes standard aircraft profiles labeled STANDARD, NOISEMAP, ICAO A and ICAO B. Each aircraft profile contains parameters that represents each phase of flight to or from an airport. Information related to aircraft speed, altitude, thrust settings, flap settings, and distance are available for each standard aircraft profile and used by AEDT to calculate noise levels on the ground. The selection of an aircraft departure profile allows for a closer match to the actual departure climb gradient out of the airport. A comparison of SFO ANOMS radar data to the STANDARD, ICAO A, and ICAO B departure profiles for sixteen (16) of the most commonly used aircraft at SFO was performed. While the STANDARD (or if not available, the NOISEMAP) profile was used for all other aircraft types, this analysis was used to select the profile that was determined to most closely match the noise footprint in the vicinity of the Airport of these sixteen (16) aircraft, based on measured noise data from existing SFO noise monitors. The analysis generally resulted in selecting the profile that kept the aircraft closest to the ground upon departure from SFO. The sixteen (16) aircraft and selected profiles from this analysis are shown below in **Table A.8**.

Table A.8 AEDT Operational Profile Selection

AIRFRAME(S)	PROFILE ASSIGNMENT
Boeing 737-700 Series	ICAO A
Boeing 747-400 Series	ICAO B
Boeing 747-400 ER	
Boeing 747-400 Series Freighter	
Airbus A319-100 Series	STANDARD
Airbus A320-200 Series	STANDARD
Airbus A350-900/1000	STANDARD
Boeing 737-800 Series	STANDARD
Airbus A321-200 Series	STANDARD
Boeing 777-300 ER	ICAO B
Boeing 777-200 Series	ICAO B
Boeing 777-200-ER	
Boeing 777-200-LR	
Boeing 787-8	
Boeing 787-9	
Embraer ERJ-175-LR	STANDARD

Sources: Landrum & Brown, 2022.
Acronym: ICAO = International Civil Aviation Organization

Aircraft weight during departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, the heavier an aircraft is, the slower the rate of climb and the wider the dispersion of noise along its route of flight. Where specific aircraft weights are unknown, the AEDT uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. The AEDT groups trip lengths into ten (10) categories; these categories are provided in **Table A.9**.

Table A.9 AEDT Stage Length Categories

CATEGORY	STAGE LENGTH
1	0-499 nautical miles
2	500-999 nautical miles
3	1,000-1,499 nautical miles
4	1,500-2,499 nautical miles
5	2,500-3,499 nautical miles
6	3,500-4,499 nautical miles
7	4,500-5,499 nautical miles
8	5,500-6,499 nautical miles
9	6,500-11,000 nautical miles
M	Maximum range at maximum takeoff weight for aircraft type

Source: AEDT Version 3d, 2022.
Note: Stage length is defined as the distance an aircraft travels from takeoff to landing.

Changes within the airline industry in recent years including higher aircraft load factors (i.e., number of seats occupied by passengers on a per flight basis) have had an effect on how aircraft fly on departure and this effect has been noticed when considering both aircraft profile and stage length when modeling aircraft noise exposure at SFO. The trip lengths flown from SFO are based on scheduled operations. **Table A.10** indicates the proportion of the aircraft operations that fell within each of the ten (10) trip length categories for the Baseline (2019) Condition. All arrivals, and helicopter operations were modeled using a STANDARD operational profile and a trip length of stage length 1.

Table A.10 SFO Baseline (2019) Condition Departure Stage Length Distribution

STAGE LENGTH	AIR CARRIER LH	AIR CARRIER WB	AIR CARRIER NB	AIR TAXI / RJ	GA JET	GA PROP	MILITARY FW	TOTAL
DAYTIME DEPARTURES (7:00:00 A.M. – 6:59:59 P.M.)								
1	0.86%	0.60%	21.11%	62.80%	93.60%	100.00%	100.00%	**25.85%**
2	3.32%	1.54%	10.21%	21.99%	1.30%			**10.32%**
3	1.03%	2.66%	6.36%	15.19%	0.79%			**6.63%**
4	18.71%	28.23%	25.45%	0.02%	3.73%			**21.10%**
5	0.00%	0.00%	5.35%					**3.74%**
6	0.22%	12.83%	31.52%		0.15%			**22.80%**
7	14.43%	48.45%			0.30%			**4.05%**
8	28.64%	1.04%			0.13%			**2.47%**
9	29.52%	4.64%						**2.76%**
M	3.27%							**0.28%**
EVENING DEPARTURES (7:00:00 P.M. – 9:59:59 P.M.)								
1	0.90%	10.14%	33.07%	67.88%	93.24%	100.00%	100.00%	34.08%

STAGE LENGTH	AIR CARRIER LH	AIR CARRIER WB	AIR CARRIER NB	AIR TAXI / RJ	GA JET	GA PROP	MILITARY FW	TOTAL
2	1.18%	0.24%	15.87%	29.18%	1.06%			14.42%
3	0.04%	0.10%	2.33%	2.95%	0.47%			1.92%
4	0.57%	22.37%	14.25%		3.44%			11.26%
5	0.00%	0.00%	7.02%		0.24%			4.51%
6	0.08%	1.35%	27.46%		0.35%			17.78%
7	47.18%	51.62%			0.71%			9.53%
8	8.51%	3.77%			0.47%			1.23%
9	38.86%	10.41%						4.98%
M	2.68%							0.28%
NIGHTTIME DEPARTURES (10:00:00 P.M. – 6:59:59 A.M.)								
1	0.30%	2.96%	14.06%	86.69%	93.14%	100.00%	97.99%	16.65%
2	0.08%	0.05%	8.75%	9.93%	1.81%		2.01%	6.73%
3	3.69%	1.78%	5.07%	3.35%	0.24%			4.46%
4	12.93%	30.35%	36.83%	0.03%	3.60%			29.95%
5			2.94%		0.24%			2.09%
6	2.19%	0.05%	32.35%					23.37%
7	11.43%	10.70%			0.60%			2.45%
8	20.22%	34.79%			0.36%			5.16%
9	47.77%	19.33%						8.90%
M	1.38%							0.23%

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.
Note: Table values include missed approach operations.

A.1.6 Engine Run-ups

Engine run-ups are conducted after certain types of maintenance are performed on an aircraft. For this procedure, the aircraft are taxied to the designated run-up locations on the airfield and engine run-ups are performed at various power settings. SFO recorded all the engine run-ups that occurred in 2019. The recorded information included aircraft type, operator, time of day, duration of run-up, location, and heading of the aircraft. Most engine run-ups were conducted at three designated run-up locations on SFO including the intersections of taxiways L and E (L/E), taxiways L and V (L/V), and taxiways C and W (C/W). The average daily engine run-ups calculated from the data are approximately 0.96 daily engine run-ups. The Baseline (2019) Condition total engine run-ups per aircraft category, time of day, and location are presented in **Table A.11**.

Table A.11 SFO Baseline (2019) Condition Engine Run-ups

AIRCRAFT CATEGORY	DAY	EVENING	NIGHT	TOTAL
Taxiways L/E				
Air Carrier LH	0.0303		0.0241	0.0544
Air Carrier WB	0.1102	0.0206	0.5779	0.7086
Air Carrier NB	0.0133	0.0024	0.0205	0.0362
Air Taxi / RJ	0.0194	0.0036	0.0060	0.0290
GA Jet	0.0133	0.0036	0.0048	0.0218
Subtotal	***0.1865***	***0.0303***	***0.6334***	***0.8501***
Taxiways L/V				
Air Carrier LH	0.0023		0.0019	0.0042
Air Carrier WB	0.0085	0.0016	0.0446	0.0547
Air Carrier NB	0.0010	0.0002	0.0016	0.0028
Air Taxi / RJ	0.0015	0.0003	0.0005	0.0022
GA Jet	0.0010	0.0003	0.0004	0.0017
Subtotal	***0.0144***	***0.0023***	***0.0489***	***0.0656***
Taxiways C/W				
Air Carrier LH	0.0016		0.0013	0.0030
Air Carrier WB	0.0060	0.0011	0.0314	0.0385
Air Carrier NB	0.0007	0.0001	0.0011	0.0020
Air Taxi / RJ	0.0011	0.0002	0.0003	0.0016
GA Jet	0.0007	0.0002	0.0003	0.0012
Subtotal	***0.0101***	***0.0016***	***0.0344***	***0.0461***
Total	**0.2110**	**0.0342**	**0.7166**	**0.9618**

Sources: SFO Airside Operations, analysis by Landrum & Brown, 2022.
Note: Totals may not sum due to rounding.

A.1.7 Weather and Climate

FAA regulations require the use of the standard AEDT weather data included in the AEDT. The use of non-standard weather data would require FAA pre-approval. Airport weather data for SFO stored in AEDT was utilized for this assessment, which was accessed from the Integrated Surface Database at the National Oceanic and Atmospheric Administration in March 2021, the date of the most recent release of AEDT. These data are the average value for the period from 2011 to 2020. The exact parameters of this weather are provided in **Table A.12** and carried forward for both runway closure scenarios described in **Sections A.2** and **A.3** of this appendix.

Table A.12 SFO Weather Parameters

PARAMETER	VALUE
Temperature (Fahrenheit)	58.13
Pressure (millibars)	1015.73

PARAMETER	VALUE
Sea Level Pressure (millibars)	1016.63
Relative Humidity (Percent)	70.19
Dew Point (Fahrenheit)	48.46
Wind Speed (Knots)	8.78

Source: AEDT Version 3d, 2022.

A.1.8 Terrain Data

Information about the terrain surrounding an airport is necessary in noise modeling to ensure that the effect of local topography is reflected in the modeled aircraft noise exposure. This analysis used data from the National Elevation Dataset provided by the U.S. Geological Survey. This data file with the data identifier "n38w123" provides terrain data covering the entirety of San Francisco and extends east into Concord, north into San Rafael, and south into Santa Cruz, which allowed for accurate aircraft noise modeling using the terrain around SFO.

A.2 Runways 1L-19R and 1R-19L Closure Scenario Input Data

A.2.1 Aircraft Activity Levels and Fleet Mix

The Runways 1L-19R and 1R-19L Closure scenario would have the same aircraft activity levels and fleet mix as discussed for the Baseline (2019) Condition.

A.2.2 Runway Definition

The Runways 1L-19R and 1R-19L Closure scenario would have the same runway definitions as discussed for the Baseline (2019) Conditions, with the exception of the runway closure during the nighttime hours of 12:00 a.m. through 6:00 a.m.

A.2.3 Runway End Utilization

AEDT aircraft operations are grouped into day, evening, and nighttime aircraft operations. The Runways 1L-19R and 1R-19L Closure scenario did not affect the day and evening group of AEDT aircraft operations. The nighttime group of AEDT aircraft operations were adjusted to simulate a shift in aircraft operations from the closed runways to the preferred open runway. The distribution of aircraft operations to the preferred runway is based on Baseline (2019) Condition nighttime Runways 10L-28R and 10R-28L utilization per aircraft category. **Table A.13** provides a summary of the estimated shift in aircraft operations that would occur as a result of the nighttime closures of Runways 1L-19R and 1R-19L. The Baseline (2019) Condition runway utilization is also shown as a reference.

Table A.13 SFO Runways 1L-19R and 1R-19L Closure Scenario Runway Utilization Summary

AIRCRAFT CATEGORY	RUNWAY END							
	1L		1R		28L		28R	
	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE
NIGHTTIME ARRIVALS (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	No Runways 1L and 1R Nighttime Arrivals				19.18%	19.18%	74.28%	74.28%
Air Carrier WB					22.73%	22.73%	69.14%	69.14%

AIRCRAFT CATEGORY	RUNWAY END							
	1L		1R		28L		28R	
	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE
Air Carrier NB					29.19%	29.19%	63.65%	63.65%
Air Taxi / RJ					32.20%	32.20%	60.50%	60.50%
GA Jet					15.67%	15.67%	79.60%	79.60%
GA Prop					10.33%	10.33%	84.09%	84.09%
Military FW					3.13%	3.13%	96.88%	96.88%
NIGHTTIME DEPARTURES (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	1.20%	0.28%	14.25%	9.13%	52.91%	56.60%	25.61%	27.97%
Air Carrier WB	1.63%	1.11%	29.41%	24.10%	51.98%	56.32%	10.53%	12.04%
Air Carrier NB	24.62%	18.58%	60.55%	45.57%	7.55%	24.46%	1.66%	5.77%
Air Taxi / RJ	54.42%	48.21%	32.99%	28.47%	4.98%	13.48%	1.04%	3.28%
GA Jet	4.82%	4.07%	20.24%	16.87%	6.08%	6.94%	63.80%	67.06%
GA Prop	1.68%	1.18%	4.12%	2.11%	6.86%	7.17%	78.81%	81.01%
Military FW			7.54%	7.54%	9.42%	9.42%	79.27%	79.27%

AIRCRAFT CATEGORY	RUNWAY END							
	19L		19R		10L		10R	
	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE
NIGHTTIME ARRIVALS (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	6.44%	3.29%	0.03%	0.03%	0.07%	3.22%		
Air Carrier WB	7.92%	3.87%			0.15%	4.20%	0.07%	0.07%
Air Carrier NB	6.77%	3.43%	0.21%	0.19%	0.15%	3.25%	0.02%	0.28%
Air Taxi / RJ	6.82%	5.05%	0.29%	0.25%	0.12%	1.93%	0.06%	0.06%
GA Jet	4.16%	2.68%	0.57%	0.43%		1.63%		
GA Prop	4.80%	2.13%	0.78%	0.59%				2.86%
Military FW								
NIGHTTIME DEPARTURES (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	0.03%	0.01%	0.02%		2.79%	2.80%	3.19%	3.21%
Air Carrier WB	0.05%	0.05%	0.14%	0.14%	3.50%	3.50%	2.75%	2.75%
Air Carrier NB	0.05%	0.02%	0.22%	0.18%	3.29%	3.33%	2.07%	2.10%
Air Taxi / RJ			0.23%	0.22%	2.09%	2.09%	4.24%	4.25%
GA Jet			0.12%	0.12%	4.82%	4.82%	0.12%	0.12%
GA Prop			0.34%	0.34%	8.18%	8.18%		
Military FW					3.77%	3.77%		

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.

A.2.4 Flight Tracks

In order to simulate the closure of Runways 1L-19R and 1R-19L during the nighttime hours of 12:00 a.m. – 6:00 a.m., for noise modeling purposes, assumptions were made as to the preferred Runways 10L-28R and 10R-28L AEDT track of use for aircraft operations occurring during the closure period. **Table A.14** presents the preferred AEDT departure track replacements during the runway closure period. **Table A.15** represents the preferred AEDT arrival track replacements during the runway closure period. The preferred AEDT track was selected based on the inbound/outbound direction of the original Runways 1L-19R and 1R-19L AEDT tracks. While track utilization per runway and operation type changed due to the shift of aircraft operations to the preferred track, the subtrack utilizations remain static.

Table A.14 Runways 1L-19R and 1R-19L Closure Scenario Departure Track Replacement

TRACK ID	TRACK REPLACEMENT	
RUNWAY 1L TRACKS	RUNWAY 28L TRACKS	RUNWAY 28R TRACKS
01LD01	28LD07	28RD06
01LD02	28LD07	28RD06
01LD03	28LD16	28RD12
01LD04	28LD07	28RD06
01LD05	28LD17	28RD13
01LD06	28LD17	28RD13
01LD082	28LD16	28RD12
01LD09	28LD101	28RD11
01LD10	28LD101	28RD092
01LD11	28LD101	28RD11
01LD12	28LD101	28RD092
01LD13	28LD101	28RD092
01LD15	28LD12	28RD092
01LD18	28LD07	28RD06
01LD19	28LD10	28RD09
01LD20	28LD04	28RD10
01LD201	28LD04	28RD10
01LD21	28LD03	28RD03
01LD22	28LD04	28RD10
01LD23	28LD16	28RD12
01LD24	28LD17	28RD13
01LD241	28LD17	28RD13
01LD25	28LD15	28RD14
01LD27	28LD20	28RD17
RUNWAY 1R TRACKS	RUNWAY 28L TRACKS	RUNWAY 28R TRACKS
01RD01	28LD17	28RD13
01RD02	28LD17	28RD13

TRACK ID	TRACK REPLACEMENT	
01RD03	28LD07	28RD06
01RD031	28LD16	28RD12
01RD032	28LD07	28RD06
01RD04	28LD20	28RD17
01RD05	28LD04	28RD10
01RD06	28LD03	28RD03
01RD061	28LD03	28RD03
01RD062	28LD03	28RD03
01RD063	28LD10	28RD09
01RD064	28LD04	28RD10
01RD07	28LD04	28RD10
01RD08	28LD101	28RD11
01RD081	28LD04	28RD10
01RD082	28LD04	28RD10
01RD09	28LD12	28RD092
01RD10	28LD12	28RD092
01RD11	28LD101	28RD11
01RD12	28LD101	28RD11
01RD13	28LD15	28RD14
01RD14	28LD16	28RD12
01RD15	28LD17	28RD13
01RD18	28LD101	28RD11
01RD20	28LD20	28RD17
01RD21	28LD20	28RD17
RUNWAY 19L TRACKS	**RUNWAY 10L TRACKS**	**RUNWAY 10R TRACKS**
19LD01	10LD09	10RD13
19LD03	10LD04	10RD04
19LD04	10LD02	10RD04
19LD05	10LD07	10RD18
RUNWAY 19R TRACKS	**RUNWAY 10L TRACKS**	**RUNWAY 10R TRACKS**
19RD03	10LD09	10RD13
19RD04	10LD11	10RD10
19RD05	10LD09	10RD13
19RD06	10LD11	10RD10
19RD07	10LD04	10RD04
19RD08	10LD04	10RD04
19RD09	10LD04	10RD04

Sources: Landrum & Brown, 2022.

Table A.15 Runways 1L-19R and 1R-19L Closure Scenario Arrival Track Replacement

TRACK ID	TRACK REPLACEMENT	
RUNWAY 19L TRACKS	**RUNWAY 10L TRACKS**	**RUNWAY 10R TRACKS**
19LA01	10LA01	10RA02
19LA012	10LA01	10RA02
19LA02	10LA01	10RA02
19LA03	10LA01	10RA02
19LA031	10LA01	10RA02
19LA032	10LA01	10RA02
19LA04	10LA06	10RA02
19LA05	10LA06	10RA02
RUNWAY 19R TRACKS	**RUNWAY 10L TRACKS**	**RUNWAY 10R TRACKS**
19RA01	10LA01	10RA02
19RA02	10LA01	10RA02
19RA03	10LA01	10RA02
19RA04	10LA01	10RA02

Sources: Landrum & Brown, 2022.

A.2.5 Aircraft Operational Profiles and Trip Length

The operational profiles and trip lengths flown from SFO for the Runways 1L-19R and 1R-19L Closure scenario are not expected to change from Baseline (2019) Conditions.

A.2.6 Engine Run-ups

Engine run-ups for the Runways 1L-19R and 1R-19L Closure scenario are not expected to change from the Baseline (2019) Conditions.

A.2.7 Weather Data

Weather data for the Runways 1L-19R and 1R-19L Closure scenario is not expected to change from the Baseline (2019) Conditions.

A.2.8 Terrain Data

Terrain data for the Runways 1L-19R and 1R-19L Closure scenario is not expected to change from the Baseline (2019) Conditions.

A.3 Runway 10R-28L Closure Scenario Input Data

A.3.1 Aircraft Activity Levels and Fleet Mix

The Runway 10R-28L Closure scenario would have the same aircraft activity levels and fleet mix as discussed for the Baseline (2019) Conditions.

A.3.2 Runway Definition

The Runway 10R-28L Closure scenario would have the same runway definitions as discussed for the Baseline (2019) Conditions, with the exception of the runway closure during the nighttime hours of 12:00 a.m. through 6:00 a.m.

A.3.3 Runway End Utilization

The Runway 10R-28L Closure scenario did not affect the day and evening group of AEDT aircraft operations. The nighttime group of AEDT aircraft operations are adjusted to simulate a shift in aircraft operations from the closed runway to the preferred open runway. The distribution of aircraft operations to the preferred runway is based on Baseline (2019) Condition nighttime Runway 10R-28L utilization. **Table A.16** provides a summary of the estimated shift in aircraft operations that would occur as a result of the closure of Runway 10R-28L. The Baseline (2019) Condition runway utilization is also shown as a reference.

Table A.16 Runway 10R-28L Closure Scenario Runway Utilization Summary

CATEGORY	RUNWAY END							
	10L		10R		28L		28R	
	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE	BASELINE	CLOSURE
NIGHTTIME ARRIVALS (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	0.07%	0.07%			19.18%	9.89%	74.28%	83.57%
Air Carrier WB	0.15%	0.15%	0.07%	0.07%	22.73%	14.63%	69.14%	77.23%
Air Carrier NB	0.15%	0.16%	0.02%	0.02%	29.19%	22.27%	63.65%	70.57%
Air Taxi / RJ	0.12%	0.12%	0.06%	0.06%	32.20%	29.07%	60.50%	63.64%
GA Jet					15.67%	8.39%	79.60%	86.88%
GA Prop					10.33%	3.55%	84.09%	90.87%
Military FW					3.13%	3.13%	96.88%	96.88%
NIGHTTIME DEPARTURES (10:00:00 P.M. – 6:59:59 A.M.)								
Air Carrier LH	2.79%	4.98%	3.19%	1.00%	52.91%	20.98%	25.61%	57.54%
Air Carrier WB	3.50%	4.41%	2.75%	1.84%	51.98%	40.10%	10.53%	22.41%
Air Carrier NB	3.29%	4.15%	2.07%	1.21%	7.55%	4.30%	1.66%	4.92%
Air Taxi / RJ	2.09%	3.61%	4.24%	2.72%	4.98%	3.96%	1.04%	2.06%
GA Jet	4.82%	4.82%	0.12%	0.12%	6.08%	2.27%	63.80%	67.61%
GA Prop	8.18%	8.18%			6.86%	1.52%	78.81%	84.15%
Military FW	3.77%	3.77%			9.42%	9.42%	79.27%	79.27%

Sources: Data from SFO ANOMS, analysis by Landrum & Brown, 2022.

A.3.4 Flight Tracks

In order to simulate the closure of Runway 10R-28L during the nighttime hours of 12:00 a.m. – 6:00 a.m., for noise modeling purposes, assumptions were made as to the preferred Runway 10L-28R AEDT track use for aircraft operations occurring during the closure period. **Table A.17** presents the preferred AEDT departure track replacements during the runway closure period. **Table A.18** represents the preferred AEDT arrival track replacements during the runway closure period. The preferred AEDT track was selected based on the inbound/outbound direction of the original Runway 10R-28L AEDT tracks. While track utilization per runway and operation type changed due to the shift of operations to the preferred track, the subtrack utilizations remain static.

Table A.17 Runway 10R-28L Closure Scenario Departure Track Replacement

TRACK ID	TRACK REPLACEMENT
RUNWAY 10R TRACKS	**RUNWAY 10L TRACKS**
10RD011	10LD044
10RD012	10LD044
10RD02	10LD022
10RD021	10LD044
10RD031	10LD04
10RD032	10LD04
10RD04	10LD02
10RD05	10LD05
10RD06	10LD03
10RD07	10LD08
10RD08	10LD01
10RD10	10LD91
10RD12	10LD12
10RD13	10LD12
10RD15	10LD12
10RD18	10LD13
10RD19	10LD13
10RD20	10LD07
RUNWAY 28L TRACKS	**RUNWAY 28R TRACKS**
28LD01	28RD18
28LD02	28RD04
28LD03	28RD02
28LD04	28RD10
28LD05	28RD06
28LD07	28RD06
28LD10	28RD09
28LD101	28RD092
28LD111	28RD10

TRACK ID	TRACK REPLACEMENT
28LD12	28RD11
28LD13	28RD01
28LD14	28RD17
28LD15	28RD14
28LD16	28RD12
28LD17	28RD13
28LD19	28RD14
28LD20	28RD17
28LMA1	28RMA1

Sources: Data from SFO ANOMS, AEDT, analysis by Landrum & Brown, 2022.

Table A.18 Runway 10R-28L Closure Scenario Arrival Track Replacement

TRACK ID	TRACK REPLACEMENT
RUNWAY 10R TRACKS	**RUNWAY 10L TRACKS**
10RA02	10LA06
RUNWAY 28L TRACKS	**RUNWAY 28R TRACKS**
28LA01	28RA01
28LA02	28RA02
28LA03	28RA04
28LA04	28RA14
28LA05	28RA05
28LA07	28RA08
28LA08	28RA09
28LA09	28RA11
28LA10	28RA11
28LA101	28RA10
28LA102	28RA11
28LA103	28RA11
28LA11	28RA12
28LA12	28RA13
28LA13	28RA13
28LA14	28RA14
28LA15	28RA15
28LA16	28RA16
28LA17	28RA16

Sources: Data from SFO ANOMS, AEDT, analysis by Landrum & Brown, 2022.

A.3.5 Aircraft Operational profiles and Trip Length

The operational profiles and trip lengths flown from SFO for the Runway 10R-28L Closure scenario are not expected to change from Baseline (2019) Conditions.

A.3.6 Engine Run-ups

Engine run-ups for the Runway 10R-28L Closure scenario are not expected to change from the Baseline (2019) Conditions.

A.3.7 Weather Data

Weather data for the Runway 10R-28L Closure scenario is not expected to change from the Baseline (2019) Conditions.

A.3.8 Terrain Data

Terrain data for the Runway 10R-28L Closure scenario is not expected to change from the Baseline (2019) Conditions.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E

Air Quality Technical Memorandum and Health Risk Assessment

SAN FRANCISCO INTERNATIONAL AIRPORT SHORELINE PROTECTION PROGRAM

Air Quality Technical Memorandum and Health Risk Assessment

Prepared for
San Francisco Planning Department

March 2022

ESA

SAN FRANCISCO INTERNATIONAL AIRPORT SHORELINE PROTECTION PROGRAM

Air Quality Technical Memorandum and Health Risk Assessment

Prepared for
San Francisco Planning Department

49 South Van Ness Ave, Suite 1400
San Francisco, CA 94103

March 2022

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900
esassoc.com

Bend
Camarillo
Delray Beach
Destin
Irvine
Los Angeles
Oakland
Orlando
Pasadena
Petaluma
Portland
Sacramento
San Diego
San Francisco
San José
Santa Monica
Sarasota
Seattle
Tampa

D201900874.00

CONTENTS

San Francisco International Airport Shoreline Protection Program Air Quality Technical Memorandum and Health Risk Assessment

Figures

Tables

Page

SECTION 1
Introduction

1.1 Project Understanding

The project sponsor, the City and County of San Francisco, acting by and through the San Francisco Airport Commission, proposes to implement the Shoreline Protection Program (proposed project) to address flood protection and future sea-level rise. The proposed project would install a new shoreline protection system that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection and would incorporate protection from future sea-level rise. The project site consists of the perimeter of the Airport, which is primarily located in unincorporated San Mateo County, California, approximately 13 miles south of downtown San Francisco. The Airport's 8-mile shoreline and western landside boundary are divided into 16 *reaches*[1] based on shoreline orientation, existing protection type, existing *foreshore*[2] conditions, and existing landside conditions.

The proposed project would remove the existing shoreline protection features and would construct a new shoreline protection system for Reaches 1–15 comprised of a combination of reinforced concrete and steel sheet pile walls to eliminate the probability of substantial inundation at the Airport through 2085 (**Figure 1**). In order to address landside flood protection, Reach 16 may be required to form a continuous, closed flood protection system. However, the landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to neighboring shoreline protection systems in South San Francisco and Millbrae.

---

[1] A *reach* is defined as a longshore segment of a shoreline where influences and impacts, such as wind direction, wave energy, littoral transport, etc., mutually interact.

[2] The *foreshore* refers to the area between low and high tide along the shoreline.

SOURCE: SFO, 2021; ESA, 2021

SFO Shoreline Protection Program

FIGURE 1

PROJECT SITE AND CONSTRUCTION STAGING AREAS

1.2 Memorandum Purpose

Construction of the proposed project would result in criteria air pollutant emissions and potential risk to human health from the emissions of toxic air contaminants (TAC).[3] This air quality technical memorandum estimates criteria pollutant emissions and potential health risks from the proposed project. Criteria pollutants include reactive organic gases (ROG), oxides of nitrogen (NO_X), and particulate matter ($PM_{2.5}$ and PM_{10}). Health risks are estimated from exposure to emissions of diesel particulate matter (DPM) and fine particulate matter ($PM_{2.5}$) from diesel-powered construction equipment, haul and vendor truck travel and idling, and fugitive dust from on-road vehicle travel.

Analysis methods are consistent with the city's 2020 Citywide Health Risk Assessment (2020 Citywide HRA), as documented in the *San Francisco Citywide Health Risk Assessment: Technical Support Documentation*.[4] The 2020 Citywide HRA evaluates the lifetime excess cancer risks and annual average $PM_{2.5}$ concentrations from existing known sources of air pollution. This memorandum presents an existing plus project health risk assessment (HRA) that estimates lifetime excess cancer risk and annual average $PM_{2.5}$ concentrations that are attributable to other nearby mobile and stationary sources, in addition to effects from the proposed project. The cumulative HRA builds upon the existing plus project HRA and includes a semi-quantitative assessment of cumulative health risks resulting from existing sources, project sources, and sources of emissions from reasonably foreseeable cumulative projects.

1.3 Memorandum Organization

This memorandum is organized into three main sections. Section 1 summarizes the project and memorandum organization. Section 2 details the emissions modeling methods and assumptions used to generate the results, which are then provided in Section 3. Appendix A includes emission calculation and modeling files used in the analysis.

---

3 Given that there would be no operational activity associated with the project, as the proposed shoreline protection system would be generally maintenance free for the first 10 years, after which visual inspections would be conducted every 5 years, this analysis focuses solely on construction-related emissions.

4 San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation*, September 2020.

INTENTIONALLY BLANK

SECTION 2
Analysis Methods and Assumptions

The project sponsor provided comprehensive, detailed information on the construction schedule, off-road and marine vessel types and use, and haul trucks and haul distances anticipated for construction of the proposed project. This information was used in the analysis and is referred to simply as “data from the project sponsor.”

2.1 Off-Road Construction Equipment Emissions

Construction emissions were estimated using the California Air Resources Board’s (CARB) OFFROAD 2011 model for off-road construction equipment. The project sponsor provided off-road equipment horsepower and activity data. Default load factors from the California Emissions Estimator Model (CalEEMod) version 2016.3.2 were used. Emissions were calculated for each reach, in spreadsheet format, according to the following equation:

Equation 1: $$E_{reach} = \sum_{i} (Activity_i * EF_i * LF_i * HP_i) * Conv$$

Where:

E_{reach} =	Total exhaust emissions for the reach, pounds per day
Activity =	Equipment activity, hours per day
EF =	Engine emission factor, grams/horsepower-hour (OFFROAD2011)
LF =	Engine load factor, unitless (CalEEMod 2016.3.2)
HP =	Engine horsepower, hp
Conv =	Conversion factor, 0.002205 pounds/grams
i =	Equipment type

Emissions modeling input data and assumptions for the project schedule, off-road construction equipment, asphalt paving, and control measures for off-road equipment are presented below.

2.1.1 Anticipated Schedule

Under an accelerated schedule, construction of the proposed project would begin in 2025 and is expected to be complete in 2031.[5] Project construction is anticipated to occur as shown in **Table 1**. To ensure a seamless construction process, work in adjacent reaches is anticipated to overlap; for example, work on Reach 5 would begin before full completion of Reach 6. This schedule is based on a 5-day work week; however, work may proceed up to seven days per week.

TABLE 1
CONSTRUCTION SCHEDULE

Reach #	Name of Reach	Working Days (5-Day Work Week)[a]	Start Date	End Date	Work Hours
1	San Bruno Channel	102	11/27/2026	4/19/2027	Daytime
2	Treatment Plant	159	6/1/2025	1/7/2026	Daytime
3	Sea Plane Harbor 1	71	12/7/2025	3/15/2026	Daytime
4	Coast Guard	67	2/10/2026	5/13/2026	Daytime
5	Sea Plane Harbor 2	111	4/14/2026	9/15/2026	Daytime
6	Superbay	97	8/16/2026	12/29/2026	Daytime
7	Runway 19L End	800	6/1/2025	6/25/2028	Nighttime
8	Runway 19L Edge	401	11/24/2027	6/6/2029	Nighttime
9	Intersection 1	22	12/24/2030	1/22/2031	Nighttime
10	Intersection 2	30	11/15/2030	12/26/2030	Nighttime
11	Runway 28R Edge	339	8/6/2030	11/23/2031	Nighttime
12	End of Runway 28R & 28L	73	6/7/2029	9/17/2029	Nighttime
13	Runway 28L Edge	428	6/7/2029	1/27//2031	Nighttime
14	Mudflat	135	7/21/2027	1/25/2028	Nighttime
15	Millbrae Channel	70	4/15/2027	7/21/2027	Daytime
	All Construction	**1,690**	**6/1/2025**	**11/23/31**	

SOURCE: Project sponsor.
NOTES:
[a] Working days are rounded up based on whole workdays for each activity provided by the project sponsor.

2.1.2 Off-Road Construction Equipment

Off-road equipment types, quantities, and activity are based on project-specific data provided by the project sponsor. Off-road equipment emission factors for the uncontrolled scenario[6] are based on OFFROAD2011 emission factors, which are average emissions factors for the statewide equipment fleet for a given calendar year of construction.

5 The construction schedule is subject to change based on project design refinements, construction contractor requirements, and other unforeseeable factors at this time. To present a conservative analysis of criteria pollutant and TAC emissions, this air quality technical memorandum assumes the most aggressive feasible construction timeline.

6 The uncontrolled scenario represents activities occurring without any emissions controls, such as Tier 4 construction equipment engines or low-VOC coatings, and relies on model default values for emission rates.

Off-road equipment types, usage (total hours), engine horsepower, and load factors are shown in **Table 2**. Engine horsepower and load factors are default values from CalEEMod.

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
Reach 1	Air Compressors	136	142	0.48
	Cement and Mortar Mixers	100	500	0.42
	Concrete/ Industrial Saws	3	74.3	0.73
	Excavator	164	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	370	114	0.4
	Generator	3,048	12	0.74
	Graders	86	250	0.41
	Loaders 3.5 CY	2,800	180	0.36
	Paving Equipment	86	111	0.36
	Rollers	86	137	0.38
	Signal Boards	2,372	6	0.82
	Skid Steer Loaders	114	74.3	0.37
	Sweepers/ Scrubbers	438	74	0.46
	Sweepers/ Scrubbers	438	74	0.46
	Welding Machine	8	20.2	0.45
Reach 2	Air Compressors	369	142	0.48
	Articulating Trench Roller	23	20.2	0.38
	Concrete/ Industrial Saws	79	74.3	0.73
	Cranes 150 Ton	472	290	0.29
	Crawler Tractors Low Ground Pressure	719	165	0.43
	Crushing/ Processing Equipment	37	540	0.4
	Excavator	515	275	0.38
	Excavator Amphibious	337	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	708	114	0.4
	Generator	3,996	12	0.74
	Graders	253	250	0.41
	Impact Hammer	118	75	0.44
	Loaders 3.5 CY	4,685	180	0.36
	Paving Equipment	133	111	0.36
	Rollers	253	137	0.38
	Rubber Tired RT Crane 40 Ton	16	165	0.29
	Sand Hopper with Conveyor	180	300	0.4
	Signal Boards	357	6	0.82
	Skid Steer Loaders	257	74.3	0.37
	Standard Light Setup	3,169	12.5	0.42
	Sweepers/ Scrubbers	747	74	0.46
	Vibratory Hammer Power Pack	472	765	0.34
	Welding Machine	472	20.2	0.45
Reach 3	Air Compressors	110	142	0.48
	Articulating Trench Roller	47	20.2	0.38
	Concrete/ Industrial Saws	104	74.3	0.73
	Cranes 150 Ton	147	290	0.29

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
	Crawler Tractors Low Ground Pressure	95	165	0.43
	Crushing/ Processing Equipment	240	540	0.4
	Excavator	432	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	221	114	0.4
	Generator	1,692	12	0.74
	Graders	46	250	0.41
	Impact Hammer	37	75	0.44
	Loaders 3.5 CY	1,863	180	0.36
	Paving Equipment	37	111	0.36
	Rollers	46	137	0.38
	Rubber Tired Loaders	43	309	0.36
	Rubber Tired RT Crane 40 Ton	24	165	0.29
	Sand Hopper with Conveyor	24	300	0.4
	Signal Boards	28	6	0.82
	Skid Steer Loaders	155	74.3	0.37
	Standard Light Setup	1,285	12.5	0.42
	Sweepers/ Scrubbers	292	74	0.46
	Vibratory Hammer Power Pack	147	765	0.34
	Welding Machine	147	20.2	0.45
Reach 4	Air Compressors	155	142	0.48
	Articulating Trench Roller	64	20.2	0.38
	Cement and Mortar Mixers	40	500	0.42
	Concrete/ Industrial Saws	53	74.3	0.73
	Cranes 150 Ton	154	290	0.29
	Crawler Tractors Low Ground Pressure	127	165	0.43
	Crushing/ Processing Equipment	62	540	0.4
	Excavator	281	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	259	114	0.4
	Generator	1,622	12	0.74
	Graders	58	250	0.41
	Impact Hammer	39	75	0.44
	Loaders 3.5 CY	1,874	180	0.36
	Paving Equipment	58	111	0.36
	Rollers	58	137	0.38
	Rubber Tired Loaders	77	309	0.36
	Rubber Tired RT Crane 40 Ton	80	165	0.29
	Sand Hopper with Conveyor	32	300	0.4
	Skid Steer Loaders	50	74.3	0.37
	Standard Light Setup	1,308	12.5	0.42
	Sweepers/ Scrubbers	289	74	0.46
	Vibratory Hammer Power Pack	154	765	0.34
	Welding Machine	154	20.2	0.45
Reach 5	Air Compressors	205	142	0.48
	Articulating Trench Roller	159	20.2	0.38
	Concrete/ Industrial Saws	54	74.3	0.73

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
	Cranes 150 Ton	294	290	0.29
	Crawler Tractors Low Ground Pressure	319	165	0.43
	Crushing/ Processing Equipment	120	540	0.4
	Excavator	688	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	442	114	0.4
	Generator	2,597	12	0.74
	Graders	76	250	0.41
	Impact Hammer	74	75	0.44
	Loaders 3.5 CY	3,268	180	0.36
	Paving Equipment	57	111	0.36
	Rollers	76	137	0.38
	Rubber Tired Loaders	172	309	0.36
	Sand Hopper with Conveyor	80	300	0.4
	Signal Boards	55	6	0.82
	Skid Steer Loaders	142	74.3	0.37
	Standard Light Setup	2,088	12.5	0.42
	Sweepers/ Scrubbers	472	74	0.46
	Vibratory Hammer Power Pack	294	765	0.34
	Welding Machine	294	20.2	0.45
Reach 6	Air Compressors	199	142	0.48
	Concrete/ Industrial Saws	12	74.3	0.73
	Cranes 150 Ton	315	290	0.29
	Excavator	425	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	531	114	0.4
	Generator	2,380	12	0.74
	Graders	42	250	0.41
	Impact Hammer	79	75	0.44
	Loaders 3.5 CY	2,754	180	0.36
	Paving Equipment	42	111	0.36
	Rollers	42	137	0.38
	Rubber Tired (RT) Crane 40 Ton	32	165	0.29
	Rubber Tired Loaders	105	309	0.36
	Skid Steer Loaders	191	74.3	0.37
	Standard Light Setup	1,786	12.5	0.42
	Sweepers/ Scrubbers	400	74	0.46
	Vibratory Hammer Power Pack	315	765	0.34
	Welding Machine	315	20.2	0.45
Reach 7	Air Compressors	3,263	142	0.48
	Concrete/ Industrial Saws	1,539	74.3	0.73
	Cranes 150 Ton	645	290	0.29
	Crawler Tractors	599	245	0.43
	Crawler Tractors Low Ground Pressure	1,489	165	0.43
	Excavator	9,591	275	0.38

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
	Excavator Amphibious	1,044	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	2,926	114	0.4
	Generator	4,653	12	0.74
	Graders	285	250	0.41
	Impact Hammer	85	75	0.44
	Jet Grout Rig	6,040	500	0.34
	Loaders 3.5 CY	8,091	180	0.36
	Mixing Plant	4,027	100	0.4
	Paving Equipment	88	111	0.36
	Pumps	2,919	49	0.74
	Rollers	285	137	0.38
	Rubber Tired Loaders	821	309	0.36
	Rubber Tired RT Crane 40 Ton	83	165	0.29
	Signal Boards	592	6	0.82
	Skid Steer Loaders	714	74.3	0.37
	Standard Light Setup	11,011	12.5	0.42
	Sweepers/ Scrubbers	143	74	0.46
	Vibratory Hammer Power Pack	2,624	765	0.34
	Welding Machine	5,632	20.2	0.45
Reach 8	Air Compressors	2,035	142	0.48
	Concrete/ Industrial Saws	1,023	74.3	0.73
	Cranes 150 Ton	37	290	0.29
	Crawler Tractors	37	245	0.43
	Crawler Tractors Low Ground Pressure	37	165	0.43
	Crushing/ Proc. Equipment	66	540	0.4
	Excavator	3,935	275	0.38
	Excavator Amphibious	37	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	2,001	114	0.4
	Generator	3,165	12	0.74
	Graders	111	250	0.41
	Jet Grout Rig	1,859	500	0.34
	Loaders 3.5 CY	2,744	180	0.36
	Mixing Plant	1,239	100	0.4
	Paving Equipment	34	111	0.36
	Pumps	1,939	49	0.74
	Rollers	111	137	0.38
	Rubber Tired (RT) Crane 40 Ton	25	165	0.29
	Rubber Tired Loaders	354	309	0.36
	Signal Boards	231	6	0.82
	Skid Steer Loaders	189	74.3	0.37
	Standard Light Setup	2,954	12.5	0.42
	Sweepers/ Scrubbers	56	74	0.46
	Vibratory Hammer Power Pack	790	765	0.34

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
	Welding Machine	1,878	20.2	0.45
Reach 9	Air Compressors	18	142	0.48
	Concrete/ Industrial Saws	20	74.3	0.73
	Cranes 150 Ton	94	290	0.29
	Crawler Tractors	8	245	0.43
	Crawler Tractors Low Ground Pressure	168	165	0.43
	Excavator	94	275	0.38
	Excavator Amphibious	8	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	102	114	0.4
	Generator	512	12	0.74
	Graders	59	250	0.41
	Impact Hammer	21	75	0.44
	Loaders 3.5 CY	747	180	0.36
	Paving Equipment	18	111	0.36
	Rollers	59	137	0.38
	Rubber Tired (RT) Crane 40 Ton	80	165	0.29
	Rubber Tired Loaders	21	309	0.36
	Signal Boards	123	6	0.82
	Skid Steer Loaders	27	74.3	0.37
	Standard Light Setup	410	12.5	0.42
	Sweepers/ Scrubbers	110	74	0.46
	Vibratory Hammer Power Pack	86	765	0.34
Reach 10	Air Compressors	67	142	0.48
	Articulating Trench Roller	27	20.2	0.38
	Concrete/ Industrial Saws	20	74.3	0.73
	Cranes 150 Ton	98	290	0.29
	Crawler Tractors Low Ground Pressure	55	165	0.43
	Excavator	110	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	166	114	0.4
	Generator	712	12	0.74
	Graders	59	250	0.41
	Impact Hammer	25	75	0.44
	Loaders 3.5 CY	865	180	0.36
	Paving Equipment	18	111	0.36
	Rollers	59	137	0.38
	Sand Hopper with Conveyor	14	300	0.4
	Signal Boards	122	6	0.82
	Skid Steer Loaders	31	74.3	0.37
	Standard Light Setup	502	12.5	0.42
	Sweepers/ Scrubbers	135	74	0.46
	Vibratory Hammer Power Pack	98	765	0.34
	Welding Machine	98	20.2	0.45

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
Reach 11	Air Compressors	404	142	0.48
	Concrete/ Industrial Saws	126	74.3	0.73
	Cranes 150 Ton	677	290	0.29
	Crushing/ Processing Equipment	141	540	0.4
	Excavator	4,869	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	1,079	114	0.4
	Generator	7,438	12	0.74
	Graders	212	250	0.41
	Impact Hammer	169	75	0.44
	Jet Grout Rig	3,797	500	0.34
	Loaders 3.5 CY	11,820	180	0.36
	Mixing Plant	1,899	100	0.4
	Paving Equipment	65	111	0.36
	Rollers	212	137	0.38
	Rubber Tired (RT) Crane 75 Ton	64	270	0.29
	Rubber Tired Loaders	410	309	0.36
	Signal Boards	440	6	0.82
	Skid Steer Loaders	166	74.3	0.37
	Standard Light Setup	7,041	12.5	0.42
	Sweepers/ Scrubbers	1,449	74	0.46
	Vibratory Hammer Power Pack	741	765	0.34
	Welding Machine	741	20.2	0.45
Reach 12	Air Compressors	113	142	0.48
	Articulating Trench Roller	98	20.2	0.38
	Concrete/ Industrial Saws	1	74.3	0.73
	Cranes 150 Ton	226	290	0.29
	Crawler Tractors Low Ground Pressure	196	165	0.43
	Crushing/ Processing Equipment	4	540	0.4
	Excavator	469	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	338	114	0.4
	Generator	1,662	12	0.74
	Impact Hammer	56	75	0.44
	Loaders 3.5 CY	2,470	180	0.36
	Rubber Tired Loaders	88	309	0.36
	Sand Hopper with Conveyor	49	300	0.4
	Skid Steer Loaders	32	74.3	0.37
	Standard Light Setup	1,516	12.5	0.42
	Sweepers/ Scrubbers	284	74	0.46
	Vibratory Hammer Power Pack	226	765	0.34
	Welding Machine	226	20.2	0.45
Reach 13	Air Compressors	309	142	0.48
	Concrete/ Industrial Saws	165	74.3	0.73
	Cranes 150 Ton	872	290	0.29

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
	Crushing/ Processing Equipment	182	540	0.4
	Excavator	6,360	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	1,159	114	0.4
	Generator	9,126	12	0.74
	Graders	278	250	0.41
	Impact Hammer	218	75	0.44
	Jet Grout Rig	4,856	500	0.34
	Loaders 3.5 CY	14,923	180	0.36
	Mixing Plant	2,428	100	0.4
	Paving Equipment	85	111	0.36
	Rollers	278	137	0.38
	Rubber Tired (RT) Crane 75 Ton	64	270	0.29
	Rubber Tired Loaders	721	309	0.36
	Signal Boards	577	6	0.82
	Skid Steer Loaders	216	74.3	0.37
	Standard Light Setup	8,667	12.5	0.42
	Sweepers/ Scrubbers	1,841	74	0.46
	Vibratory Hammer Power Pack	936	765	0.34
	Welding Machine	512	20.2	0.45
Reach 14	Air Compressors	344	142	0.48
	Articulating Trench Roller	209	20.2	0.38
	Concrete/ Industrial Saws	113	74.3	0.73
	Cranes 150 Ton	503	290	0.29
	Crawler Tractors Low Ground Pressure	417	165	0.43
	Excavator	901	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	903	114	0.4
	Generator	3,657	12	0.74
	Graders	326	250	0.41
	Impact Hammer	126	75	0.44
	Jet Grout Rig	107	500	0.34
	Loaders 3.5 CY	5,006	180	0.36
	Mixing Plant	53	100	0.4
	Paving Equipment	100	111	0.36
	Rollers	326	137	0.38
	Rubber Tired (RT) Crane 75 Ton	64	270	0.29
	Sand Hopper with Conveyor	104	300	0.4
	Signal Boards	678	6	0.82
	Skid Steer Loaders	155	74.3	0.37
	Standard Light Setup	2,916	12.5	0.42
	Sweepers/ Scrubbers	694	74	0.46
	Vibratory Hammer Power Pack	567	765	0.34
	Welding Machine	550	20.2	0.45

TABLE 2
OFF-ROAD CONSTRUCTION EQUIPMENT FLEET BY REACH

Reach	Equipment Type[a]	Total Activity Hours	Engine Horsepower	Load Factor[b]
Reach 15	Air Compressors	78	142	0.48
	Backhoes	60	148	0.37
	Cement and Mortar Mixers	156	500	0.42
	Excavator	95	275	0.38
	Forklift 10,000 lb. Extendable Rough Terrain	303	114	0.4
	Generator	1,733	12	0.74
	Loaders 3.5 CY	1,984	180	0.36
	Skid Steer Loaders	65	74.3	0.37
	Standard Light Setup	1,254	12.5	0.42
	Sweepers/ Scrubbers	274	74	0.46

SOURCE: Project sponsor.

ABBREVIATIONS: Lb. = pound; CY = cubic yard

NOTES:

[a] Equipment type provided by the project sponsor was matched to the equipment categories in the OFFROAD 2011 model. If no match was available (e.g., vibratory hammer power pack), categories of “other construction equipment,” “other general industrial equipment,” or “other material handling equipment” were used.
[b] CalEEMod (version 2020.4.0) default values were used for engine load factors.

2.1.3 Asphalt Paving

Fugitive ROG emissions from asphalt paving off-gassing were calculated using the methods included in CalEEMod based on a default emission factor of 2.62 pounds per acre.[7] Approximately 18 acres of the project site would be paved with asphalt.

2.1.4 Painting

The analysis did not include ROG emissions from painting. It was assumed that any painting would be limited to minor amounts of re-striping pavement at the reaches and would result in negligible amounts of ROG emissions.

2.2 On-Road Construction Vehicles

In addition to off-road equipment, project construction would require on-road vehicles for materials import/export (i.e., haul trucks), employee commute trips, onsite personnel movement, and vendor trips. Criteria pollutants and TAC emissions generated by on-road vehicle trips were calculated for each reach using **Equation 2**.

[7] CalEEMod User’s Guide, Appendix A, 2016, http://www.caleemod.com, accessed March 2021.

Equation 2: $E_{phase} = \sum_{i}(Activity_i * EF_i * Distance_i) * Conv$

Where:

E_{phase} = Total exhaust emissions for the phase, pounds per day

Activity = Vehicle trips, trips per day (project sponsor)

Distance = Vehicle trip length, miles per trip (project sponsor)

EF = Engine emissions factor, grams/mile (EMFAC2021)

Conv = Conversion factor, 0.002205 grams/pound

i = Vehicle type

Emissions modeling input data and assumptions for on-road vehicles are presented below.

2.2.1 On-Road Vehicle Activity

Truck Trips and Worker Commutes

This category includes both "offsite" trips and "onsite" trips. Offsite vehicle travel represents vehicles traveling from offsite destinations (such as a material supply location or landfill) to the project site. For vehicles traveling from offsite locations to the project site, these vehicles may travel to the Aviador Lot or Plot 16D staging areas first (Figure 1, p. 2), before materials and supplies are transported to the reach, or they may travel directly to the reach (such as for concrete deliveries). For vehicles traveling from the project site to offsite locations, these vehicles may travel to the Aviador Lot or Plot 16D staging area first before materials are transported elsewhere, or they may travel directly from the project site to their final destination. Trip lengths for offsite roundtrips range from 31 to 1,405 miles, with an average roundtrip length of 48 miles. Onsite vehicle travel represents vehicles traveling from the Aviador Lot or Plot 16D staging areas to the reach or from the reach to the Aviador Lot or Plot 16D. Trip lengths for onsite roundtrips range from 12 to 16 miles.

Vehicle types include demolition trucks, material off-haul trucks, material import trucks, concrete trucks, miscellaneous trucks, and worker commute vehicles. Truck and worker commute trips and vehicle miles traveled (VMT) were developed based on the quantities of construction materials required for each reach and activity (including concrete and other deliveries made by vendor trucks) and demolished structures for material off-haul. The project sponsor provided this information. For each reach and activity, the project sponsor also provided the average number of trips per day, the total number of trips, and the total VMT for all trips required during construction. However, ESA recalculated trips and VMT based on whole working days for each activity because the information included a fractional number of workdays required to complete each activity, which was based on total quantities (such as linear feet of site preparation or cubic yards of material removal) and production rates (such as linear feet per day). This yielded workday fractions (e.g., 10.4 workdays). ESA rounded these workday fractions up and recalculated total trips and VMT based on average daily trips and VMT per trip. Daily vendor trips delivering materials and supplies to the project site would occur during construction of all reaches. Vendor trips would be required to deliver concrete, steel, aggregate, and other materials to the project site. **Table 3** presents truck trip lengths provided by the project sponsor based on the origin of the material delivered or the destination of the material disposed.

TABLE 3
OFFSITE TRUCK TRIP DISTANCES AND DESTINATIONS

Trip Type	Material	Destination	Roundtrip Miles
Worker commutes		Various	80
Demolition	Vinyl, asphalt, miscellaneous	West Contra Costa Landfill	71
Demolition	Riprap, concrete, clay/mud	Dutra Material, Richmond	78
Demolition	Vinyl, asphalt, miscellaneous	Altamont Landfill	108
Material off-haul	Vinyl, asphalt, miscellaneous	West Contra Costa Landfill	71
Material off-haul	Riprap, concrete, clay/mud	Dutra Material, Richmond	78
Material import	Sand	Hanson Aggregates, Pier 92 Port of SF	30–40
Material import	Riprap, clay/mud, rock	Dutra Quarry, San Rafael	74
Material import	Asphalt	Dutra Material, Richmond	78
Material import	Rebar, sheet pile, tie rods, wick drain material, capbeam	Stockton[a]	160–180
Material import	Soil grout	Pier 92	31
Concrete	Concrete	Cemex Cement, Pier 90 Port of SF	31
Concrete	Concrete	Various	80
Other truck trips	Sheet pile	Various	250
Other truck trips	Flood gate	Texas[a]	2,810

SOURCE: Project Sponsor

NOTES:

[a] For trips that leave the San Francisco Bay Area Air Basin (SFBAAB), such as to Stockton, CA or Texas, only the portion of the trip that occurs within the air basin is included in the emissions modeling. These truck trips will produce emissions as the trucks pass through neighboring air basins and across the United States; however, the majority of emissions for all truck trips occur within the SFBAAB and emissions in other air basins would be a small fraction of the emissions in the SFBAAB; therefore, quantification of emissions in other air basins is not necessary.

The primary staging area for Reaches 1–8 would be Plot 16D (located north of the U.S. 101/I-380 Interchange in the City of South San Francisco) and for Reaches 7–15 would be the Aviador Lot (located at 65 Aviador Avenue in Millbrae). These lots would be used for bulk material storage for the respective reaches. Vehicular access to Reaches 1–8 would be via North Access Road, while access to Reaches 9–15 would be via Millbrae Avenue/South McDonnell Road.

The project sponsor provided the total number of daily workers traveling to the site during all phases of construction. The project sponsor also provided total worker commute trips and total worker commute VMT for each reach and activity, assuming an average roundtrip distance of 80 miles. The number of workers that would be required for each reach is summarized in **Table 4**.

TABLE 4
PROJECT CONSTRUCTION TRUCKS AND WORKER TRIP SUMMARY BY REACH

Reach (Construction Period)	Total Workdays	Total Roundtrip Truck Trips[a]	Average Daily Trucks and Worker Trips by Reach[b]		
			Construction Trucks	Worker Trips	Total
Reach 1	102	2,390	47	26	***73***
Reach 2	159	5,236	66	26	***91***
Reach 3	71	2,216	62	24	***86***
Reach 4	67	2,181	65	24	***89***
Reach 5	111	3,917	71	24	***95***
Reach 6	97	2,894	60	24	***84***
Reach 7	800	36,067	90	27	***117***
Reach 8	401	10,038	50	21	***71***
Reach 9	22	884	80	27	***107***
Reach 10	30	1,017	68	25	***93***
Reach 11	339	23,300	137	32	***169***
Reach 12	73	3,324	91	25	***116***
Reach 13	428	29,890	140	31	***171***
Reach 14	135	6,388	95	29	***124***
Reach 15	70	1,296	37	23	***60***
Total trucks		***131,038***			

SOURCE: Project sponsor with ESA adjustments. Because the project sponsor provided total trips and VMT based on workday fractions (such as 10.4), ESA first rounded-up these workday fractions (e.g., 10.4 to 11) and then re-calculated total trips and VMT for each trip type for each reach and activity based on the rounded-up workdays and the daily trips and trip distances (see Table 1, p. 6).

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Total roundtrip truck trips were calculated using the average daily trucks provided by the project sponsor and multiplying by the rounded-up number of work days for each reach and activity.

[b] Each truck represents one roundtrip (or two one-way trips). Trucks that would travel to and from the reaches and Aviador Lot or Plot 16D throughout the duration of the reach's construction period were added to the number of trucks during the phase with the greatest number of trucks.

Table 4 also presents the total number of offsite truck and worker commute trips used to estimate the proposed project's on-road vehicle emissions. These numbers were calculated by summing the number of truck trips for each trip type for each reach, which was provided by the project sponsor. The project sponsor provided truck trips by trip type (e.g., demolition, material off-haul, worker commutes) for each activity occurring from the offsite areas to the project site at the Aviador Lot or to the specific reach. Concrete truck trips occur entirely from offsite locations directly to each reach. Because the project sponsor provided trips and VMT based on workday fractions, ESA re-calculated total trips and VMT for each trip type for each reach and activity based on rounded-up workdays (see Table 1, p. 6).

Table 5 presents average trips per day, total one-way trips, and total VMT for on-road truck and worker trips by reach and the totals for all construction activities for all reaches; this detailed information was provided by the project sponsor. The table includes both offsite trips and onsite trips.

Construction Support Trucks and Shuttles

This category includes trucks performing local construction activities at each reach. Vehicles include dump trucks, long-reach pump trucks, flatbed trucks, and pickup trucks. This activity would take place at each reach and is in addition to the offsite and onsite truck trips discussed above. Shuttles would bring workers from parking lots on the Airport near the site (primarily Lot D) to each reach for each construction shift (Figure 1, p. 2).

Instead of trips and VMT, the project sponsor provided hours of operation per day for each vehicle type for support trucks (for each reach and activity). It was assumed that these vehicles would be traveling an average of 5 miles per hour (mph) for 50 percent of the time and would be idling for the remaining 50 percent of the time. The 5 mph average speed was used to calculate total VMT for onsite vehicles. This is a conservative assumption since it is likely that many of these trucks would be parked and not running for some time during each day. Shuttle trips and VMT were calculated using the daily number of workers needed at the site; an occupancy of 12 persons per shuttle trip (in order to calculate the number of shuttles required to bring workers to and from the site); two roundtrips each day (start of the shift and end of the shift); and the distance from the Lot D to each reach (which ranges from 1.5 to 5.7 miles one-way depending on the destination reach).

Table 6 presents the support truck activity for each reach. These vehicles would not travel from an offsite location to the site each day and would remain parked at the Aviador Lot during off-shift hours.

Haul Truck Idling

Idling emissions were calculated separately for offsite and onsite heavy-duty truck trips. CARB has adopted regulations for on-road vehicles with a gross vehicular weight rating of 10,000 pounds or greater to require that they not idle for longer than five minutes at any location [Title 13 California Code of Regulations (CCR) section 2485]. Therefore, for purposes of this analysis, it was assumed that for all offsite and onsite truck trips, trucks would idle for a total of 15 minutes per trip, representing three separate 5-minute idling occurrences: (1) check-in to the site or queuing at the site boundary upon arrival; (2) onsite idling during loading/unloading; and (3) check-out of the site or queuing at the site boundary upon departure. For construction support vehicle activity (see description above), it was assumed that each vehicle is idling for 50 percent of the time the vehicle is operating at the reach, as discussed above. Separate idling emissions were only calculated for heavy-heavy-duty trucks (HHDT) vehicle types.

TABLE 5
TRUCK TRIPS AND WORKER COMMUTES

	Workers			Demolition[a]						Material Off-Haul[a]						Material Import[a]						Concrete[a]			Other Truck Trips[a]						Total For All Vehicle and Trip Types		
				Offsite[b]			Onsite[c]			Offsite[b]			Onsite[c]			Offsite[b]			Onsite[c]			Offsite[b]			Offsite[b]			Onsite[c]					
Reach	Avg. Workers/ Day	Total VMT	Total One-Way Trips	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT	Avg. One-Way Trips/ Day[d]	One-Way Trips	Total VMT
1	26	5,348	213,920	2.6	264	14,256	—	—	—	2.6	264	10,296	5.8	594	3,564	—	—	—	—	—	—	8.6	874	10,952	3.1	313	14,405	24.2	2,471	14,035	99.3	10,129	281,428
2	26	8,146	325,840	2.3	366	18,286	0.5	82	492	1.2	192	7,488	2.9	460	2,760	3.5	558	11,104	17.0	2,710	49,040	—	—	—	13.2	2,093	106,149	25.2	4,012	24,072	117.1	18,619	545,231
3	24	3,374	134,960	6.8	480	20,880	7.7	546	3,276	2.2	156	6,084	5.0	356	2,808	3.1	220	6,304	7.6	540	3,840	—	—	—	6.2	441	25,475	23.9	1,694	10,164	110.0	7,807	213,791
4	24	3,218	128,720	4.3	288	14,208	2.1	144	864	3.9	260	10,140	8.7	580	4,600	4.7	312	9,096	11.3	760	5,360	0.4	24	352	5.3	353	23,107	24.5	1,642	9,852	113.1	7,581	206,299
5	24	5,356	214,240	2.9	318	15,072	2.2	240	1,440	5.2	572	22,308	11.5	1,272	10,096	5.0	556	14,452	12.8	1,420	10,520	—	—	—	6.4	712	44,017	24.7	2,744	16,464	118.8	13,190	348,609
6	24	4,720	188,800	2.1	204	11,016	—	—	—	7.2	700	27,300	15.7	1,524	10,712	1.4	140	5,180	3.1	300	1,800	—	—	—	4.0	392	33,312	26.1	2,528	15,168	108.3	10,508	293,288
7	27	43,368	1,734,720	0.2	148	7,992	—	—	—	8.4	6,706	261,534	18.4	14,690	99,900	4.4	3,528	130,536	9.5	7,560	45,360	—	—	—	45.3	36,206	628,214	4.1	3,296	22,752	144.4	115,502	2,931,008
8	21	16,506	660,240	0.2	90	3,600	0.4	144	864	3.9	1,580	61,620	8.5	3,400	25,552	1.4	560	20,720	3.0	1,200	7,200	—	—	—	28.4	11,368	198,036	4.3	1,734	11,460	91.2	36,582	989,292
9	27	1,182	47,280	0.9	20	1,080	—	—	—	3.5	78	3,042	8.2	180	1,416	3.8	84	3,108	8.2	180	1,080	—	—	—	29.6	651	29,123	26.1	574	3,444	134.0	2,949	89,573
10	25	1,484	59,360	0.7	20	1,080	—	—	—	—	—	—	0.5	16	96	6.1	184	5,584	14.7	440	3,040	—	—	—	21.5	646	30,241	24.3	728	4,368	117.3	3,518	103,769
11	32	21,454	858,160	0.5	180	7,200	0.8	288	1,728	10.5	3,552	85,728	21.7	7,356	49,960	3.5	1,176	43,512	7.4	2,520	15,120	0.0	16	640	69.9	23,683	455,975	23.1	7,828	46,968	200.7	68,053	1,564,991
12	25	3,632	145,280	0.1	10	400	0.2	16	96	3.9	286	11,154	8.9	648	5,120	15.5	1,130	37,832	35.2	2,570	16,720	—	—	—	2.1	157	19,169	25.1	1,832	10,992	140.8	10,281	246,763
13	31	26,820	1,072,800	0.5	230	9,200	0.9	368	2,208	11.5	4,916	130,524	24.0	10,252	71,704	2.9	1,232	45,584	6.2	2,640	15,840	0.0	16	640	70.7	30,251	581,465	23.1	9,874	59,244	202.3	86,599	1,989,209
14	29	7,882	315,280	0.7	96	5,184	—	—	—	—	—	—	0.5	64	384	11.9	1,606	51,160	27.8	3,750	25,200	0.1	8	124	27.2	3,673	152,820	26.5	3,580	21,480	153.0	20,659	571,632
15	23	3,270	130,800	—	—	—	—	—	—	1.7	120	4,680	5.2	362	2,172	-	-	-	-	-	-	9.1	635	8,072	0.0	2	1,405	21.0	1,472	8,832	83.7	5,861	155,961
All	**46**	**155,760**	**6,230,400**	**1.6**	**2,714**	**129,454**	**1.1**	**1,828**	**10,968**	**11.5**	**19,382**	**641,898**	**24.7**	**41,754**	**290,844**	**6.7**	**11,286**	**384,172**	**15.7**	**26,590**	**200,120**	**0.9**	**1,573**	**20,780**	**65.6**	**110,940**	**2,342,914**	**27.2**	**279,295**	**279,295**	**247.2**	**417,836**	**10,530,845**

SOURCE: Project sponsor.

ABBREVIATIONS: Avg. = average; VMT = vehicle miles traveled; — = no truck trips

NOTES:

[a] Modeled in EMFAC2021 as a diesel heavy-heavy diesel truck (HHDT). Truck type categories include:
Demolition = trucks disposing of material during demolition activities.
Material Off-Haul = trucks hauling off riprap, soil, vinyl, concrete, and other material from the site.
Material Import = trucks importing sand, riprap, rock, asphalt, rebar, and other material to the site.
Concrete = trucks bringing in concrete to the site.
Other Truck Trips = miscellaneous trucks bringing material to the site and exporting material from the site.

[b] Offsite represents travel from point of origin to the proposed project site or from the project site to the destination (mileage listed in Table 3).

[c] Onsite represents travel from the Aviador Lot or Plot 16D to each reach.

[d] Avg. One-Way Trips/Day represents the total number of truck trips for each trip type divided by the total number of workdays for each reach or divided by the total number of workdays for the entire construction period (for "All"). Because many activities within each reach do not have trucking activities, the actual number of trucks trips per day during trucking activities is higher than the averages presented in this table.

TABLE 6
CONSTRUCTION SUPPORT TRUCKS AND SHUTTLES

	Highway Dump Trucks Super 10[a]			Pump Truck Long Reach[a]			Pickup Trucks Company Owned[b]			Flat Bed Truck 3-Axle[a]			Shuttles[c]			
	Onsite[d]			Onsite[d]			Onsite[d]			Onsite[d]			Onsite[e]			
Reach	**Hrs/Day**	**Total Hrs**	**Total VMT[f]**	**Hrs/Day**	**Total Hrs**	**Total VMT**	**Hrs/Day**	**Total Hrs**	**Total VMT**	**Hrs/Day**	**Total Hrs**	**Total VMT**	**Avg. One-Way Trips/Day**	**Total One-Way Trips**	**One-Way Miles/trip**	**Total VMT**
1	—	—	—	4	368	920	4-8	2,150	10,750	—	—	—	20.5	2,088	1.5	3,132
2	8	32	80	—	—	—	2-8	3,204	16,020	—	—	—	18.6	2,952	2.0	5,904
3	8	48	120	—	—	—	4-8	1,334	6,670	—	—	—	17.7	1,256	2.3	2,889
4	—	—	—	4	28	70	4-8	1,274	6,370	—	—	—	18.1	1,212	2.8	3,394
5	8	120	300	—	—	—	2-8	2,136	10,680	—	—	—	17.8	1,972	3.0	5,916
6	—	—	—	—	—	—	-	1,972	9,860	—	—	—	18.2	1,768	3.6	6,365
7	—	—	—	—	—	—	4-24	9,086	45,430	2	112	280	12.4	9,892	4.0	39,568
8	8	72	180	—	—	—	4-24	2,524	12,620	—	—	—	8.8	3,540	4.5	15,930
9	—	—	—	—	—	—	2-8	486	2,430	—	—	—	19.6	432	5.7	2,462
10	—	—	—	—	—	—	2-8	588	2,940	—	—	—	17.7	532	5.7	3,032
11	8	144	360	4	32	80	2-8	6,622	33,110	—	—	—	21.9	7,428	5.4	39,740
12	8	8	20	-	-	-	2-8	1,444	7,220	—	—	—	18.4	1,344	4.8	6,451
13	8	184	460	4	32	80	2-8	8,296	41,480	—	—	—	21.7	9,296	4.3	39,508
14	—	—	—	4	32	80	2-8	3,012	15,060	—	—	—	20.7	2,800	3.0	8,400
15	—	—	—	4	308	770	2-8	1,192	5,960	—	—	—	17.5	1,228	2.5	3,070
All	**—**	**608**	**1,520**	**—**	**800**	**2,000**	**—**	**45,320**	**226,600**	**—**	**112**	**280**	**—**	**47,740**	**—**	**185,761**

SOURCE: Project sponsor.

ABBREVIATIONS: VMT = vehicle miles traveled; Hrs = hours; Hrs/Day = average hours of operation per truck per day; - = no truck trips

NOTES:

[a] Modeled in EMFAC2021 as a diesel heavy-heavy diesel truck (HHDT). Truck type categories include:
Highway Dump Trucks Super 10 = represents a Peterbilt 389 with a 12-cubic-yard material capacity.
Pump Truck Long Reach = represents a Puzmeister 36, used for pumping various materials.
Pickup Trucks Company Owned = represents a ¾-ton diesel pickup truck.
Flat Bed Truck 3-Axle = represents a Peterbilt 348 Flatbed truck with a 10-ton capacity.
Shuttles = represents a gasoline 12-person van for transporting workers from Lot D to the reach.

[b] Modeled in EMFAC2021 as a diesel Medium-Duty Vehicle (MDV).

[c] Modeled in EMFAC2021 as a gasoline Light Heavy-Duty truck (LDHT1).

[d] Onsite represents travel at or near each reach during construction activities. VMT was calculated based on hours of use provided by the project sponsor at an average speed of 5 miles per hour.

[e] For shuttles, onsite represents travel from Lot D to each reach during construction activities. VMT was calculated based on a shuttle occupancy of 12, two roundtrips per day (one at the start of the shift and one at the end of the shift), and an average speed of 15 miles per hour.

[f] VMT was calculated assuming that vehicles would be traveling an average of 5 miles per hour (mph) for 50 percent of the time and would be idling for the remaining 50 percent of the time.

2.2.2 Emission Factors

Emission factors for all trip types and vehicle types were derived from the 2021 EMission FACtor (EMFAC2021) model for the entire BAAQMD region, which includes nine counties: Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, San Francisco, and Marin. The emission rates used in the analysis include all emission-generating processes from the EMFAC model.[8] Road dust emissions were based on BAAQMD and United States Environmental Protection Agency (U.S. EPA) AP-42 methods.[9,10] Emission rates were calculated for each county in the BAAQMD region and averaged. Separate emission rates for different vehicle types were calculated based on average vehicle weights, as discussed below. Following CARB's methods for paved road dust for entrained road travel, the average composite silt loading factor of 0.044 grams per square meter (g/m^2) was used in the modeling.

Truck Trips and Worker Commutes

All trucks were assumed to be diesel HHDT. For offsite trips (vehicles traveling to/from offsite locations to the project site), emission rates are based on the aggregate speed data embodied in EMFAC2021. For onsite trips (vehicles traveling onsite from the Aviador Lot or Plot 16D to the reach), it was assumed vehicles travel an average of 15 mph. For road dust, an average vehicle weight of 2.4 tons was used for all vehicles.

Worker vehicles were assumed to be a mix of light-duty auto (LDA), light-duty trucks (LDT1 and LDT2), motorcycles (MCY), and medium-duty vehicles (MDV). The specific vehicle mix was based on the default share of VMT by vehicle type for the BAAQMD region from EMFAC2021. Emission rates are based on the aggregate speed data embodied in EMFAC2021. For road dust, an average vehicle weight of 2.4 tons was used.

Construction Support Trucks and Shuttles

Dump trucks, long-reach pump trucks, and flatbed trucks were all assumed to be diesel HHDT; pickup trucks were assumed to be medium-duty diesel vehicles (MDV); shuttles were assumed to be light heavy-duty gasoline trucks (LHDT1). Vehicle activity was provided by the project sponsor in units of hours. To calculate emissions for onsite vehicle activity, hours of operation were converted to VMT assuming an average speed of 5 mph for 50 percent of each vehicle's total operating time, as discussed above. Emission rates represent the 5-mph speed bin from EMFAC2021. Shuttles were assumed to travel at 15 mph on average. For road dust, an average vehicle weight of 2.4 tons was used for all vehicles.

---

8 The processes include RUNEX, PMBW, PMTW, STREX, HOTSOAK, RUNLOSS, IDLEX, and DIURN.

9 Bay Area Air Quality Management District, Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust, March 2018, https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2018.pdf, accessed March 2021.

10 United States Environmental Protection Agency, AP 42, Fifth Edition, Volume I Chapter 13: Miscellaneous Sources, Section 13.2.1 Paved Roads, January 2011, https://www.epa.gov/sites/production/files/2020-10/documents/13.2.1_paved_roads.pdf, accessed March 2021.

Haul Truck Idling

Idling emissions were calculated for all HHDT vehicles using the IDLEX process emission rates from EMFAC2021.[11]

The tables below present a summary of the on-road vehicle emission rates used in the analysis. **Table 7a** presents travel emission rates; **Table 7b** presents idling emission rates for heavy-duty trucks; and **Table 7c** presents road dust emission rates by vehicle type.

2.2.3 Offshore Activities at Reaches

Below is a general description of the types of activities that would involve marine vessels. Specific marine vessels associated with each reach and construction activity are shown below in **Table 8** through **Table 10**, pp. 26 to 29.

A derrick barge would be used to remove and place riprap on the shoreline slope and install some of the sheet piling; a crane barge may also be used for this. Dredging is anticipated for Reaches 7 and 8 to remove bay mud prior to placing fill in open waters of the San Francisco Bay. The dredged material would be removed with a derrick barge or a crane barge. A derrick barge would also be involved in the demolition and reconstruction of the lighting trestle at the end of Runway 19L.

A sand dredge barge with a conveyor would supply backfill sand, bringing material from Hanson Aggregates over a 70-mile round-trip distance. A material barge would be used to place sand or a sand-gravel mixture into the excavated area between the shoreline and the outer sheet pile wall in the bay. Push boats would maneuver the barges in place and push them to and from the project site (the material barges have no engines). Material barges, crane/excavator barges, and small skiffs would be involved in bolting a cap to the sheet pile wall. The construction of the double sheet pile wall for Reach 7 would be accomplished by a combination of land-based equipment and marine-based equipment.

2.2.4 Material Transport

Some of the demolished concrete rubble would be hauled via barge to a disposal site. In addition, some riprap would be brought from the Dutra Quarry in San Rafael by material barge. The material barges would be moved by push boats. Fill material for Reaches 7 and 8 would be transported to the project site by truck and barge. The gravel portion of the mix is likely to come from the Dutra quarry in San Rafael. The barges and push boats would travel between the site and the Dutra Quarry in San Rafael, Piers 90 and 92 in San Francisco, and Berth 10 at the Port of Oakland.

[11] EMFAC2021 only provides idling-specific emission rates for HHDT vehicles. Idling emissions for other vehicle types are embodied in the emission factors for other processes.

TABLE 7A
UNCONTROLLED MOBILE SOURCE EMISSION FACTORS – TRAVEL

Year & Vehicle Type[b]	Grams Per Mile[a]																		Grams per Trip[a]			
	Offsite Trips – Aggregated Speed						Onsite Trips – 15 mph						Onsite Trips – 5 mph						Offsite Trips – Aggregated Speed[b]			
	ROG	NO_X	PM_{10} Exhaust	PM_{10} Dust	$PM_{2.5}$ Exhaust	$PM_{2.5}$ Dust	ROG	NO_X	PM_{10} Exhaust	PM_{10} Dust	$PM_{2.5}$ Exhaust	$PM_{2.5}$ Dust	ROG	NO_X	PM_{10} Exhaust	PM_{10} Dust	$PM_{2.5}$ Exhaust	$PM_{2.5}$ Dust	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025																						
Workers	0.014	0.053	0.001	0.152	0.001	0.025	0.037	0.037	0.003	0.142	0.003	0.023	0.023	0.023	0.002	0.023	0.002	0.021	0.736	0.282	0.002	0.002
Pickup Trucks	0.011	0.053	0.005	0.153	0.005	0.026	0.076	0.090	0.010	0.149	0.010	0.025	0.199	0.139	0.015	0.145	0.014	0.023	0.000	0.000	0.000	0.000
Shuttles	0.037	0.155	0.002	0.222	0.001	0.050	0.052	0.170	0.002	0.214	0.002	0.048	0.110	0.211	0.004	0.214	0.004	0.048	0.524	0.618	3.0E-04	2.8E-04
HD Trucks	0.017	1.868	0.027	0.250	0.026	0.057	0.055	5.839	0.013	0.280	0.012	0.071	0.539	17.761	0.109	0.290	0.105	0.074	0.044	3.467	2.7E-04	2.6E-04
2026																						
Workers	0.013	0.048	0.001	0.152	0.001	0.025	0.033	0.032	0.003	0.142	0.003	0.023	0.020	0.020	0.002	0.023	0.002	0.021	0.700	0.267	0.002	0.002
Pickup Trucks	0.011	0.049	0.005	0.153	0.005	0.026	0.074	0.085	0.010	0.149	0.009	0.025	0.193	0.131	0.014	0.145	0.013	0.023	0.000	0.000	0.000	0.000
Shuttles	0.033	0.139	0.002	0.222	0.001	0.050	0.047	0.152	0.002	0.214	0.002	0.048	0.098	0.189	0.004	0.214	0.003	0.048	0.512	0.598	2.8E-04	2.6E-04
HD Trucks	0.016	1.801	0.027	0.251	0.026	0.057	0.053	5.679	0.012	0.280	0.012	0.071	0.511	16.802	0.101	0.290	0.097	0.074	0.044	3.496	2.6E-04	2.5E-04
2027																						
Workers	0.012	0.044	0.001	0.152	0.001	0.025	0.030	0.028	0.003	0.142	0.003	0.022	0.030	0.028	0.003	0.024	0.003	0.022	0.671	0.255	0.002	0.002
Pickup Trucks	0.010	0.043	0.005	0.153	0.004	0.026	0.071	0.079	0.009	0.149	0.009	0.025	0.186	0.123	0.012	0.145	0.011	0.023	0.000	0.000	0.000	0.000
Shuttles	0.029	0.124	0.002	0.222	0.001	0.050	0.041	0.136	0.002	0.214	0.002	0.048	0.086	0.169	0.004	0.214	0.003	0.048	0.494	0.579	2.6E-04	2.4E-04
HD Trucks	0.016	1.742	0.027	0.251	0.025	0.057	0.051	5.535	0.012	0.280	0.011	0.071	0.486	15.965	0.095	0.289	0.091	0.074	0.045	3.503	2.6E-04	2.5E-04
2028																						
Workers	0.011	0.040	0.001	0.152	0.001	0.025	0.027	0.025	0.003	0.142	0.002	0.022	0.027	0.025	0.003	0.024	0.002	0.022	0.642	0.244	0.002	0.002
Pickup Trucks	0.010	0.038	0.004	0.153	0.004	0.026	0.068	0.073	0.008	0.149	0.008	0.025	0.179	0.116	0.010	0.145	0.010	0.023	0.000	0.000	0.000	0.000
Shuttles	0.025	0.111	0.002	0.222	0.001	0.050	0.037	0.122	0.002	0.214	0.002	0.048	0.077	0.152	0.003	0.214	0.003	0.048	0.476	0.561	2.5E-04	2.3E-04
HD Trucks	0.015	1.685	0.026	0.252	0.025	0.057	0.048	5.386	0.011	0.281	0.011	0.071	0.460	15.115	0.087	0.289	0.084	0.074	0.045	3.490	2.5E-04	2.4E-04
2029																						
Workers	0.011	0.037	0.001	0.152	0.001	0.025	0.025	0.023	0.002	0.142	0.002	0.022	0.025	0.023	0.002	0.024	0.002	0.022	0.612	0.235	0.002	0.002
Pickup Trucks	0.009	0.034	0.004	0.153	0.004	0.026	0.065	0.068	0.007	0.149	0.007	0.025	0.171	0.108	0.009	0.145	0.009	0.023	0.000	0.000	0.000	0.000
Shuttles	0.022	0.099	0.001	0.222	0.001	0.050	0.032	0.109	0.002	0.214	0.002	0.048	0.067	0.137	0.003	0.214	0.003	0.048	0.449	0.546	2.3E-04	2.1E-04
HD Trucks	0.015	1.634	0.026	0.252	0.025	0.057	0.046	5.252	0.011	0.281	0.010	0.071	0.434	14.340	0.080	0.288	0.077	0.074	0.045	3.466	2.4E-04	2.3E-04
2030																						
Workers	0.010	0.035	0.001	0.152	0.001	0.025	0.023	0.021	0.002	0.142	0.002	0.022	0.023	0.021	0.002	0.024	0.002	0.022	0.587	0.227	0.002	0.001
Pickup Trucks	0.008	0.030	0.003	0.153	0.003	0.026	0.062	0.063	0.006	0.149	0.006	0.025	0.163	0.102	0.008	0.145	0.008	0.023	0.000	0.000	0.000	0.000
Shuttles	0.018	0.088	0.001	0.222	0.001	0.050	0.026	0.097	0.002	0.214	0.002	0.048	0.056	0.123	0.003	0.214	0.003	0.048	0.425	0.532	2.2E-04	2.0E-04
HD Trucks	0.014	1.591	0.026	0.252	0.025	0.058	0.044	5.135	0.010	0.282	0.010	0.071	0.407	13.617	0.072	0.288	0.069	0.074	0.046	3.448	2.3E-04	2.2E-04
2031																						
Workers	0.010	0.033	0.001	0.152	0.001	0.025	0.024	0.022	0.002	0.142	0.002	0.023	0.024	0.022	0.002	0.024	0.002	0.022	0.564	0.221	0.002	0.001
Pickup Trucks	0.008	0.027	0.003	0.154	0.003	0.026	0.059	0.058	0.006	0.149	0.006	0.025	0.153	0.094	0.007	0.145	0.007	0.023	0.000	0.000	0.000	0.000
Shuttles	0.015	0.078	0.001	0.222	0.001	0.050	0.022	0.087	0.002	0.214	0.002	0.048	0.048	0.112	0.003	0.214	0.003	0.048	0.411	0.521	2.0E-04	1.9E-04
HD Trucks	0.014	1.555	0.026	0.253	0.025	0.058	0.042	5.038	0.010	0.282	0.009	0.071	0.384	12.991	0.066	0.287	0.063	0.073	0.046	3.430	2.3E-04	2.2E-04

SOURCE: EMFAC2021; ESA, 2021

ABBREVIATIONS: mph = miles per hour; HD = heavy-duty; ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

[a] Modeled in EMFAC2021. Trip type categories include:
Offsite Trips - Aggregated Speed = emission factors for offsite trips using aggregated (average) speeds from EMFAC.
Onsite Trips - 15 mph = emission factors for onsite trips using the 15-mph speed bin from EMFAC.
Onsite Trips - 5 mph = emission factors for onsite trips using the 5-mph speed bin from EMFAC.

[a] Vehicle type categories include:
Workers = worker commute vehicles, modeled in EMFAC as LDA, LDT1, LDT2, MDV, and MCY.
Pickup Trucks = 3/4-ton diesel pickup trucks, modeled in EMFAC as diesel MDV.
Shuttles = worker shuttles, modeled in EMFAC as gasoline LHDT1.
HD Trucks = heavy-duty haul trucks and vendor trucks, modeled in EMFAC as diesel HHDT.

INTENTIONALLY BLANK

TABLE 7B
UNCONTROLLED MOBILE SOURCE EMISSION FACTORS – HEAVY-DUTY DIESEL TRUCK IDLING (G/HR)

Year	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025	2.36	30.61	0.020	0.019
2026	2.36	30.36	0.019	0.018
2027	2.36	30.14	0.018	0.017
2028	2.36	29.94	0.017	0.016
2029	2.36	29.75	0.016	0.015
2030	2.36	29.59	0.015	0.014
2031	2.36	29.44	0.014	0.013

SOURCES: EMFAC2021; ESA, 2021

ABBREVIATIONS: g/hr = grams per hour; ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

TABLE 7C
UNCONTROLLED MOBILE SOURCE EMISSION FACTORS – ROAD DUST (G/MI)

Vehicle Type	PM_{10} Dust	$PM_{2.5}$ Dust
Workers	0.136	0.020
Pickup Trucks	0.136	0.020
Shuttles	0.136	0.020
HD Trucks	0.136	0.020

SOURCES:

1. Bay Area Air Quality Management District, *Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust*, March 2018, https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2018.pdf, accessed March 2021.
2. United States Environmental Protection Agency, AP 42, Fifth Edition, Volume I Chapter 13: Miscellaneous Sources, Section 13.2.1 Paved Roads, January 2011, https://www.epa.gov/sites/production/files/2020-10/documents/13.2.1_paved_roads.pdf, accessed March 2021.

ABBREVIATIONS: g/mi = grams per mile; HD = heavy-duty; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTE:

[a] Vehicle type categories include:
Workers = worker commute vehicles, modeled in EMFAC as LDA, LDT1, LDT2, MDV, and MCY.
Pickup Trucks = 3/4-ton diesel pickup trucks, modeled in EMFAC as diesel MDV.
Shuttles = worker shuttles, modeled in EMFAC as gasoline LHDT1.
HD Trucks = heavy-duty haul trucks and vendor trucks, modeled in EMFAC as diesel HHDT.

2.3 Marine Vessels

Marine vessels would perform most of the Reach 7, 8, and 9 construction work, material delivery, and material off-haul. The marine vessels include several types of barges as well as skiffs, push boats, and crew boats. Marine vessels would emit criteria pollutant and TAC emissions during onsite work at the reaches and as material is transported by barge to and from the project site.

Anticipated Schedule

Offshore activities would take place at Reaches 7, 8, and 9, starting in June 2025 for Reach 7 and ending in January 2031 for Reach 9, for a total of 1,223 working days. A complete construction schedule for each reach is presented in Table 1, p. 6.

Vessel and Engine Types and Activity

Table 8 presents the engine information for the various marine vessels anticipated for construction of Reaches 7, 8, and 9. The material barges do not have engines, so they would need to be brought to and from the project site by push boats. The rest of the vessels in Table 8 have engines. **Table 9a**, p. 27, presents the hours of use for each marine vessel used for Reach 7, **Table 9b**, p. 28, presents the hours of use for each marine vessel used for Reach 8, and **Table 9c**, p. 29, presents the hours of use for each marine vessel used for Reach 9. **Table 10**, p. 29, presents the number of barge trips and mileage used in calculating the barge travel emissions during material transport.

TABLE 8
MARINE VESSELS ENGINE SPECIFICATIONS

Equipment[a]	Total Hp	Main Engine Hp[b]	Auxiliary Engine Hp[b]	Main Engine Load Factor[c]	Auxiliary Engine Load Factor[c]	Engine Tier[d]
Skiff w/Outboard Motor	30	30	0	0.45	—	Tier 1
Derrick Barge[e]	936	425	511	0.52	0.43	Tier 3
Push Boat	950	882	68	0.68	0.43	Tier 3
Crew Boat	700	658	42	0.45	0.43	Tier 3
Sand Dredge with Conveyors	1,500	1332	168	0.66	0.66	Tier 3
Spud Barge w/Deck Winches	400	229	171	0.52	0.43	Tier 3

SOURCE: Project sponsor; Environmental Protection Agency, Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, 2020, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10102U0.pdf, accessed April 2021.

ABBREVIATIONS: Hp = horsepower

NOTES:

a Marine vessel types, description, and total engine horsepower were provided by the project sponsor. Material barges are not listed in this table because they do not have engines and are moved to and from the site using push boats.
b Auxiliary Engine horsepower were obtained from Table G.1 of the Environmental Protection Agency document referenced below. The Main Engine horsepower were derived by taking the difference of the total horsepower and the auxiliary horsepower.
c Load factors were obtained from Table 4.4 of the Environmental Protection Agency document referenced below.
d Tier 3 engine factors were obtained from Table H.7 of the Environmental Protection Agency document referenced below and are based solely on tier, rather than engine model year.
e The horsepower of the derrick barge that was provided by the project sponsor represents the total combined horsepower of the multiple engines. The derrick barge has a 425 hp main engine (https://www.dutragroup.com/fleet-details-aggregates-dredging-marine-construction.html?id=4), so the auxiliary engine was assumed to be the difference between the total engine power provided by the project sponsor (936 hp) minus the main engine, resulting in a 511-HP auxiliary engine.

TABLE 9A
ONSITE MARINE VESSELS USE FOR REACH 7

Activity Item	Equipment Type	Onsite Use Hours[a]
Dredging	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	800
Dredging	Derrick Barge	400
Dredging	Push Boat	400
Dike Fill (Double Crew)	Sand Dredge with Conveyors	1,424
Dike Fill (Double Crew)	Push Boat	712
Double Sheet Pile Wall (Double Crew)	Derrick Barge	2,288
Double Sheet Pile Wall (Double Crew)	Push Boat	572
Double Sheet Pile Wall (Double Crew)	Crew Boat	1,144
Double Sheet Pile Wall (Double Crew)	Skiff w/Outboard Motor	1,144
Double Sheet Pile Wall (Double Crew)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	2,288
Tie Rods	Material Barge 155 'x 55' x 9' 585-Ton Cap/390 CY Cap	88
Tie Rods	Push Boat	44
Tie Rods	Material Barge 155 'x 55' x 9' 585-Ton Cap/390 CY Cap	88
Tie Rods	Push Boat	44
Temporary Platform and Waler	Derrick Barge	688
Temporary Platform and Waler	Crew Boat	688
Temporary Platform and Waler	Material Barge 155 'x 55' x 9' 585-Ton Cap/390 CY Cap	344
Temporary Platform and Waler	Push Boat	172
Soil Grout Ground Improvement (Triple Crew)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	4,032
Soil Grout Ground Improvement (Triple Crew)	Crew Boat	2,016
Back Fill Sand (Barge)	Sand Dredge with Conveyors	300
Back Fill Sand (Barge)	Push Boat	300
Back Fill Sand (Barge)	Crew Boat	150
Back Fill Sand (Barge)	Skiff w/Outboard Motor	300
Back Fill Sand (Barge)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	600
Surcharge Fill and Spreading	Sand Dredge with Conveyors	448
Surcharge Fill and Spreading	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	448
Trestle Demo and Rebuild	Derrick Barge	296
Trestle Demo and Rebuild	Push Boat	148
Trestle Demo and Rebuild	Crew Boat	296
Trestle Demo and Rebuild	Skiff w/Outboard Motor	148
Trestle Demo and Rebuild	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	296

SOURCE: Project Sponsor.

ABBREVIATION: CY = cubic yard

NOTE:

[a] Onsite use hours do not include time spent in transit importing or exporting material to the reach.

TABLE 9B
ONSITE MARINE VESSELS USE FOR REACH 8

Activity Item	Equipment Type	Onsite Use Hours[a]
Dredging	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1066 CY Cap	192
Dredging	Derrick Barge	96
Dredging	Push Boat	96
Dike Fill (Double Crew)	Sand Dredge with Conveyors	432
Dike Fill (Double Crew)	Push Boat	216
Double Sheet Pile Wall (Double Crew)	Derrick Barge	800
Double Sheet Pile Wall (Double Crew)	Push Boat	200
Double Sheet Pile Wall (Double Crew)	Crew Boat	400
Double Sheet Pile Wall (Double Crew)	Skiff w/Outboard Motor	400
Double Sheet Pile Wall (Double Crew)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1,066 CY Cap	800
Tie Rods	Material Barge 155 'x 55' x 9' 585-Ton Cap/390 CY Cap	32
Tie Rods	Push Boat	16
Temporary Platform and Waler	Derrick Barge	64
Temporary Platform and Waler	Crew Boat	64
Temporary Platform and Waler	Material Barge 155 'x 55' x 9' 585-Ton Cap/`390 CY Cap	64
Temporary Platform and Waler	Push Boat	32
Soil Grout Ground Improvement (Triple Crew)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1,066 CY Cap	1,248
Soil Grout Ground Improvement (Triple Crew)	Crew Boat	624
Back Fill Sand (Barge)	Sand Dredge with Conveyors	20
Back Fill Sand (Barge)	Push Boat	20
Back Fill Sand (Barge)	Crew Boat	10
Back Fill Sand (Barge)	Skiff w/Outboard Motor	20
Back Fill Sand (Barge)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1,066 CY Cap	40

SOURCE: Project Sponsor.

ABBREVIATION: CY = cubic yard

NOTE:

[a] Onsite use hours do not include time spent in transit importing or exporting material to the reach.

TABLE 9C
ONSITE MARINE VESSELS USE FOR REACH 9

Activity Item	Equipment Type	Onsite Use Hours[a]
Back Fill Sand (Barge)	Sand Dredge with Conveyors	4
Back Fill Sand (Barge)	Push Boat	4
Back Fill Sand (Barge)	Crew Boat	2
Back Fill Sand (Barge)	Skiff w/Outboard Motor	4
Back Fill Sand (Barge)	Material Barge 180' x 54' x 12' 1,600-Ton Cap/1,066 CY Cap	8

SOURCE: Project Sponsor.

ABBREVIATION: CY = cubic yard

NOTE:

[a] Onsite use hours do not include time spent in transit.

TABLE 10
MATERIAL TRANSPORT BY MARINE VESSELS FOR REACHES 7, 8, AND 9

Activity Item	Barge Description	Marine Vessels with Engines[a]	Mileage per Round Trip	Total Daily Trips	Total Trips	Total Mileage
Back Fill Sand (Barge)	Fill Barge (Sand)	Push Boat	70	1	81	5,670
Surcharge Fill and Spreading	Fill Barge (Sand)[b]	Push Boat	70	0.4	22.4	1,568
Surcharge Fill and Spreading	Barge Daily Movement	Push Boat	8	2	112	896
Soil Grout Ground Improvement (Triple Crew)	Soil Grouting Material Delivery	Push Boat	20	2	660	13,200
Temporary Platform and Waler	Barge Daily Movement	Push Boat	8	2	204	1,632
Tie Rods	Barge Daily Movement	Push Boat	8	1	15	120
Dike Fill (Double Crew)	Fill Barge (Sand)	Sand Dredge with Conveyors	70	2	232	16,240
Dredging	Dredge Disposal	Push Boat	60	2	124	7,440
Double Sheet Pile Wall (Double Crew)	Sheet Pile Delivery	Push Boat	60	2	386	23,160
Double Sheet Pile Wall (Double Crew)	Barge Daily Movement	Derrick Barge	8	2	386	3,088
Double Sheet Pile Wall (Double Crew)	Barge Daily Movement	Push Boat	8	2	386	3,088
Trestle Demo and Rebuild	Barge Daily Movement	Push Boat	12	2	74	888

SOURCE: Project Sponsor.

NOTES:

[a] Not all of the barges have engines. This column presents the marine vessels with the engine that is associated with the activity item.
[b] The "Total Daily Trips" for this fill barge appears as a fraction because it represents two trips per week.

Emission Calculations

Criteria pollutant and TAC emissions were calculated using Tier 3 engine emission factors from the U.S. EPA's *Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related* *and Goods Movement Mobile Source Emissions*.[12,13] Emissions are calculated using the average harbor craft emission factors for Tier 3 engines obtained from table H.7, using vessel engine horsepower, operating load factor, and hours of use. **Table 11**, p. 30, presents the average harbor craft emission factors by engine tier.

TABLE 11
AVERAGE HARBOR CRAFT EMISSION FACTORS BY ENGINE TIER (G/KWH)

Tier[a]	NOx	PM_{10}	$PM_{2.5}$	VOC
Tier 0	10.28152	0.258902	0.251135	0.295615
Tier 1	9.624039	0.2580902	0.251135	0.295615
Tier 2	5.642273	0.148049	0.143608	0.295615
Tier 3	4.749214	0.082975	0.080486	0.124798
Tier 4	1.3	0.03	0.0291	0.124798

SOURCE: Environmental Protection Agency, Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, Table H.7, 2020, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10102U0.pdf, accessed April 2021.

ABBREVIATIONS: g/kWh = grams per kilowatt-hour; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds.

Major harbor craft fleet owners in the region have a large number of marine vessels that already meet Tier 3 engine standards, and it is anticipated that by the start of project construction, the majority their fleets will meet Tier 3 engine standards. This is supported by marine vessel inventory data provided by CARB, which shows that much of the harbor craft used in the Bay Area (dredges and barges, push/tow/tug boats, crew supply and work boats) already meet Tier 3 engine standards.[14]

2.4 Health Risk Assessment

The HRA was prepared using technical information and HRA guidance and protocol from the Bay Area Air Quality Management District (BAAQMD),[15] CARB,[16] the California Office of

12 Engines less than 50 hp are not subject to California's Airborne Toxic Control Measures; therefore, engines less than 50 hp were conservatively modeled as Tier 1 engines. California Air Resources Board, 17 CCR §93118.5 Airborne Toxic Control Measures for Commercial Harbor Crafts, 2006.

13 Environmental Protection Agency, Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, 2020, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10102U0.pdf, accessed April 2021.

14 Damiano, Andrew, Air Resources Engineer, Transportation and Toxics Division, California Air Resources Board, e-mail correspondence with Brian Schuster, Senior Managing Associate, Environmental Science Associates, April 2, 2021. These CARB inventory data show that 67% of dredges, 48% of push boats, 32% of crew boats, 41% of other barges, and 8% of small workboats currently meet Tier 3 engine standards.

15 Bay Area Air Quality Management District, *Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines,* January 2016, http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en, accessed March 2021.

16 California Air Resources Board, Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, last updated October 2, 2020, https://ww2.arb.ca.gov/sites/default/files/classic//toxics/healthval/contable.pdf, accessed March 2021.

Environmental Health Hazard Assessment (OEHHA),[17] and the 2020 Citywide HRA.[18] The HRA evaluates the estimated incremental increase in lifetime cancer risks from exposure to emissions of DPM associated with combustion (i.e., exhaust) and the annual average $PM_{2.5}$ concentrations associated with combustion and fugitive sources including tire wear, brake wear, and road dust, that would be emitted by project-related construction sources. While DPM is a complex mixture of gases and fine particles that includes over 40 substances that are listed by the U.S. EPA as hazardous air pollutants and by CARB as toxic air contaminant, the HRA used PM_{10} emissions as a surrogate for DPM emissions.[19,20] Pollutant concentrations were estimated using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) regulatory air dispersion model (AERMOD version 19191).[21]

Consistent with the 2020 Citywide HRA, health risks from DPM and annual average $PM_{2.5}$ concentrations were estimated at all sensitive receptors located within 1,000 meters of the proposed project's boundaries for all reaches. The closest residential area (sensitive receptors) to any reach is on Aviador Avenue located approximately 750 feet west of Reach 15. However, this residential area is just northwest of the Aviador Lot, which is one of two main staging areas for construction materials. Truck deliveries to the Aviador Lot would travel via Millbrae Avenue and Camino Millennia from U.S. 101. In addition, haul trucks would travel past the Gateway at Millbrae Station project on Millbrae Avenue. This is a mixed-use residential and commercial project that is currently under construction and is expected to be occupied by 2022 or 2023, before the beginning of the construction activities for the proposed project. This analysis assumes that residential land uses will occupy the Gateway at Millbrae Station project site prior to construction of the proposed project. Figure 1, p. 2, shows the Aviador Lot and the Gateway at Millbrae Station project area.

Additionally, the HRA estimates existing plus project lifetime excess cancer risk and annual average exhaust and fugitive $PM_{2.5}$ concentrations by considering the proposed project's impact in aggregate with existing sources. The existing sources are attributable to the other mobile and stationary sources listed below that are within 1,000 feet of the maximally exposed individual resident (MEIR).[22]

The primary assumptions used to model health risks are presented below.

---

[17] Office of Environmental Health Hazard Assessment, *Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments,* February 2015, http://oehha.ca.gov/air/hot_spots/hotspots2015.html, accessed March 2021.

[18] San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation,* September 2020.

[19] Office of Environmental Health Hazard Assessment, *For the "Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant" Part B: Health Risk Assessment for Diesel Exhaust,* May 1998 https://www.arb.ca.gov/toxics/dieseltac/part_b.pdf, accessed June 4, 2021.

[20] BAAQMD, Regulation 2 Permits Rule 5 New Source Review of Toxic Air Contaminants, 2016a, December 7, http://www.baaqmd.gov/~/media/dotgov/files/rules/reg-2-rule-5-new-source-review-of-toxic-air-contaminants/documents/rg0205_120716-pdf.pdf?la=en, accessed June 4, 2021.

[21] United States Environmental Protection Agency, AERMOD Implementation Guide, December 2016, https://www3.epa.gov/ttn/scram/models/aermod/aermod_implementation_guide.pdf, accessed March 2021.

[22] The proposed project site is outside of the modeling domain of the 2020 Citywide HRA, so the existing risk values from that modeling cannot be combined with those from the proposed project within its modeling domain.

2.4.1 Toxic Air Contaminant Concentrations

Inputs to the model include general modeling parameters that account for atmospheric conditions, emission rates for each contaminant from the project sources, source parameters that characterize the activities generating emissions, variable phase durations to characterize construction schedule, and sensitive receptor characteristics (e.g., resident child, school-age child, childcare facility).

General AERMOD Parameters

General AERMOD modeling parameters are presented in **Table 12**. Meteorological data from the SFO (Site ID# 23234) monitoring site was used. Terrain and elevation data were imported from the United States Geological Survey's National Elevation Dataset (NED)[23]; the horizontal datum of NED 83 with a ⅓ arc-second resolution was used.

TABLE 12
OVERALL AERMOD MODELING PARAMETERS

Pathway	Characteristic	Parameter
Control Pathway	Averaging Time	Period average
	Urban vs Rural	Rural[a]
	Model Version	AERMOD v. 19191
Source Pathway	Spacing	*See Table 13*
	Release Height	*See Table 13*
	Initial Vertical Dimension	*See Table 13*
	Initial Lateral Dimension	*See Table 13*
Receptor Pathway	Receptor Height	1.8 m[b]
	Grid	20 m x 20 m[b]
Meteorological Pathway	Surface Data	SFO (Site ID# 23234) monitoring site
	Upper Air	Oakland International Airport (Site ID# 23230)
	Station Elevation	2.4 m

SOURCES:
1. Bay Area Air Quality Management District, Recommended Methods for Screening and Modeling Local Risks and Hazards, May 2012, Table 6, Urban Land Use, http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Risk%20Modeling%20Approach%20—May%202012.ashx?la=en, accessed March 2021.
2. San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation*, September 2020.

ABBREVIATIONS: m = meters; HRA = Health Risk Assessment; AERMOD = American Meteorological Society/Environmental Protection Agency regulatory air dispersion model

NOTES:
a From Recommended Methods for Screening and Modeling Local Risk and Hazards (BAAQMD, 2012).
b Consistent with the 2020 Citywide HRA (SFDPH, 2020).

23 United States Geological Survey, National Elevation Dataset, 2016, www.mrlc.gov/viewerjs/, accessed March 2021.

Emission Rates

Emission rates of DPM along with exhaust and fugitive[24] $PM_{2.5}$ from the various emission sources (e.g., construction equipment, vehicles on roadways) were based on the anticipated hours of activity for each source and other information as described above. It was assumed that all haul trucks and all vendor trucks are diesel HHDT.

Each source was modeled with a unitized emission rate of 1 gram/second (g/s). The modeled concentration at each receptor (micrograms per cubic meter [μ/m^3]/[g/s]) represents a "dispersion factor." The dispersion factor from each source was then multiplied by its annual average emission rate to determine the annual average ambient pollutant concentration at every receptor from that source. Each source's resulting pollutant concentrations were added together at each receptor to obtain the final result. For simplicity, the model assumed a constant annual emission rate for each individual calendar year of construction.

Source Parameters

Table 13 and **Figure 2** present AERMOD source configurations and parameters used in the model. Off-road construction sources and marine sources were modeled as an area source within AERMOD using the same release parameters used in the Citywide-HRA, including a release height of 5 meters and an initial vertical dimension of 1.4 meters.

Haul truck and vendor trips associated with construction were modeled as line-area sources. The line-area source width corresponds to the roadway width, while the modeled release height was 2.55 meters and the initial vertical dimension was 2.37 meters, consistent with the Citywide-HRA modeling and U.S. EPA Haul Road Guidance.[25] Road dust generated from the truck trips was modeled with a release height at ground level and an initial vertical dimension of 1 meter.

Onsite idling during construction from haul truck and vendor deliveries was modeled as an area source with the same release height and initial vertical dimensions as the haul truck and vendor trips, which are 2.55 meters and 2.37 meters, respectively.

---

[24] Fugitive emissions include brake wear and tire wear obtained from EMFAC2021 and entrained paved road dust derived from Bay Area Air Quality Management District, Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust, March 2018, https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2018.pdf, accessed March 2021.

[25] United States Environmental Protection Agency, Haul Road Workgroup Final Report Submission to EPA-OAQPS, March 2012, https://www3.epa.gov/scram001/reports/Haul_Road_Workgroup-Final_Report_Package-20120302.pdf, accessed March 2021.

TABLE 13
AERMOD SOURCE MODELING PARAMETERS

Parameter	Off-Road Construction Equipment	Marine Equipment	On-Road Trucks	Haul/Vendor Onsite Idling	Mobile Source Dust
Construction Period					
Source Type[a]	Area	Area	Line Area	Area	Line Area
Source Dimension	Project Area	Variable	Variable	Project Area	Variable
Number of Sources[b]	16	3	Variable	16	Variable
Release Height (m)[c]	5.0	5	2.55	2.55	0.0
Initial Vertical Dimension (m)[d]	1.4	1.4	2.37	2.37	1.0
Hours per Day	Continuous	Continuous	Continuous	Continuous	Continuous
Days per Week	5	5	5	5	5

SOURCES:

1. United States Environmental Protection Agency, Haul Road Workgroup Final Report Submission to EPA-OAQPS, March 2012, https://www3.epa.gov/scram001/reports/Haul_Road_Workgroup-Final_Report_Package-.20120302.pdf, accessed September 2020.
2. San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation*, September 2020.
3. South Coast Air Quality Management District, Final Localized Significance Threshold Methodology, 2008, http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/final-lst-methodology-document.pdf, accessed October 2020.

ABBREVIATION: m = meters

NOTES:

[a] Construction was modeled as area sources covering the project site, consistent with the Citywide-HRA (SF DPH & SF Planning, 2020).

[b] Construction was modeled as fifteen separate sources to represent off-road construction activities at the reaches, the Aviador Lot, and Plot 16D. Marine construction activities were included in the off-road construction sources for Reaches 7, 8, and 9. The number of on-road mobile sources is based on the geometry of the truck routes. Onsite idling from haul truck and vendor deliveries during construction were modeled at the reaches, the Aviador Lot, and Plot 16D.

[c] Release height for off-road construction equipment and on-road operational mobile sources are from the Citywide-HRA (SF DPH & SF Planning, 2020). For on-road construction trucks and operational loading truck idling, the release height is equal to 0.5 * top of plume height, which is equal to 1.7 * the vehicle height, which is equal to 3 meters; equation = 0.5 * 1.7 * 3 = 2.55 meters (U.S. EPA 2012). Operational mobile exhaust release heights are from the Citywide- HRA (SF DPH & SF Planning, 2020). Road dust (i.e., resuspended dust of entrained surface materials), brake wear, and tire wear were modeled with release heights consistent with fugitive dust modeling in South Coast Air Quality Management District's (SCAQMD) Final Localized Significance Threshold Methodology (SCAQMD, 2008).

[d] Initial vertical dimension for off-road construction equipment and on-road operational mobile sources are from the Citywide-HRA (SF DPH & SF Planning, 2020). Initial vertical dimension (IVD) for on-road construction trucks and operational loading truck idling is equal to the top of the plume height divided by 2.15 meters or IVD = 1.7 * 3 / 2.15 = 2.37 meters. Road dust, brake wear, and tire wear were modeled with initial vertical dimensions consistent with fugitive dust modeling in SCAQMD's Final Localized Significance Threshold Methodology (SCAQMD 2008).

Receptors

A 20-meter receptor modeling grid extended 1,000 meters from the project boundary was modeled within AERMOD to represent sensitive receptors; this is consistent with the receptor grid used in the Citywide-HRA.

Receptors were placed at a height of 1.8 meters above terrain height, which represents the default breathing height for ground-floor receptors (i.e., human residents).

SOURCE: SFO, 2021

SFO Shoreline Protection Program

FIGURE 2
AERMOD SOURCES

Sensitive receptor locations include residential areas (based on residential land use and/or zoning data), childcares, and schools (for children under 16 years of age). **Table 14** presents the location of the five closest, non-residential sensitive receptors within 1,000 meters of the project site. All non-residential sensitive receptors modeled in the HRA are presented in **Figure 3**.

TABLE 14
OFFSITE NON-RESIDENTIAL SENSITIVE RECEPTOR LOCATIONS

Sensitive Receptor	Address	Distance from Project Boundary (feet)[a]	Direction
Closest to Western Boundary of SFO International Airport[a]			
C & C Care Home (senior care facility)	657 Angus Ave E	1,168	West
Belle Air Elementary School	450 3rd Ave	1,334	West
Millbrae Nursery School	86 Center St	1,447	West
Happy Hall Schools	233 Santa Inez Ave	1,498	West
Lomita Park Elementary School	200 Santa Helena	1,453	West
Closest to Aviador Lot[a]			
Millbrae Nursery School	86 Center St	4,449	Northwest
My First Steps Home Daycare	1260 El Camino Real Apt 989	4,928	Northwest
St Dunstan School	1150 Magnolia Ave	4,788	Northwest
St Dunstan Extension Program (School)	1133 Broadway	4,466	Northwest
Lomita Park Elementary School	200 Santa Helena	5,760	Northwest
Closest to Haul Roads from Millbrae Avenue Off-Ramp to Aviador Lot[a]			
Burlingame Skilled Nursing	1100 Trousdale Dr	1,925	Southwest
Millbrae Manor Assisted Living	1001 Hemlock Ave	3,038	Northwest
Diyamonte Post-Acute Care Nursing Home	33 Mateo Ave	3,195	Northwest
St Dunstan Extension Program (School)	1133 Broadway	4,581	Northwest
Millbrae Nursery School	86 Center St	4,598	Northwest

SOURCES:

1. County of San Mateo, Schools [Data file], 2016, https://services.arcgis.com/yq3FgOI44hYHAFVZ/arcgis/rest/services/Education/FeatureServer, accessed August 2020;
2. County of San Mateo. Healthcare Facilities Inpatient [Data file]. (2017), https://services.arcgis.com/yq3FgOI44hYHAFVZ/arcgis/rest/services/SLRMapService/FeatureServer/19/query?outFields=*&where=1%3D1, accessed August 2020;
3. County of San Mateo, Provider Referral Database, June 12, 2020, https://sanmateo4cs.org/providers/provider-referral-database/, accessed August 2020.

NOTES:

a The distance from the project boundary represents three distances, showing the distance from (1) the western boundary of SFO International Airport, (2) the distance from the Aviador Lot, and (3) the distance from the haul roads used to travel from the Millbrae Avenue southbound exit from U.S. 101 to the Aviador Lot.

SOURCE: SFO, 2021

SFO Shoreline Protection Program

FIGURE 3
NON-RESIDENTIAL SENSITIVE RECEPTORS

2.4.2 Health Risks

The analysis calculated lifetime excess cancer risks and annual average $PM_{2.5}$ concentrations from project construction. Lifetime excess cancer risks and annual average $PM_{2.5}$ concentrations were estimated for construction activity including off-road construction equipment, haul and vendor truck travel and idling, onsite marine vessel operation,[26] as well as fugitive dust from on-road vehicle travel (brake wear, tire wear, and road dust).

Pollutants Modeled

The TACs modeled in the health risk assessment include DPM, modeled using exhaust PM_{10} as a surrogate, and $PM_{2.5}$ exhaust from off-road equipment, diesel truck travel and idling, and onsite marine vessel operations, and fugitive $PM_{2.5}$ from brake wear, tire wear, and entrained road dust from on-road truck travel on paved roads.

Exposure Assessment

Receptor types evaluated in the HRA include existing resident, childcare, and school student receptors. Figure 3, p. 37, shows the location of childcare, health care, and school sensitive receptors included in the analysis.

Exposure Scenarios and Assumptions

Maximum lifetime excess cancer risk and annual average $PM_{2.5}$ concentrations were modeled for the construction period from 2025 through 2031. The analysis was organized by the reach activity in each calendar year because the TAC emissions vary substantially with each year of construction. OEHHA and BAAQMD guidance recommends evaluating the lifetime excess cancer risk from exposure to pollutants over a 30-year exposure period. The exposure duration modeled was 6.5 years representing the total construction period, with exposure starting when construction commences.

All exposure assumptions are presented in **Table 15**; these assumptions are based on risk assessment guidelines from OEHHA (2015)[27] and BAAQMD (2016).[28]

[26] TAC emissions and exposure to onsite marine vessel activity were included in the HRA. Onsite marine vessel activity includes dredging, dike fill, pile wall work, backfill, etc. at the reach as well as marine travel to the reach within 1,000 meters of the project site. Offsite marine equipment travel on the San Francisco Bay, outside of the modeling domain, was not included in the HRA because these activities and emissions would occur more than 1,000 meters from sensitive receptors.

[27] Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments, February 2015, http://oehha.ca.gov/air/hot_spots/hotspots2015.html, accessed March 2021.

[28] Bay Area Air Quality Management District, Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines, January 2016, http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en, accessed March 2021.

TABLE 15
EXPOSURE PARAMETERS

Receptor Type	Age Group (construction or operations)	Daily Breathing Rate (L/kg day or L/kg 8hrs)[a]	Exposure Duration (years)[b]	Fraction of Time at Home (unitless)[c]	Exposure Frequency (days/year)[d]	Averaging Time (days)[e]	Model Adjustment Factor (unitless)[f]	Age Sensitivity Factor (unitless)[g]
Offsite Resident	Third Trimester	361	0.25	1	350	25,550	1	10
	Age 0–2 Years	1,090	2	1	350	25,550	1	10
	Age 2–16 Years	572	4.25	1	350	25,550	1	3
Offsite Childcare	Age 0–2 Years	1,200	2	n/a	250	25,550	4.2	10
	Age 2–9 Years	640	4.5	n/a	250	25,550	4.2	3
Offsite School	Age 2–16 Years[h]	520	6.5	n/a	180	25,550	4.2	3

SOURCES:

1. Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments, February 2015. http://oehha.ca.gov/air/hot_spots/hotspots2015.html, accessed March 2021.
2. San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation*, September 2020.
3. Bay Area Air Quality Management District, Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines, January 2016. http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en, accessed March 2021.

ABBREVIATIONS: kg = kilogram; L = liter; m^3 = cubic meters

NOTES:

[a] Daily breathing rates are from OEHHA (2015) based on BAAQMD guidance (2016) as follows: for residents, 95th percentile 24-hour breathing rates (OEHHA Table 5.6) for third trimester and age 0–2 years and 80th percentile 24-hour breathing rates (OEHHA Table 5.7) for age 2–9 years, age 2–16 years, and age 16–30 years; for school, 95th percentile 8-hour moderate-intensity breathing rates (OEHHA Table 5.8) for age 2–16 years.
[b] The exposure duration represents 6.5 years of exposure to construction emissions (the entire construction period for the proposed project).
[c] Fraction of time at home is set to 1 for all age groups less than 2 years and for age group 2 to 16, since there is a school within cancer risk isopleths of one in a million or greater, per BAAQMD guidance (2016).
[d] Exposure frequency represents default residential exposure frequency from BAAQMD guidance (2016).
[e] Averaging time represents 70 years for lifetime cancer risk, per OEHHA (2015).
[f] The Model Adjustment Factor is applied to adjust the annual average concentration (24 hours per day, 7 days per week) from AERMOD associated with construction emissions, which assumes emissions occur seven days per week; to the actual construction emission schedule and receptor exposure for school receptors, which is based on 5 days per week of both construction emissions and receptor exposure (equation = [7 days / 5 days] * (24 hours residential/8 hours when construction coincides with school and childcare operation) = 4.2).
[g] Age sensitivity factors from OEHHA (2015) Table 8.3
[h] The earliest age at the school is assumed to be 2 years and based on a 9-year exposure duration, based on BAAQMD guidance (2016).

Toxicity Assessment

The toxicity values used in the analysis for DPM are from CARB/OEHHA (2020).[29] This toxicity value is for carcinogenic (cancer) effects; the primary pathway for exposures is assumed to be inhalation. The incremental risks were determined for each TAC emission source and summed to obtain an estimated total incremental cancer health risk. **Table 16** presents this value. $PM_{2.5}$ toxicity is correlated directly to ambient air concentrations and presented and summarized in Section 3, below.

TABLE 16
CARCINOGENIC TOXICITY VALUES FOR DPM

Chemical/Toxic Air Contaminant	CAS Number	Inhalation Cancer Potency Factors $(mg/kg\text{-}day)^{-1}$
Diesel Exhaust (Diesel Vehicles)		
DPM	9901	1.1

SOURCE: California Air Resources Board, Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, Last updated October 2, 2020. http://www.arb.ca.gov/toxics/healthval/contable.pdf, accessed March 2021.

ABBREVIATION: CAS = chemical abstract services

Age Sensitivity Factors

Cancer risk estimates were weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to 2 years of age and by a factor of three for exposures that occur from 2 years through 16 years of age.

Modeling Adjustment Factors

For exposure to construction emissions, since construction represents a non-continuous source, a modeling adjustment factor was used for school and childcare receptors to determine the long-term average daily concentration the student or childcare sensitive receptor may be breathing during their time at childcare and school. This is consistent with OEHHA (2015) protocol.

Although nighttime work is anticipated, it was conservatively assumed that all the construction activities would occur during an 8-hour period that coincides with when children are present in schools and childcare.

For school and childcare sensitive receptors, a model adjustment factor of 4.2 was used (equation = [7 days / 5 days] * [24-hour residential exposure / 8 hours of exposure while at school/childcare] = 4.2).

29 California Air Resources Board, Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. Last Updated: October 2, 2020, https://ww2.arb.ca.gov/sites/default/files/classic//toxics/healthval/contable.pdf, accessed March 2021.

Calculation of Intake

The dose estimated for each exposure pathway is a function of the concentration of a chemical and the intake of that chemical. The intake factor for inhalation was calculated as follows using **Equation 1**. The values used in this equation are presented in Table 15, p. 39.

Equation 1: $IF_{inh} = \frac{DBR * FAH * EF * ED * MAF * ASF * CF}{AT}$

Where:

IF_{inh} =	Intake Factor for Inhalation (m^3/kg-day)
DBR =	Daily Breathing Rate (L/kg-day)
FAH =	Frequency of time at home (unitless)
EF =	Exposure Frequency (days/year)
ED =	Exposure Duration (years)
AT =	Averaging Time (days)
MAF =	Model Adjustment Factor (unitless)
ASF =	Age Sensitivity Factor (unitless)
CF =	Conversion Factor, 0.001 (m^3/L)

Calculation of Cancer Risk

Excess lifetime cancer risk is estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to carcinogens. Excess lifetime cancer risk is expressed as a unitless probability, and is calculated as the number of cancer incidences per million individuals. The cancer risk for each chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor. Excess lifetime cancer risk occurs exclusively through the inhalation pathway and is calculated according to **Equation 2**.

***Equation* 2**: $Risk_{inh} = C_i * IF_{inh} * CPF_i * CF_1 * CF_2$

Where:

$Risk_{inh}$ =	Cancer risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular carcinogen (per million)
C_i =	Average annual air concentration of chemical, from AERMOD (μ/m^3)
IF_{inh} =	Intake Factor for Inhalation (m^3/kg-day)
CPF_i =	Cancer potency factor for chemical (mg chemical/kg body weight-day)$^{-1}$
CF_1 =	Conversion factor, micrograms to milligrams (mg/μg)
CF_2 =	Risk per million individuals
i =	Chemical

2.4.3 Risk from Existing Sources

The HRA estimated the lifetime excess cancer risk and annual average $PM_{2.5}$ concentrations from existing TAC sources within 1,000 feet of the MEIR. For mobile sources, the HRA modeled lifetime excess cancer risk and annual average $PM_{2.5}$ concentrations from TAC sources within 1,000 feet of the MEIR. Roadways with more than 10,000 average daily traffic volumes were modeled in AERMOD with source parameters consistent with the Citywide-HRA.[30] Stationary sources within 1,000 feet of the MEIR and the localized risk values for these stationary sources were acquired through BAAQMD's Permitted Sources Risk and Hazards Map.[31] Permitted stationary sources within 1,000 feet of the MEIR include a backup generator and a gasoline dispensing facility. The sources are current as of 2020. The cancer risk and $PM_{2.5}$ concentration values provided by BAAQMD and presented below represent the risk at each stationary source location itself. To determine the impact of these sources at the MEIR, a distance equation BAAQMD tool was used.[32]

The existing cancer risk and $PM_{2.5}$ emissions sources that were included for the risk modeling are listed in **Table 17**, along with their distances from the MEIR. The sources include a generator located at 190 Aviador Avenue, a gas station on Rollins Road, and traffic on U.S. 101 and Millbrae Avenue. The traffic data for U.S. 101 and for Millbrae Avenue were obtained from the Travel Demand Memorandum[33] prepared for the proposed project.

Additionally, the construction of the Gateway at Millbrae Station[34] project would contribute to the existing health risk near the MEIR even though the construction would be completed by the time the proposed project's construction begins in 2025. Therefore, to provide a worst-case assessment of existing health risks, maximum risks from this project were included.

2.4.4 Risk Analysis

This analysis evaluates the existing[35] plus proposed project cancer risk and annual average $PM_{2.5}$ concentrations at the MEIR in order to:

- Identify the maximum lifetime excess cancer risks and annual average $PM_{2.5}$ concentration contributions from the proposed project; and
- Determine the project's contribution to existing health risks in the area.

30 San Francisco Department of Public Health, and San Francisco Planning Department, *The San Francisco Citywide Health Risk Assessment: Technical Support Documentation*, September 2020

31 Bay Area Air Quality Management District, Permitted Sources Risk and Hazards Map, June 2020. https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65, accessed March 2021.

32 Bay Area Air Quality Management District, BAAQMD Health Risk Calculator (Beta 4.0), 2020. Available at https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/tools/baaqmd-health-risk-calculator-beta-4-0-xlsx.xlsx?la=en.

33 SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities, LCW Consulting, [date of completion TBD].

34 Millbrae Station Area Specific Plan Update and Transit-Oriented Development #1 and #2 Draft EIR, City of Millbrae, June 2015, https://www.ci.millbrae.ca.us/deparmtnents-services/community-development/planning-division/millbrae-station-area-specific-plan-msasp, accessed April 2021.

35 Existing risk does not include cumulative projects because they were not evaluated quantitatively.

TABLE 17
EXISTING RISK SOURCES WITH 1,000 FEET OF THE MEIR

Source	Distance to MEIR (feet)
Mobile	
Millbrae Avenue	738
Highway 101	443
Millbrae Station Transit-Oriented Development[a]	176
Stationary	
Generators – City of Millbrae	249
Gas Dispensing Facility – ARCO SS #07119[b]	1,184

SOURCES:

1. City of Millbrae, *Millbrae Station Area Specific Plan Update and Transit-Oriented Development #1 and #2 Draft EIR*, June 2015, https://www.ci.millbrae.ca.us/deparmtnents-services/community-development/planning-division/millbrae-station-area-specific-plan-msasp, accessed April 2021.
2. Bay Area Air Quality Management District, Permitted Sources Risk and Hazards Map, https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65, accessed April 2021.

ABBREVIATION: MEIR= maximally exposed individual resident

NOTES:

[a] TAC sources include construction and operational vehicle traffic.
[b] Distance is slightly greater than 1,000 feet but this source was included in the analysis.

2.5 Control Measures

Given the uncertainties in the availability of specific emissions control technologies during the project's construction from 2025 to 2031, two control scenarios were evaluated. The "Best-Case Scenario" represents the maximum potential emission reductions given current and anticipated future emissions control technologies and assumes 100 percent compliance with Tier 4 Final off-road emissions standards, electric equipment for certain small pieces of construction equipment, 100 percent Tier 4 Final marine vessel engines, 100 percent model year 2018 or newer heavy-duty trucks, 30 percent electric heavy-duty trucks and 20 percent natural gas heavy-duty trucks, a 2-minute idling limit for all vehicles, and 100 percent electric worker shuttles. The "Likely Scenario" accounts for uncertainties in the ability to meet the mitigation measure (e.g., the feasibility of obtaining equipment) and assumes 90 percent compliance with Tier 4 Final off-road emissions standards, 100 percent Tier 3 marine vessel engines, 100 percent model year 2018 or newer heavy-duty trucks, EMFAC2021 default fleet electric and natural gas heavy-duty trucks, a 2-minute idling limit for all vehicles, and 100 percent electric worker shuttles.

2.5.1 Off-Road Construction Equipment

Tier 4 Final Engine Emission Standards

This control measure requires all off-road equipment greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities to meet or exceed either U.S. EPA or CARB Tier 4 Final off-road emission standards. Off-road construction equipment emissions for this control measure were calculated using Tier 4 Final emission factors based on horsepower bin from OFFROAD2011. Tier 4 Final emission factors, in grams per horsepower-hour, were multiplied by the hours of use for a given piece of equipment for its duration of use at a given reach, as described above for the uncontrolled modeling.

The Best-Case Scenario assumes all off-road equipment meet Tier 4 Final engine emissions standards. The Likely Scenario assumes a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts:

90 percent Tier 4 Final;

5 percent Tier 4 Interim;

3 percent Tier 3; and

2 percent Tier 2.

Emissions were calculated by using composite emission factors comprising the above split of engine tier technology based on total horsepower-hours.

Electric Equipment

This control measure requires electric engines for all equipment that is readily available as plug-in or battery-electric equipment, as feasible during each construction phase and activity. This control measure was modeled assuming that the following equipment, generally low-horsepower, would be plug-in or battery-electric: air compressors, concrete/industrial saws, generators, pumps, signal boards, standard light setup, and welding machines. Emissions from electric equipment were assumed to be zero. The Best-Case Scenario incorporates this electric equipment; the Likely Scenario assumes no electric equipment.

2.5.2 On-Road Construction Vehicles

Model Year 2018 or Newer Engines

This control measure requires all heavy-duty trucks (those with a gross vehicle weight rating of 19,500 pounds or greater) to be model year 2018 or newer. This measure was modeled by running EMFAC2021 for the HHDT vehicle type for each calendar year of construction (2025–2031) and selecting only 2018 or newer model years. For example, construction year 2027 would include model years 2018–2027. The emission factors were then weighted based on VMT for each model year, producing an activity-weighted emission factor for each calendar year. Default values for the BAAQMD region were used, consistent with the uncontrolled modeling. The Best-Case Scenario and the Likely Scenario are the same for this measure: all heavy-duty trucks must be model year 2018 or newer.

Alternative Fuel Trucks

This control measure requires that all on-road vehicles use alternative fuels as commercially available, such as renewable diesel, biodiesel, natural gas, propane, hydrogen fuel cell, and electric vehicles. This measure was modeled by increasing the number of electric and natural gas vehicles in the heavy-duty construction truck fleet, compared to the default EMFAC2021 vehicle fleet for the BAAQMD region, as described below. This was done for the Best-Case Scenario only; the Likely Scenario does not include any alternative fuels for on-road vehicles.

The default electric vehicle activity data from EMFAC2021 shows that for HHDTs, electric VMT represents 0.9 to 6.7 percent of total VMT from 2025 to 2031; the value is 5.5 percent in 2030. Similarly, the default natural gas vehicle activity data from EMFAC2021 shows that for HHDTs, natural gas VMT represents 3.4 to 3.7 percent of total VMT from 2025 to 2031; the value is 3.7 percent in 2030. To determine the Best-Case Scenario condition for the future use of electric and natural gas heavy-duty trucks, data from CARB's 2020 Mobile Source Strategy META tool was used.[36] According to META, electric HHDTs will comprise 33.2 percent of total VMT in 2030. This is 5.5 times higher than the default EMFAC2021 values. It was assumed that in the Best-Case Scenario, electric HHDT construction trucks would represent 30 percent of the total VMT in 2030; this value was scaled for other years of construction, resulting in 5.1 to 37.1 percent electric VMT from 2025-2030. Similarly, it was assumed that in the Best-Case Scenario, natural gas HHDT construction trucks would represent 10 percent of the total VMT in 2030, which is 2.7 times higher than the default EMFAC2021 values. This value was scaled for other years of construction, resulting in 9.1 to 10.0 percent natural gas VMT from 2025 to 2030.

Weighted average emission factors for each calendar year for the composite HHDT fleet were then calculated by using these scaled-up electric and natural gas VMT and trip values, using the same methods as described above for the uncontrolled emissions modeling.

2-Minute Idling Limit for Material Haul Trucks

This control measure requires that idling time for on-road vehicles be limited to no more than 2 minutes, except as provided in exceptions to the applicable state regulations regarding idling for on-road vehicles. This measure was modeled by changing the 5-minute idling time assumptions for all truck trips to 2 minutes. The Best-Case Scenario and the Likely Scenario are the same for this measure.

Electric Worker Shuttles

This control measure requires that electric shuttles shall be used to transport construction workers from the worker parking areas to each construction site, including all reaches and any other construction staging or activity areas. This measure was modeled by assuming a zero-emissions rate for all criteria pollutants for shuttles, because electric shuttles produce no tailpipe emissions. The Best-Case Scenario and the Likely Scenario are the same for this measure.

[36] California Air Resources Board, DRAFT Mobile Emissions Toolkit for Analysis (META), 2021, https://arb.ca.gov/emfac/meta, accessed October 2021.

2.5.3 Marine Vessels

Tier 4 Final Engine Emission Standards

This control measure requires Tier 4 engines for all marine engines greater than 50 horsepower. The Best-Case Scenario assumes all marine vessels greater than 50 horsepower would meet or exceed U.S. EPA Tier 4 marine diesel engine emission standards. Marine vessel emissions for the Best-Case Scenario were calculated using Tier 4 marine diesel engine emission standards as shown in Table 11, p. 30. As was done for the uncontrolled case, these emission factors (grams per horsepower-hour) were multiplied by the hours of use for a given piece of equipment. The Likely Scenario assumes all Tier 3 marine engines.

2.6 Reach 16 Programmatic Analysis

The air quality technical memorandum estimated emissions for Reach 16 at the programmatic level, given that the details of this reach (including the construction schedule, equipment fleet, truck trips, etc.) are unknown at this time. Reach 16, if it were to be constructed, would form a continuous, closed flood protection system approximately 15,050 feet long (approximately 2.9 miles) along the western perimeter of the Airport. Construction of Reach 16 would be similar to Reach 1 (San Bruno Channel) and Reach 15 (Millbrae Channel) and would consist of a low reinforced-concrete wall with passive and/or deployable floodgates. Reach 16 would involve no riprap removal, pile driving, or fill material. To estimate emissions for Reach 16, total annual average emissions (for each criteria pollutant) per linear foot from Reaches 1 and 15 were used as a proxy.

It is anticipated that Reach 16, if constructed, would begin construction after Reaches 1–15 are complete, which is currently anticipated to be in 2032. As such, construction emissions associated with Reach 16 are not anticipated to overlap with construction emissions associated with Reaches 1–15. However, if construction of Reach 16 is needed, it was assumed that Reach 16 would begin construction on June 1, 2025, at the start of project construction to provide a conservative assessment of Reach 16 construction emissions (as off-road construction equipment and on-road vehicles get cleaner with time). Based on the average production rate (linear feet per day) of Reaches 1 and 15, construction of Reach 16 would last for 452 workdays and end on February 23, 2027.

SECTION 3
Results

This section presents the results of the construction emissions analysis and HRA for the proposed project.

3.1 Construction Emissions – Proposed Project

The following tables present average daily uncontrolled and controlled construction emissions by source (e.g., off-road equipment) for the proposed project. The tables presented below include:

Table 18: Detailed average daily uncontrolled construction emissions for the proposed project by source and by year.

Table 19: Detailed average daily uncontrolled construction emissions for the proposed project by reach and by year.

Table 20: Summary of the average daily uncontrolled construction emissions for the proposed project by year.

Table 21: Detailed average daily controlled construction emissions under the Best-Case Scenario for the proposed project by source and by year.

Table 22: Detailed average daily controlled construction emissions under the Best-Case Scenario for the proposed project by reach and by year.

Table 23: Summary of the average daily controlled construction emissions under the Likely Scenario for the proposed project by year.

Table 24: Detailed average daily controlled construction emissions under the Likely Scenario for the proposed project by source and by year.

Table 25: Detailed average daily controlled construction emissions under the Likely Scenario for the proposed project by reach and by year.

Table 26: Summary of the average daily controlled construction emissions under the Likely Scenario for the proposed project by year.

TABLE 18
DETAILED AVERAGE DAILY UNCONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR

	Average Daily Emissions (pounds/day)			
Year/Source[a]	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025				
Off-Road Equipment	5.5	52.9	1.7	1.6
On-Road Vehicles	1.2	26.1	0.2	0.2
Marine Vessels	3.6	137.7	2.3	2.3
Subtotal	10.4	216.7	4.3	4.1
2026				
Off-Road Equipment	5.6	51.3	1.7	1.6
On-Road Vehicles	0.8	20.5	0.2	0.2
Marine	2.6	97.0	1.7	1.6
Subtotal	9.0	168.8	3.5	3.4
2027				
Off-Road Equipment	5.0	45.0	1.6	1.5
On-Road Vehicles	0.6	17.2	0.1	0.1
Marine	3.3	123.9	2.1	2.0
Subtotal	8.9	186.0	3.8	3.6
2028				
Off-Road Equipment	3.4	30.6	0.9	0.9
On-Road Vehicles	0.4	11.3	0.1	0.1
Marine	2.7	99.1	1.7	1.6
Subtotal	6.5	141.0	2.7	2.6
2029				
Off-Road Equipment	5.8	27.9	0.8	0.8
On-Road Vehicles	0.6	16.8	0.1	0.1
Marine	0.2	7.0	0.1	0.1
Subtotal	6.5	51.8	1.1	1.1
2030				
Off-Road Equipment	6.6	25.6	0.8	0.8
On-Road Vehicles	0.7	20.4	0.2	0.2
Marine	0	0	0	0
Subtotal	7.3	46.0	1.0	0.9
2031				
Off-Road Equipment	3.8	14.8	0.5	0.5
On-Road Vehicles	0.5	12.6	0.1	0.1
Marine	<0.1	0.4	<0.1	<0.1
Subtotal	4.3	27.8	0.6	0.6

Year/Source[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Source categories defined as follows:
Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors.
On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021.
Marine = operating emissions from marine vessels, such as skiffs, barges, crew boats, push boats, and dredges. Refer to Table 9a, p. 27, through Table 10, p. 29, for equipment activity assumptions. Emissions were calculated using U.S. EPA's Ports Emissions Inventory Guidance and CARB's Emissions Estimation Methodology for Commercial Harbor Craft Operating in California.

TABLE 19
DETAILED AVERAGE DAILY UNCONTROLLED CONSTRUCTION EMISSIONS BY REACH AND YEAR

Year/Reach[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025				
Reach 2	3.1	38.0	1.0	0.9
Reach 3	0.6	4.9	0.2	0.2
Reach 7	6.6	173.8	3.1	3.0
Subtotal	*10.4*	*216.7*	*4.3*	*4.1*
2026				
Reach 6	1.0	11.3	0.3	0.3
Reach 5	1.2	14.0	0.4	0.3
Reach 4	0.7	7.9	0.2	0.2
Reach 3	0.7	7.6	0.2	0.2
Reach 1	0.2	1.9	0.1	0.1
Reach 7	5.2	126.0	2.4	2.3
Subtotal	*9.0*	*168.8*	*3.5*	*3.4*
2027				
Reach 1	0.6	5.8	0.2	0.2
Reach 7	5.7	141.9	2.7	2.6
Reach 15	0.5	4.4	0.1	0.1
Reach 14	1.7	20.6	0.5	0.5
Reach 8	0.4	13.4	0.2	0.2
Subtotal	8.9	186.0	3.8	3.6

	Average Daily Emissions (pounds/day)			
Year/Reach[a]	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2028				
Reach 7	2.8	54.3	1.1	1.1
Reach 8	3.5	84.3	1.5	1.5
Reach 14	0.2	2.3	0.1	0.1
Subtotal	6.5	141.0	2.7	2.6
2029				
Reach 8	1.3	16.7	0.4	0.4
Reach 13	4.4	27.8	0.6	0.6
Reach 12	0.9	7.2	0.1	0.1
Subtotal	6.5	51.8	1.1	1.1
2030				
Reach 13	3.5	22.1	0.4	0.4
Reach 11	3.4	20.5	0.4	0.4
Reach 10	0.3	2.7	0.1	0.1
Reach 9	0.1	0.6	<0.1	<0.1
Subtotal	7.3	46.0	1.0	0.9
2031				
Reach 11	3.6	22.9	0.5	0.5
Reach 9	0.3	2.6	0.1	0.1
Reach 13	0.4	2.4	0.1	0.1
Subtotal	4.3	27.8	0.6	0.6

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals

[a] Reaches are listed in chronological order of construction.

TABLE 20
AVERAGE DAILY UNCONTROLLED CONSTRUCTION EMISSIONS

	Average Daily Emissions (pounds/day)			
Year	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025	10.4	216.7	4.2	4.1
2026	9.0	168.8	3.5	3.4
2027	8.9	186.0	3.8	3.6
2028	6.5	141.0	2.7	2.6
2029	6.5	51.8	1.1	1.1
2030	7.3	46.0	1.0	0.9
2031	4.3	27.8	0.6	0.6
Maximum (2025)	10.4	216.7	4.2	4.1

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

TABLE 21
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR – BEST-CASE SCENARIO

	Average Daily Emissions (pounds/day)			
Year/Source[a]	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025				
Off-Road Equipment	1.3	16.5	0.2	0.2
On-Road Vehicles	0.8	8.9	0.1	0.1
Marine Vessels	3.6	38.1	0.9	0.8
Subtotal	5.8	63.6	1.2	1.1
2026				
Off-Road Equipment	1.5	15.0	0.2	0.2
On-Road Vehicles	0.5	7.4	0.1	0.1
Marine	2.6	26.9	0.6	0.6
Subtotal	4.5	49.2	0.9	0.9
2027				
Off-Road Equipment	1.3	12.4	0.2	0.2
On-Road Vehicles	0.4	5.2	<0.1	<0.1
Marine	3.3	34.2	0.8	0.8
Subtotal	5.0	51.8	1.0	1.0
2028				
Off-Road Equipment	0.9	9.6	0.1	0.1
On-Road Vehicles	0.2	2.9	<0.1	<0.1
Marine	2.7	27.6	0.6	0.6
Subtotal	3.8	40.1	0.8	0.8

Year/Source[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2029				
Off-Road Equipment	1.5	12.0	0.2	0.2
On-Road Vehicles	0.3	5.2	<0.1	<0.1
Marine	0.2	1.9	<0.1	<0.1
Subtotal	1.9	19.1	0.3	0.3
2030				
Off-Road Equipment	1.7	11.6	0.2	0.2
On-Road Vehicles	0.4	5.4	<0.1	<0.1
Marine	0	0	0	0
Subtotal	2.0	17.0	0.3	0.3
2031				
Off-Road Equipment	0.9	6.4	0.1	0.1
On-Road Vehicles	0.2	3.4	<0.1	<0.1
Marine	<0.1	0.1	<0.1	<0.1
Subtotal	1.2	9.9	0.2	0.2

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

a Source categories defined as follows:
Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors. The Best-Case Scenario was modeled assuming all off-road equipment meet Tier 4 Final engine emissions standards.
On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021. The Best-Case Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes alternative fuels, electric and natural gas for portions of the HHDT fleet, a 2-minute idling time limitation, and electric powered shuttles for workers.
Marine = operating emissions from marine vessels, such as skiffs, barges, crew boats, push boats, and dredges. Refer to Table 9a, p. 27, through Table 10, p. 29, for equipment activity assumptions. Emissions were calculated using U.S. EPA's Ports Emissions Inventory Guidance and CARB's Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. The Best-Case Scenario was modeled as Tier 4 engines for all engines >50 hp.

TABLE 22
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY REACH AND YEAR – BEST-CASE SCENARIO

	Average Daily Emissions (pounds/day)			
Year/Reach[a]	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025				
Reach 2	0.9	11.9	0.1	0.1
Reach 3	0.2	1.3	<0.1	<0.1
Reach 7	4.7	50.4	1.0	1.0
Subtotal	*5.8*	*63.6*	*1.2*	*1.1*
2026				
Reach 6	0.3	3.8	<0.1	0.1
Reach 5	0.4	4.5	0.1	0.1
Reach 4	0.2	2.4	<0.1	<0.1
Reach 3	0.2	2.3	<0.1	<0.1
Reach 1	0.1	0.6	<0.1	<0.1
Reach 7	3.4	35.6	0.7	0.7
Subtotal	*4.5*	*49.2*	*0.9*	*0.9*
2027				
Reach 1	0.2	1.5	<0.1	<0.1
Reach 7	3.8	39.6	0.8	0.8
Reach 15	0.2	1.1	<0.1	<0.1
Reach 14	0.5	6.1	0.1	0.1
Reach 8	0.3	3.5	0.1	0.1
Subtotal	5.0	51.8	1.0	1.0
2028				
Reach 7	1.5	14.9	0.3	0.3
Reach 8	2.2	24.6	0.5	0.5
Reach 14	0.1	0.6	<0.1	<0.1
Subtotal	3.8	40.1	0.8	0.8
2029				
Reach 8	0.5	4.0	0.1	0.1
Reach 13	1.2	12.0	0.2	0.2
Reach 12	0.2	3.0	<0.1	<0.1
Subtotal	1.9	19.1	0.3	0.3
2030				
Reach 13	1.0	7.3	0.1	0.1
Reach 11	0.9	8.4	0.1	0.1
Reach 10	0.1	1.1	<0.1	<0.1
Reach 9	<0.1	0.2	<0.1	<0.1
Subtotal	2.0	17.0	0.3	0.3

Year/Reach[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2031				
Reach 11	1.0	7.9	0.1	0.1
Reach 9	0.1	1.0	<0.1	<0.1
Reach 13	0.1	1.0	<0.1	<0.1
Subtotal	1.2	9.9	0.2	0.2

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals

[a] Reaches are listed in chronological order of construction. The Best-Case Scenario was modeled assuming all off-road equipment meet Tier 4 Final engine emissions standards and all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes alternative fuels, electric and natural gas for portions of the HHDT fleet, a 2-minute idling time limitation, and electric powered shuttles for workers. The Best-Case Scenario was modeled as Tier 4 engines for all marine engines > 50 hp.

TABLE 23
AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS – BEST-CASE SCENARIO

Year[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025	5.8	63.6	1.2	1.1
2026	4.5	49.2	0.9	0.9
2027	5.0	51.8	1.0	1.0
2028	3.8	40.1	0.8	0.8
2029	1.9	19.1	0.3	0.3
2030	2.0	17.0	0.3	0.3
2031	1.1	9.9	0.2	0.2
Maximum (2025)	5.8	63.6	1.2	1.1

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

NOTES:

[a] The Best-Case Scenario was modeled assuming all off-road equipment meet Tier 4 Final engine emissions standards and all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes alternative fuels, electric and natural gas for portions of the HHDT fleet, a 2-minute idling time limitation, and electric powered shuttles for workers. The Best-Case Scenario was modeled as Tier 4 engines for all marine engines > 50 hp.

TABLE 24
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR – LIKELY SCENARIO

	Average Daily Emissions (pounds/day)			
Year/Source[a]	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025				
Off-Road Equipment	1.8	27.3	0.4	0.4
On-Road Vehicles	0.9	17.2	0.2	0.2
Marine Vessels	3.6	137.7	2.3	2.3
Subtotal	6.3	182.3	2.9	2.8
2026				
Off-Road Equipment	1.9	25.7	0.4	0.4
On-Road Vehicles	0.5	13.8	0.1	0.1
Marine	2.6	97.0	1.7	1.6
Subtotal	5.0	136.4	2.2	2.1
2027				
Off-Road Equipment	1.7	21.5	0.4	0.4
On-Road Vehicles	0.4	11.9	0.1	0.1
Marine	3.3	123.9	2.1	2.0
Subtotal	5.4	157.3	2.6	2.5
2028				
Off-Road Equipment	1.2	16.2	0.3	0.3
On-Road Vehicles	0.2	8.0	0.1	0.1
Marine	2.7	99.1	1.7	1.6
Subtotal	4.2	123.3	2.1	2.0
2029				
Off-Road Equipment	1.8	20.1	0.4	0.4
On-Road Vehicles	0.4	12.2	0.1	0.1
Marine	0.2	7.0	0.1	0.1
Subtotal	2.3	39.3	0.6	0.6
2030				
Off-Road Equipment	2.0	20.2	0.4	0.4
On-Road Vehicles	0.5	15.2	0.2	0.2
Marine	0	0	0	0
Subtotal	2.4	35.4	0.6	0.5
2031				
Off-Road Equipment	1.1	11.6	0.2	0.2
On-Road Vehicles	0.3	9.5	0.1	0.1
Marine	<0.1	0.4	<0.1	<0.1
Subtotal	1.4	21.6	0.3	0.3

Year/Source[a]	Average Daily Emissions (pounds/day) ROG	NOX	PM10 Exhaust	PM2.5 Exhaust

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Source categories defined as follows:
Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors. The Likely Scenario was modeled assuming a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts: 90 percent Tier 4 Final, 5 percent Tier 4 Interim, 3 percent Tier 3, and 2 percent Tier 2.
On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021. The Likely Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes a 2-minute idling time limitation and electric powered shuttles for workers.
Marine = operating emissions from marine vessels, such as skiffs, barges, crew boats, push boats, and dredges. Refer to Table 9a, p. 27, through Table 10, p. 29, for equipment activity assumptions. Emissions were calculated using U.S. EPA's Ports Emissions Inventory Guidance and CARB's Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. The Likely Scenario does not include additional controls on marine engine emissions compared to the uncontrolled scenario.

TABLE 25
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY REACH AND YEAR – LIKELY SCENARIO

Year/Reach[a]	Average Daily Emissions (pounds/day) ROG	NOX	PM10 Exhaust	PM2.5 Exhaust
2025				
Reach 2	1.2	20.0	0.2	0.2
Reach 3	0.2	2.8	<0.1	<0.1
Reach 7	5.0	159.5	2.6	2.5
Subtotal	*6.3*	*182.3*	*2.9*	*2.8*
2026				
Reach 6	0.4	6.2	0.1	0.1
Reach 5	0.5	7.5	0.1	0.1
Reach 4	0.3	4.2	0.1	0.1
Reach 3	0.3	4.1	0.1	0.1
Reach 1	0.1	1.2	<0.1	<0.1
Reach 7	3.6	113.2	1.9	1.8
Subtotal	*5.0*	*136.4*	*2.2*	*2.1*
2027				
Reach 1	0.2	2.7	<0.1	<0.1
Reach 7	4.0	128.1	2.1	2.1
Reach 15	0.2	2.3	<0.1	<0.1
Reach 14	0.6	11.0	0.1	0.1
Reach 8	0.4	13.1	0.2	0.2
Subtotal	*5.4*	*157.3*	*2.6*	*2.5*

	Average Daily Emissions (pounds/day)			
Year/Reach[a]	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2028				
Reach 7	1.7	44.6	0.8	0.7
Reach 8	2.4	77.5	1.3	1.2
Reach 14	0.1	1.2	<0.1	<0.1
Subtotal	*4.2*	*123.3*	*2.1*	*2.0*
2029				
Reach 8	0.6	12.7	0.2	0.2
Reach 13	1.4	21.3	0.3	0.3
Reach 12	0.3	5.4	0.1	0.1
Subtotal	*2.3*	*39.3*	*0.6*	*0.6*
2030				
Reach 13	1.2	17.0	0.3	0.3
Reach 11	1.1	15.7	0.3	0.3
Reach 10	0.1	2.1	<0.1	<0.1
Reach 9	<0.1	0.5	<0.1	<0.1
Subtotal	*2.4*	*35.4*	*0.6*	*0.5*
2031				
Reach 11	1.2	17.7	0.3	0.3
Reach 9	0.1	2.0	<0.1	<0.1
Reach 13	0.1	1.9	<0.1	<0.1
Subtotal	*1.4*	*21.6*	*0.3*	*0.3*

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals

[a] Reaches are listed in chronological order of construction. The Likely Scenario was modeled assuming a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts: 90 percent Tier 4 Final, 5 percent Tier 4 Interim, 3 percent Tier 3, and 2 percent Tier 2. The Likely Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes a 2-minute idling time limitation and electric powered shuttles for workers. The Likely Scenario does not include additional controls on marine engine emissions from the uncontrolled scenario.

TABLE 26
AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS – LIKELY SCENARIO

	Average Daily Emissions (pounds/day)			
Year[a]	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025	6.3	182.3	2.9	2.8
2026	5.0	136.4	2.2	2.1
2027	5.4	157.3	2.6	2.5
2028	4.2	123.3	2.1	2.0
2029	2.3	39.3	0.6	0.6
2030	2.4	35.4	0.6	0.5
2031	1.4	21.6	0.3	0.3
Maximum (2025)	6.3	182.0	2.9	2.8

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

NOTE:

The Likely Scenario was modeled assuming a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts: 90 percent Tier 4 Final, 5 percent Tier 4 Interim, 3 percent Tier 3, and 2 percent Tier 2. The Likely Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes a 2-minute idling time limitation and electric powered shuttles for workers. The Likely Scenario does not include additional controls on marine engine emissions from the uncontrolled scenario.

Fugitive ROG emissions from asphalt paving off-gassing were not included in the emissions summaries presented in Table 18, p. 48, through Table 26, p. 58. Approximately 18 acres of the project site would be paved with asphalt, which equates to approximately 48 pounds of ROG. This amount is less than 1 percent of total ROG emissions (4.3 tons) from all off-road equipment and, therefore, is considered negligible.

3.2 Construction Emissions – Reach 16

The following tables present average daily uncontrolled and controlled construction emissions by source (e.g., off-road equipment) for Reach 16. The tables presented below include:

Table 27: Detailed average daily uncontrolled construction emissions for Reach 16 by source and by year.

Table 28: Summary of the average daily uncontrolled construction emissions for the Reach 16 by year.

Table 29: Detailed average daily controlled construction emissions under the Best-Case Scenario for Reach 16 by source and by year.

Table 30: Summary of the average daily controlled construction emissions under the Best-Case Scenario for the Reach 16 by year.

Table 31: Detailed average daily controlled construction emissions under the Likely Scenario for Reach 16 by source and by year.

Table 32: Summary of the average daily controlled construction emissions under the Likely Scenario for the Reach 16 by year.

TABLE 27
DETAILED AVERAGE DAILY UNCONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR FOR REACH 16

Year/Source[a]	Average Daily Emissions (pounds/day)			
	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025				
Off-Road Equipment	1.7	12.7	0.05	0.05
On-Road Vehicles	0.4	7.5	<0.1	<0.1
Subtotal	*2.1*	*20.2*	*0.6*	*0.5*
2026				
Off-Road Equipment	1.7	12.7	0.5	0.5
On-Road Vehicles	0.4	7.5	<0.1	<0.1
Subtotal	*2.1*	*20.2*	*0.6*	*0.5*
2027				
Off-Road Equipment	0.3	1.9	0.1	0.1
On-Road Vehicles	<0.1	0.7	<0.1	<0.1
Subtotal	*0.3*	*2.6*	*0.1*	*0.1*

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Source categories defined as follows:
Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors.
On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021.

TABLE 28
AVERAGE DAILY UNCONTROLLED CONSTRUCTION EMISSIONS FOR REACH 16

Year	Average Daily Emissions (pounds/day)			
	ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025	2.1	20.2	0.6	0.5
2026	2.1	20.2	0.6	0.5
2027	0.3	2.6	0.1	0.1
Maximum (2025)	2.1	20.2	0.6	0.5

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

TABLE 29
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR FOR REACH 16 – BEST-CASE SCENARIO

Year/Source[a]	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025				
Off-Road Equipment	0.4	3.0	<0.1	<0.1
On-Road Vehicles	0.2	3.0	<0.1	<0.1
Subtotal	*0.6*	*6.0*	*0.1*	*0.1*
2026				
Off-Road Equipment	0.4	3.0	<0.1	<0.1
On-Road Vehicles	0.2	3.0	<0.1	<0.1
Subtotal	*0.6*	*6.0*	*0.1*	*0.1*
2027				
Off-Road Equipment	0.1	0.4	<0.1	<0.1
On-Road Vehicles	<0.1	0.2	<0.1	<0.1
Subtotal	*0.1*	*0.7*	*<0.1*	*<0.1*

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Source categories defined as follows:
Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors. The Best-Case Scenario was modeled assuming all off-road equipment meet Tier 4 Final engine emissions standards.
On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021. The Best-Case Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes alternative fuels, electric and natural gas, for portions of the HHDT fleet, a 2-minute idling time limitation, and electric powered shuttles for workers.

TABLE 30
AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS FOR REACH 16 – BEST-CASE SCENARIO

Year	Average Daily Emissions (pounds/day) ROG	NO_X	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
2025	0.6	6.0	0.1	0.1
2026	0.6	6.0	0.1	0.1
2027	0.1	0.7	<0.1	<0.1
Maximum (2025)	0.6	6.0	0.1	0.1

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

NOTE:

The Best-Case Scenario was modeled assuming all off-road equipment meet Tier 4 Final engine emissions standards. The Best-Case Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes alternative fuels, electric and natural gas, for portions of the HHDT fleet, a 2-minute idling time limitation, and electric powered shuttles for workers. The Best-Case Scenario was modeled as Tier 4 engines for all engines >50 hp.

TABLE 31
DETAILED AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS BY SOURCE AND YEAR FOR REACH 16 – LIKELY SCENARIO

		Average Daily Emissions (pounds/day)			
Year/Source[a]		**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025					
Off-Road Equipment		0.6	7.3	0.1	0.1
On-Road Vehicles		0.3	5.1	<0.1	<0.1
	Subtotal	*0.8*	*12.4*	*0.1*	*0.1*
2026					
Off-Road Equipment		0.6	7.3	0.1	0.1
On-Road Vehicles		0.3	5.1	<0.1	<0.1
	Subtotal	*0.8*	*12.4*	*0.1*	*0.1*
2027					
Off-Road Equipment		0.1	0.8	<0.1	<0.1
On-Road Vehicles		<0.1	0.5	<0.1	<0.1
	Subtotal	*0.1*	*1.3*	*<0.1*	*<0.1*

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter

NOTES:

Due to rounding, numbers in columns may not add to totals.

[a] Source categories defined as follows:

Off-Road Equipment = operating emissions from heavy-duty equipment, such as bulldozers, cranes, and excavators. Refer to Table 1, p. 6, and Table 2, p. 7, for equipment activity assumptions. Emissions were modeled using OFFROAD 2011 and CalEEMod load factors. The Likely Scenario was modeled assuming a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts: 90 percent Tier 4 Final, 5 percent Tier 4 Interim, 3 percent Tier 3, and 2 percent Tier 2.

On-Road Vehicles = Travel and idling emissions from on-road vehicles, including heavy-duty trucks, medium-duty trucks, shuttles, and worker commutes (light-duty autos and trucks). Emissions were modeled using EMFAC2021. The Likely Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes a 2-minute idling time limitation and electric powered shuttles for workers.

TABLE 32
AVERAGE DAILY CONTROLLED CONSTRUCTION EMISSIONS FOR REACH 16 – LIKELY SCENARIO

	Average Daily Emissions (pounds/day)			
Year	**ROG**	**NO_X**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
2025	0.8	12.4	0.1	0.1
2026	0.8	12.4	0.1	0.1
2027	0.1	1.3	<0.1	<0.1
Maximum (2025)	0.8	12.4	0.1	0.1

SOURCE: ESA, 2021.

ABBREVIATIONS: ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = particulate matter less than or equal to 10 microns in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compounds

NOTE:

The Likely Scenario was modeled assuming a combination of engine tiers ranging from Tier 4 Final to Tier 2, based on total horsepower-hours for all construction equipment, in the following amounts: 90 percent Tier 4 Final, 5 percent Tier 4 Interim, 3 percent Tier 3, and 2 percent Tier 2. The Likely Scenario was modeled with all heavy-duty trucks as model year 2018 or newer. Additionally, this scenario includes a 2-minute idling time limitation and electric powered shuttles for workers. The Likely Scenario does not include additional restrictions on marine engine emissions standards from the uncontrolled scenario.

3.3 Health Risk Assessment

This section presents the results from the health risk assessment of cancer risk from DPM and $PM_{2.5}$ exposure as a result of uncontrolled emissions from the proposed project.

Table 33 presents a summary of the maximum health risk results from the proposed project. The table includes lifetime excess cancer risk (chances per million) and average annual $PM_{2.5}$ concentrations ($\mu g/m^3$) at the MEIR from exposure to the proposed project's construction emissions.

TABLE 33
SUMMARY OF LIFETIME EXCESS CANCER RISK AND ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS

	Uncontrolled			
	Lifetime Excess Cancer Risk (chances per million)		Annual Average $PM_{2.5}$ Concentrations ($\mu g/m^3$)	
Scenario/ Receptor Type	**Receptor Location[a] (UTM X, UTM Y)**	**Project Contribution**	**Receptor Location[a] (UTM X, UTM Y)**	**Project Contribution**
Construction				
Resident	(554360, 4161960)	3.4	(554360, 4161960)	0.01
School	(552560, 4164380)	1.3	(552560, 4164380)	<0.01
Childcare	(552060, 4164940)	2.4	(552060, 4164940)	<0.01

SOURCE: ESA, 2021.

ABBREVIATIONS: UTM = Universal Transverse Mercator; UTM – X = eastward-measured distance; UTM – Y = northward-measured distance; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in aerodynamic diameter; $\mu g/m^3$ = micrograms per cubic meters

NOTES:

a Maximally exposed individual residents are shown in Figure 4, p. 64.

Table 34 presents a summary of the maximum health risk results from existing sources at the MEIR (shown in **Figure 4**).

TABLE 34
EXISTING AND EXISTING PLUS PROJECT LIFETIME EXCESS CANCER RISK AND ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS AT THE MEIR

Receptor Type/Source	Distance to MEIR (meters)[a]	Lifetime Excess Cancer Risk (chances per million)	Annual Average $PM_{2.5}$ Concentration (μg/m^3)
		Existing Contribution	Existing Contribution
Mobile			
Millbrae Avenue	225	5.6	0.18
Highway 101	135	16.5	0.53
Adjacent Project			
Millbrae Station Transit-Oriented Development[b]	54	20.8	0.05
Stationary			
Generators – City of Millbrae	76	1.4	<0.01
Gas Dispensing Facility – ARCO SS #07119	361	0.6	<0.01
Total Existing[c]		**44.8**	**0.77**
Total Project		**3.4**	**0.01**
Total Existing + Project		**48.1**	**0.78**

SOURCES:
1. ESA, 2021.
2. City of Millbrae, Millbrae Station Area Specific Plan Update and Transit-Oriented Development #1 and #2 Draft EIR, Chapter 4.2, Air Quality, https://www.ci.millbrae.ca.us/departments-services/community-development/planning-division/millbrae-station-area-specific-plan-msasp, accessed April 2021.
3. BAAQMD, Health Risk Calculator with Distance Multipliers, 2020, https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/tools/baaqmd-health-risk-calculator-beta-4-0-xlsx.xlsx?la=en&rev=dab7d85a772d45caa9c99e59395bf12d, accessed October 2021.

ABBREVIATIONS: MEIR = maximally exposed individual resident; $PM_{2.5}$ = fine particulate matter less than 2.5 micrometers in aerodynamic diameter; μg/m^3 = micrograms per cubic meters

NOTES:
a Maximally exposed individual resident for existing offsite resident.
b Mitigated construction impacts were taken from the Millbrae Station Transit-Oriented Development Draft EIR (Chapter 4.2 Air Quality, Table 4.2-16 and Table 4.2-18). The maximum health risk impacts at the Millbrae Station MEIR location (191 Aviador Avenue) were scaled to the Project MEIR using BAAQMD's Health Risk Calculator with Distance Multipliers tool, as referenced below.
c Total Existing risk may not appear to add due to rounding.

SOURCE: SFO, 2021

SFO Shoreline Protection Program

FIGURE 4

MEIR LOCATIONS

3.4 Reach 16 Programmatic Analysis

Health risks associated with Reach 16 would be similar to those estimated for the proposed project. However, Reach 16 off-road activities would be closer to offsite sensitive receptors than the other reaches because it is on the western perimeter of the Airport. The closest construction area for Reach 16 would be approximately 650 feet to the east of the project MEIR. Because health risks at the MEIR are driven by off-road and on-road activity at the Aviador Lot and Reach 16 would increase activities occurring at the Aviador Lot, the MEIR would not change. However, the risk values at the MEIR would increase with the contribution from Reach 16.

By simply assuming that health risks due to exposure of the MEIR to TAC emissions associated with Reach 16 would be roughly proportional to health risks associated with all other reaches, because Reach 16 adds 15,050 feet of flood protection to the 40,500 feet constructed for Reaches 1–15, it could be estimated that Reach 16 would increase health risks at the MEIR by 37 percent (55,550 feet versus 40,500 feet). Applying this percent increase directly to the project's health risk values at the MEIR location (see Table 33, p. 62), this would result in maximum cancer risks of 4.6 per million and annual average $PM_{2.5}$ concentrations of 0.018 µg/m^3. This is a substantial simplification because health risks do not scale linearly with construction activity.

INTENTIONALLY BLANK

SECTION 4
Cumulative Health Risk

This section presents information regarding potential cumulative health risks in combination with the existing plus project health risks at the project MEIR. Below is a list of cumulative projects located within 1,000 feet of the project's MEIR, which is the zone of influence directed by the BAAQMD for cumulative assessments.[37] However, because of the lack of available emissions data for the cumulative projects, cumulative health risks were not evaluated quantitatively. **Table 35** lists the cumulative projects and provides a brief description, the expected risk sources associated with each project, and the project distances from the proposed project's MEIR. **Figure 5** shows these projects in addition to the existing sources of risk and the MEIR.

TABLE 35
CUMULATIVE PROJECTS

Location	Project Name and Description	Potential Source of Health Risk	Distance from MEIR (feet)
401 E Millbrae Ave	**Moxy Hotel, Millbrae** – Construction of a 209-room, six-story hotel in the existing Aloft Hotel parking lot	Construction DPM and $PM_{2.5}$; operational emergency generator DPM and $PM_{2.5}$	2,000
1 and 45 Adrian Ct	**Adrian Court, Burlingame** – Demolish two existing commercial buildings and construct 265 residential units in a seven-story building with 3,730 square feet of ground-floor commercial space and 25,000 square feet of public-access open space on a 2.83-acre lot	Construction DPM and $PM_{2.5}$; operational emergency generator DPM and $PM_{2.5}$	2,100
On SFO West-of-Bayshore Property	**San Francisco Garter Snake Recovery Action Plan 2019 to 2029** – The 2008 Recovery Action Plan (RAP) for the San Francisco Garter Snake provides a comprehensive management framework for the conservation of sensitive biological resources on the Airport-owned project site, known as the West-of-Bayshore property. The 2008 RAP proposed the following types of activities: upland habitat enhancement and vegetation management; fuel abatement and firebreaks; access road maintenance and restoration; wetland deepening; access control; aquatic habitat enhancement; and maintenance and trash management. An addendum to the 2008 RAP that was approved in 2020 authorized the following additional activities on the West-of-Bayshore property: selected non-native tree removal; an alternative canal vegetation maintenance pilot program; minor maintenance of existing infrastructure; feral cat management; and research projects to advance understanding of species.	Construction DPM and $PM_{2.5}$	400 to 7,500 (multiple locations on Airport property)

[37] Bay Area Air Quality Management District, *California Environmental Quality Act Air Quality Guidelines*, May 2017, http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed April 2019.

Location	Project Name and Description	Potential Source of Health Risk	Distance from MEIR (feet)
On SFO Property	**Consolidated Administration Campus Phase II** – Implementation of phase II of the Consolidated Administration Campus Program, which includes construction of a 140,000-square-foot office building and a 900-stall employee parking garage	Construction DPM and $PM_{2.5}$; operational emergency generator DPM and $PM_{2.5}$	8,000
On SFO Property	**West Field Cargo Redevelopment** – This project would demolish seven buildings and construct two consolidated cargo/ground service equipment facilities and one ground service equipment facility to accommodate current and future air cargo operations.	Construction DPM and $PM_{2.5}$; operational emergency generator DPM and $PM_{2.5}$	7,500
On SFO Property	**Recommended Airport Development Plan (RADP)** – A long-range plan to guide the Airport's landside development. The purpose of the RADP is to plan for forecast passenger and operations growth at SFO through the following measures: maximizing gate capacity, geometry, and flexibility; optimizing lobby and security flows and incorporating new technology for passenger screening; maximizing shared-use facilities and baggage claim flexibility; and maximizing transfer connectivity for passengers and baggage.	Construction DPM and $PM_{2.5}$; operational sources of DPM and $PM_{2.5}$, including aircraft, ground support equipment, auxiliary power units, on-road vehicle traffic, and emergency generators; organic compounds from refueling.	1,200 to 10,000 (multiple locations on Airport property)
On SFO Property	**Recycled Water Distribution Pipeline System** – Construction and installation of infrastructure necessary to expand the use of reclaimed water at the Airport. The recycled water will be distributed Airport wide for restroom dual plumbing, cooling tower make-up water, irrigation, and other purposes.	Construction DPM and $PM_{2.5}$	1,200 to 10,000 (multiple locations on Airport property)
On SFO Property	**Underground Pipeline and Pump Station Upgrades** – Improvements to underground industrial waste, sewer, and drainage pipelines and pump stations across Airport property.	Construction DPM and $PM_{2.5}$	1,200 to 10,000 (multiple locations on Airport property)
On SFO Property	**Sanitary Sewer Infrastructure Improvements** – Replacement of sanitary sewer headworks and associated electronics and hardware at the wastewater treatment plant.	Construction DPM and $PM_{2.5}$	12,000
On SFO Property	**Pipeline Replacement to South San Francisco Water Treatment Plant Project** – Replacement of sewer pipeline from the Mel Leong Treatment Plant to the South San Francisco Water Treatment Plant.	Construction DPM and $PM_{2.5}$	13,000

SOURCE: SFO, 2022

SFO Shoreline Protection Program

FIGURE 5
EXISTING SOURCES AND CUMULATIVE PROJECTS

INTENTIONALLY BLANK

APPENDIX F
Biological Resources Technical Memorandum

Final

SFO SHORELINE PROTECTION PROGRAM

Biological Resources Technical Memorandum
Case Number: 2020-004398ENV

Prepared for
San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

March 2021

ESA

Final

SFO SHORELINE PROTECTION PROGRAM

Biological Resources Technical Memorandum
Case Number: 2020-004398ENV

Prepared for
San Francisco Planning Department
49 South Van Ness Avenue, Suite 1400
San Francisco, CA 94103

March 2021

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900
esassoc.com

OUR COMMITMENT TO SUSTAINABILITY | ESA helps a variety of public and private sector clients plan and prepare for climate change and emerging regulations that limit GHG emissions. ESA is a registered assessor with the California Climate Action Registry, a Climate Leader, and founding reporter for the Climate Registry. ESA is also a corporate member of the U.S. Green Building Council and the Business Council on Climate Change (BC3). Internally, ESA has adopted a Sustainability Vision and Policy Statement and a plan to reduce waste and energy within our operations. This document was produced using recycled paper.

TABLE OF CONTENTS

SFO Shoreline Protection Program Biological Resources Technical Memorandum

Page

Page

Appendices

Figures

Tables

ACRONYMS AND ABBREVIATIONS

Acronym	Description
Airport	San Francisco International Airport
annual grassland	California annual grassland
Bay-Delta	San Francisco Bay/Sacramento–San Joaquin Delta
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
coastal saltmarsh	mixed coastal saltmarsh
CRLF	California red-legged frog
DOI	Department of the Interior
DPS	Distinct Population Segment
EFH	essential fish habitat
EIR	environmental impact report
EP	San Francisco Planning Department Environmental Planning Division
ESA	Environmental Science Associates
ESU	evolutionarily significant unit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FESA	federal Endangered Species Act
FMP	fisheries management plan
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NPPA	Native Plant Protection Act
project, proposed project	San Francisco Airport Shoreline Protection Program project
SFGS	San Francisco garter snake
SFO	San Francisco International Airport
SLR	sea-level rise
U.S. 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSR	vehicle service road
WBWG	Western Bat Working Group

This page intentionally left blank

CHAPTER 1
Introduction

Environmental Science Associates (ESA) has prepared this biological resources technical memorandum in support of environmental clearance under the California Environmental Quality Act (CEQA) and regulatory permitting for the proposed SFO Shoreline Protection Program.

The term “study area” is used to identify sites and areas adjacent to the proposed project that could be indirectly affected by project activities. The study area includes the project site plus a 50-foot buffer around all sides of the work area. The intent and scope of this assessment is to identify vegetation communities and wildlife habitat present in the study area; determine the quality of those communities and habitat types relative to the special-status plant and animal species they may host; and assess the likelihood of those special-status species to occur within the study area. This assessment also describes sensitive natural communities, including potential wetlands and waters of the United States and state.

1.1 Project Understanding

1.1.1 Project Location

The project site is the perimeter of San Francisco International Airport (SFO or Airport), located on the west shore of San Francisco Bay, about 13 miles south of downtown San Francisco in unincorporated San Mateo County. The Airport is owned by the City and County of San Francisco and operated by and through the San Francisco Airport Commission. The proposed project includes approximately 8 miles of shoreline, beginning where the San Bruno Channel flows under U.S. Highway 101 (U.S. 101) on the north side of the Airport, continuing along San Francisco Bay to the east, and ending where the Millbrae Channel crosses under U.S. 101 on the south side of the Airport (see **Figure 1**).

1.1.2 Shoreline Protection Program Description

The project sponsor, San Francisco International Airport (SFO or Airport), proposes to implement the SFO Shoreline Protection Program (proposed project) to address flood protection and future sea-level rise for the expected lifespan of the shoreline improvements. The proposed project would install new shoreline protection infrastructure that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection and incorporate protection for future sea-level rise. The Airport’s 8-mile shoreline and western

SOURCE: SFO, 2018

SFO Shoreline Protection Program

Figure 1
Project Study Area

landside boundary are divided into 16 reaches[1] based on shoreline orientation, existing protection type, existing foreshore[2] conditions, and existing landside conditions. Reach-specific design criteria were developed for 15 of the reaches, including 13 shoreline reaches and two landside reaches, based on the requirements promulgated by FEMA[3] and the U.S. Army Corps of Engineers. Based on current FEMA requirements and guidance from the California Ocean Protection Council[4] adopted in March 2018, the project proposes to construct shoreline protection improvements specific to 15 of the reaches to eliminate the probability of substantial inundation at the Airport until 2085.

In order to address landside flood protection, Reach 16 would be required to form a continuous, closed flood protection system. However, the landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to anticipated future improvements to neighboring shoreline protection systems in South San Francisco and Millbrae.

The proposed project would remove most of the existing shoreline protection structures (e.g., existing riprap, concrete wall, and vinyl sheet pile sea wall) and would construct a new shoreline protection system consisting of a combination of concrete walls and steel king pile and sheet pile walls, some with armor rock revetments[5] and/or open water fill. These structures would vary from reach to reach, depending on existing site characteristics. The steel sheet pile and concrete walls would range in height from approximately 5.2 to 12.1 feet above the existing ground, given that the elevation and ground slope varies by reach. The king pile walls would extend approximately 26 feet above the Bay floor, and the crest of the king pile walls would range from approximately 13 to 20 feet above San Francisco Bay's typical tidal water levels, depending on the phase of the tide. Storm surge, waves, and sea-level rise would further raise water levels, thereby reducing the height of the king pile walls above the bay. In total, the proposed project would construct an approximately 40,564-foot-long (approximately 7.6 miles) new shoreline protection system for Reaches 1 through 15, which would require approximately 27.5 acres of open water fill in the Bay for various reaches and result in approximately 4.4 acres of impacts to wetland areas.[6] The steel sheet piles would be driven approximately 10 to 25 feet below grade, and the steel king pile walls, including the H-shaped steel piles and interlocking sheets, would be driven approximately 50 feet below grade.

---

1 A *reach* is defined as a longshore segment of a shoreline where influences and impacts, such as wind direction, wave energy, littoral transport, etc., mutually interact.

2 The foreshore refers to the area between low and high tide along the shoreline.

3 FEMA, Coastal Frequently Asked Questions, How is FEMA accounting for sea-level rise and climate change on the FIRMs? Does sea-level rise/climate change affect the FIRMs? https://www.fema.gov/coastal-frequently-asked-questions, accessed May 19, 2020.

4 Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group), *Rising Seas in California: An Update on Sea-Level Rise Science*, California Ocean Science Trust, April 2017.

5 *Revetments* are sloping structures meant to barricade or prevent erosion caused by wave action. *Rock armor* is a rock used to reinforce or "armor" shorelines and shoreline structures like pilings against erosion.

6 It is possible that the permit applications for the proposed project may note smaller amounts of open water fill based on further refinements to the project as the design progresses.

The vehicle service road (VSR) along Sub-reach 7C, as well as Reaches 8, 9, 10, 11, 13, and 14, would be relocated to meet existing Federal Aviation Administration (FAA) Taxiway and Taxilane Object-Free Area (TOFA) standards for safety.[7] The relocated VSR would be shifted toward the San Francisco Bay, away from the existing taxiways to maintain a required separation distance of 193 feet per FAA design standards, and would have a new shoulder. The relocated VSRs would have two 12-foot lanes (one for each direction) and a 12-foot shoulder, resulting in a total width of 36 feet. The alignment of the VSRs would follow the sheet pile walls for roughly 200 feet of Sub-reach 7C and the entirety of Reaches 8, 9, 10, 11, 13, and 14. The existing VSR along those reaches would be removed and backfilled.

In order to accommodate construction of Sub-reach 7B, the existing lighting trestle at the end of Runway 19L would be demolished, and a new lighting trestle would be constructed in the same location and at the same elevation of the proposed king pile wall. The project proposes to remove the existing approach lights, demolish the existing lighting trestle, and remove the wood piles in the Bay that support the lighting trestle. The proposed project would install new, longer composite or plastic lumber piles in the Bay and reconstruct the lighting trestle platform, which would be approximately 8.5 feet taller than the current platform. The reinstalled approach lights would be approximately 7 feet taller than the existing approach lights.

As part of construction of the proposed project, nine of the 10 stormwater outfalls located on Airport property would need to be raised over the height of the proposed wall to ensure their functionality in tandem with the shoreline protection program system. Raising the stormwater outfalls would require cutting the outfalls on the landside of the proposed wall and installing one or two additional concrete piles in the Bay, depending on the reach, to a maximum depth of approximately 80 feet. The outfalls would then rest and extend over the proposed wall and slope down to reconnect with the outfalls on the Bay side of the shoreline protection program system.

A new non-publicly accessible road also would be constructed along the alignment of Reach 2, east of the Mel Leong Wastewater Treatment Plant. The roadway would support fire safety capabilities for the wastewater treatment facility and allow for greater connectivity of the roadways on Airport property. The new roadway would connect to North Access Road, continue along the entirety of Reach 2, and connect to North Access Road again at the east end of Reach 3. In addition, a new roadway also would be constructed to connect the new roadway along Reach 2 to Clearwater Drive. The new roadways would include two lanes (one lane for each direction).

1.1.3 Construction and Maintenance

Construction of the proposed project would begin in 2025 and is expected to be complete by 2032. The preliminary construction phasing is anticipated to begin at Reach 6 and move west towards Reach 1. Work would then commence on Reach 15, followed by Reaches 14 through 9 (in reverse numerical order). Construction of Reaches 7 and 8 is anticipated to run concurrently with the other reaches as a separate undertaking, starting shortly after Reach 6. Work is

[7] The *taxilane object-free area* is a clearing standard to prohibit vehicle service roads, parked aircraft, and other objects, except for objects that need to be located in the object-free area for air navigation or aircraft ground maneuvering purposes.

anticipated to overlap for adjacent reaches; for example, work on Reach 5 would begin prior to full completion of Reach 6 to ensure a seamless construction process.

The proposed project would utilize temporary construction workers on-site in numbers that would vary, depending on the reach and specific construction activities being performed. An assortment of mobile and stationary construction equipment would be used at the project site during construction for the types of construction activities noted below.

The types of construction activities that would occur over the entire project site would include but not be limited to the following: site preparation; riprap removal; concrete demolition; berm or soil removal; pipe outlet removal and reattachment; sheet pile installation, concrete wall construction, king pile wall construction; riprap placement; soil back fill; ongoing site services (temporary fences, temporary barriers, access/security); and continuous laydown area management.

Sheet pile walls in a marine environment with even relatively low maintenance have an expected lifespan of approximately 60 years. The proposed project would be generally maintenance free for the first 10 years. After that, the sheet pile and concrete wall segments would be visually inspected every 5 years, and any damage would be repaired. With these regular maintenance activities, which would include routinely reapplying corrosion-resistant coatings roughly every 10 years and inspecting the concrete cap for cracks and repairing as necessary, it is estimated that the lifespan of the wall would extend for up to 85 years. In addition, all passive flood gates would be inspected annually for visible damage or misuse and would be repaired as needed.

1.1.4 Construction Staging Areas

The proposed project includes the following six construction staging areas, listed from north to south:

- Area near North Access Road and the U.S. 101 ramp (0.90 acres)
- Area near tanks at the Mel Leong Wastewater Treatment Plant (wastewater treatment plant) (1.75 acres)
- Two areas on the north and south end of the U.S. Coast Guard Air Station (0.42 acres and 0.26 acres)
- Plot 41 (1.26 acres)
- Saint Francis Lot near Millbrae Gate (1.0 acre)
- Aviador Lot (2.5 acres)

The areas near North Access Road and the U.S. 101 ramp, the tanks at the wastewater treatment plant, the U.S. Coast Guard Air Station, and Plot 41 are on Reaches 1, 2, 3, 4, and 6, respectively, and are located in graveled areas. The Saint Francis Lot is located on barren ground adjacent to Reach 14. The Aviador Lot, located west of U.S. 101, is owned by the Airport.

1.2 Regulatory Considerations

Biological resources in the study area may fall under the jurisdiction of various regulatory agencies and be subject to their regulations. In general, the greatest legal protections are provided for plant and wildlife species that are formally listed by the U.S. government. The following regulations are commonly associated with projects that have the potential to affect biological resources.

1.2.1 Federal Endangered Species Act

The federal Endangered Species Act (FESA) protects listed plant and wildlife species from harm or "take," which is broadly defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Take can also include habitat modification or degradation that directly results in death or injury of a listed wildlife species. An activity can be defined as take even if it is unintentional or accidental. Listed plant species are provided less protection than listed wildlife species. Listed plant species are legally protected from take under the FESA only if they occur on federal lands or if the project requires a federal action, such as a Section 404 permit from the U.S. Army Corps of Engineers (USACE). The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over wildlife species that are federally listed as threatened and endangered under the FESA, while the National Marine Fisheries Service (NMFS) has jurisdiction over marine species and anadromous fish that are federally listed as threatened and endangered. Species that are candidates for listing under the FESA are not granted these protections under the FESA.

No federally listed plant species occur in the study area. California Ridgway's rail (*Rallus obsoletus obsoletus*), a federally listed species, is known to occur in coastal marsh habitat present along Reach 14.[8] Western snowy plover (*Charadrius nivosus nivosus*) a federally listed species, has been observed in Reach 12 during the non-breeding season.[9] Salt marsh harvest mouse (*Reithrodontomys raviventris*), a federally listed species, is not known to occur in the study area. Federally listed fish species that may occur in open water habitats in the study area include green sturgeon (*Acipenser medirostris*), central California coast steelhead (*Oncorhynchus mykiss*), and Chinook salmon (*O. tshawytscha*). Longfin smelt (*Spirinchus thaleichthys*), a candidate species for federal listing, may also occur. Critical habitat for green sturgeon and central California coast steelhead is also present in the study area.

1.2.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act governs all fishery management activities that occur in federal waters within the United States' 200-nautical-mile limit. The act establishes eight regional fishery management councils responsible for the preparation of

[8] Upon first mention of a species, the text will include the scientific name; thereafter, reference will include only the colloquial name.

[9] Natalie Reeder, Wildlife Biologist, San Francisco International Airport, online meeting communication, August 5, 2020.

fisheries management plans (FMPs) to achieve the optimum yield from U.S. fisheries in their regions. These councils, with assistance from the NMFS, establish essential fish habitat (EFH) in FMPs for all managed species. Federal agencies that fund, permit, or implement activities that may adversely affect EFH are required to consult with NMFS regarding the potential adverse effects of their actions on EFH, and to respond in writing to recommendations by NMFS.

Bay habitat within the study area is listed as EFH for Chinook salmon under the Pacific Coast Salmon FMP, benthic fish and sharks under the Pacific Coast Groundfish FMP, and other commercially important fish species under the Coastal Pelagic Species FMP.

1.2.3 Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (16 United States Code [U.S.C.] § 703 et seq. [1989]) is the domestic law that affirms and implements a commitment by the United States to four international conventions (with Canada, Mexico, Japan, and Russia) for the protection of a shared migratory bird resource. Unless and except as permitted by regulations, the MBTA makes it unlawful at any time, by any means, or in any manner to intentionally pursue, hunt, take, capture, or kill migratory birds anywhere in the United States. The law also applies to the intentional disturbance and removal of nests occupied by migratory birds or their eggs during the breeding season.

On December 22, 2017, under Solicitor's Opinion M-37050 (M-opinion), the U.S. Department of the Interior (DOI) redefined "incidental take" under the MBTA such that "the MBTA's prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control."[10] Under this definition, the federal MBTA definition of take does not prohibit or penalize the incidental take of migratory birds that results from actions that are performed without motivation to harm birds. On January 7, 2021, the USFWS (a department within the DOI) published a "final rule" ("MBTA rule") defining incidental take as described above. On February 5, 2021, the USFWS delayed the MBTA rule's effective date until March 8, 2021 and requested public comments to inform their review of the MBTA rule and determine whether a further extension of the effective date would be necessary.[11] On March 8, 2021, the DOI rescinded the M-opinion on the MBTA.[12] The DOI has yet to issue a replacement rule.

All native bird species occurring in the study area are protected by the MBTA and could be affected by the proposed project.

---

[10] U.S. Department of the Interior, "The Migratory Bird Treaty Act Does Not Prohibit Incidental Take." Office of the Solicitor, Memorandum (M-37050) to Secretary, Deputy Secretary, Assistant Secretary for Land and Minerals Management, and Assistant Secretary for Fish and Wildlife and Parks Department, December 22, 2017.

[11] U.S. Department of the Interior, *Regulations Governing Take of Migratory Birds; Delay of Effective Date*. 50 CFR Part 10 [Docket No. FWS-HQ-MB-2018-0090; FF09M22000-201-FXMB1231090BPP0]. RIN 1018-BD-76, February 9, 2021.

[12] BirdWatching website. Biden administration reverses Trump rule on bird law. *https://www.birdwatchingdaily.com/news/conservation/biden-reverses-trump-rule-bird-law/*. Accessed March 8, 2021.

1.2.4 Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972, as amended (16 U.S.C. § 1361 et seq.), establishes a federal responsibility for the protection and conservation of marine mammal species by prohibiting the harassment, hunting, capture, or killing of any marine mammal. The primary authority for implementing the act belongs to USFWS and NMFS.

Marine mammals known to occur in San Francisco Bay include Pacific harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and harbor porpoise (*Phocoena phocoena*).

1.2.5 Federal Regulation of Wetlands and Other Waters

Wetlands are ecologically complex habitats that support a variety of both plant and animal life. The federal government defines and regulates other waters, including wetlands, in section 404 of the Clean Water Act. Wetlands are "areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [C.F.R.] § 328.3[c] and 40 CFR 230.3). Under normal circumstances, the federal definition of wetlands requires the presence of three identification parameters: wetland hydrology, hydric soils, and hydrophytic vegetation.

The regulations and policies of various federal agencies (e.g., USACE, the U.S. Environmental Protection Agency, and USFWS) mandate that the filling of wetlands be avoided unless it can be demonstrated that there is no practicable alternative to filling. USACE has primary federal responsibility for administering regulations that concern waters and wetlands in the study area under the statutory authority of the Rivers and Harbors Appropriation Act (sections 9 and 10) and the Clean Water Act (section 404).

Pursuant to section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. § 403), USACE regulates the construction of structures in, over, or under, excavation of material from, or deposition of material into navigable waters. In tidal areas, the limit of navigable water under section 10 is the elevation of the mean high-water mark;[13] in nontidal waters, it is the ordinary high-water mark.[14] Larger streams, rivers, lakes, bays, and oceans are examples of navigable waters regulated under section 10 of the Rivers and Harbors Appropriation Act. The act prohibits the unauthorized obstruction or alteration of any navigable water (33 U.S.C. § 403). Navigable waters under the act are those "subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce" (33 C.F.R. § 329.4).

[13] The mean high-water mark, with respect to ocean and coastal waters, is defined as the line on the shore established by the average of all high tides. It is established by survey based on available tidal data (preferably averaged over a period of 18.6 years because of the variations in tide). In the absence of such data, less precise methods to determine the mean high water mark are used, such as physical markings, lines of vegetation or comparison of the area in question with an area having similar physical characteristics for which tidal data are readily available.

[14] The ordinary high-water mark is defined in 33 C.F.R. § 328.3[c][7] as "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter or debris, or other appropriate means that consider the characteristics of the surrounding area."

Typical activities requiring section 10 permits are construction of piers, wharves, bulkheads, marinas, ramps, floats, intake structures, cable or pipeline crossings, and dredging and excavation.

Section 404 of the federal Clean Water Act (33 USC 1251 et seq. [1972]) prohibits the discharge of dredged or fill material into waters of the United States, including wetlands, without a permit from USACE. The agency's jurisdiction in tidal waters under section 404 extends to the high-tide line or high-tide mark, simply indicating a point on the shore where water reaches a peak height at some point each year.

The Clean Water Act prohibits the discharge of any pollutant without a permit. Implicit in the act's definition of *pollutant* is the inclusion of dredged or fill material regulated by section 404 (33 U.S.C. § 1362). The discharge of dredged or fill material typically means adding into waters of the United States materials such as concrete, dirt, rock, pilings, or side-cast material for the purpose of replacing an aquatic area with dry land or raising the elevation of an aquatic area. Activities typically regulated under section 404 include the use of construction equipment such as bulldozers, and the leveling or grading of sites where jurisdictional waters occur.

1.2.6 California Endangered Species Act

Under the California Endangered Species Act (CESA), the California Department of Fish and Wildlife (CDFW) has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code section 2070). The department also maintains a list of candidate species, which are species formally under review for addition to either the list of endangered species or the list of threatened species.

The CESA prohibits the take of plant and animal species that the California Fish and Game Commission has designated as either threatened or endangered in California. "Take" in the context of this regulation means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill a listed species (California Fish and Game Code section 86). The take prohibitions also apply to candidates for listing under the CESA. However, section 2081 of the act allows the department to issue permits for the minor and incidental take of species by an individual or permitted activity listed under the act. Unlike the FESA, species that are candidates for state listing are granted the same protections as listed species under the CESA.

In accordance with the requirements of the CESA, an agency reviewing a project within its jurisdiction must determine whether any state-listed endangered or threatened species could be present in the project area. The agency also must determine whether the project could have a potentially significant impact on such species. In addition, the department encourages informal consultation on any project that could affect a candidate species.

No state-listed plant species occur in the study area. California Ridgway's rail, a state-listed species, is known to occur in coastal marsh habitat present along Reach 14. Salt marsh harvest mouse, a state-listed species, occurs in coastal salt marsh, but is not known to occur in the study area.

1.2.7 California Fish and Game Code

Fully Protected Species

Certain species are considered fully protected, meaning that the California Fish and Game Code explicitly prohibits all take of individuals of these species except take permitted for scientific research. Fully protected amphibians and reptiles, fish, birds, and mammals are listed in sections 5050, 5515, 3511, and 4700, respectively. It is possible for a species to be protected under the California Fish and Game Code, but not be fully protected. For instance, mountain lion (*Puma concolor*) is protected under section 4800 et seq., but is not a fully protected species.

Fully protected species known to occur within the study area include American peregrine falcon (*Falco peregrinus anatum*), brown pelican (*Pelecanus occidentalis*), white-tailed kite (*Elanus leucurus*), and California Ridgway's rail. Salt marsh harvest mouse, another fully protected species, occurs in coastal salt marsh but is not known to occur in the study area.

Protection of Birds and Their Nests

Under section 3503 of the California Fish and Game Code, it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by the code or any regulation made pursuant thereto. Section 3503.5 of the code prohibits take, possession, or destruction of any birds in the orders Falconiformes (hawks) or Strigiformes (owls), or of their nests and eggs. Migratory non-game birds are protected under section 3800, whereas other specified birds are protected under section 3505. California Fish and Game Code section 3513 adopts the federal definition of migratory bird take, which is defined by the Secretary of the Department of the Interior under provisions of the MBTA. Section 3513 does not prohibit the incidental take of birds if the underlying purpose of the activity is not to take birds.

1.2.8 Marine Life Management Act

In California, most of the legislative authority over fisheries management is enacted within the Marine Life Management Act. This law directs CDFW and the California Fish and Game Commission to issue sport and commercial harvesting licenses, and to license aquaculture operations. The department, through the commission, is the state's lead biological resource agency and is responsible for enforcement of the state's endangered species regulations and the protection and management of all state biological resources.

1.2.9 State Regulation of Wetlands and Other Waters

California's authority in regulating activities in wetlands and waters in the project area resides primarily with the State Water Resources Control Board. The state water board, acting through the San Francisco Bay Regional Water Quality Control Board, must certify that a USACE permit action meets state water quality objectives (Clean Water Act section 401). Any condition of water quality certification is then incorporated into the USACE section 404 permit authorized for the project.

The state water board and regional water board also have jurisdiction over waters of the state under the Porter-Cologne Water Quality Control Act. They evaluate proposed actions for consistency with the regional water board's Basin Plan, and authorize impacts on waters of the state by issuing Waste Discharge Requirements or, in some cases, a waiver of Waste Discharge Requirements.

The San Francisco Bay Conservation and Development Commission has jurisdiction over coastal activities occurring within and around San Francisco Bay and Suisun Marsh. The commission was created by the McAteer-Petris Act (California Government Code sections 66600−66694). The commission regulates fill, extraction of materials, and substantial change in use of land, water, and structures in San Francisco Bay and development within 100 feet of the bay. The commission has jurisdiction over all areas of San Francisco Bay that are subject to tidal action, including subtidal areas, intertidal areas, and tidal marsh areas that are between mean high tide and 5 feet above mean sea level.

This page intentionally left blank

CHAPTER 2

Soils, Plant Communities, Wildlife Habitats, and Special-Status Species in the Study Area

2.1 Methods

2.1.1 Desktop Research

A literature review and database search for special-status plant and animal species was focused on the following U.S. Geological Survey (USGS) 7.5-minute topographic quadrangles: San Francisco South, Montara Mountain, Hunters Point, and San Mateo. Information on special-status plants, animals, and sensitive vegetation communities was compiled through a review of databases, including CDFW's California Natural Diversity Database (CNDDB),[15] the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants of California,[16] the National Oceanic and Atmospheric Administration Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay,[17] the USFWS Critical Habitat for Threatened and Endangered Species,[18] and USFWS's Information for Planning and Consultation (IPAC) website.[19]

Several other sources were reviewed for relevant biological resource information, including those listed in **Appendix A**. Soil types present in the study area were obtained from the U.S. Natural Resources Conservation Service's online Web Soil Survey.[20] Information on wetlands and other waters of the United States and state that are in and adjacent to the study area was reviewed in the National Wetland Inventory database.[21] The National Wetland Inventory database is a federal

---

15 California Department of Fish and Wildlife, California Natural Diversity Database RareFind version 5 query of the San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles, Commercial Version, 2020, accessed August 12, 2020.

16 California Native Plant Society, Inventory of Rare and Endangered Plants for the San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles, *http://www.rareplants.cnps.org/result.html?adv=t&quad=3712264:3712274*, accessed August 12, 2020.

17 National Oceanic and Atmospheric Administration, *Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay*, June 2007.

18 U.S. Fish and Wildlife Service, Threatened and Endangered Species Active Critical Habitat in GIS file format, 2020, *https://ecos.fws.gov/ecp/report/table/critical-habitat.html*, accessed August 12, 2020.

19 U.S. Fish and Wildlife Service, My Project, Information for Planning and Consultation Trust Resource Report and Official Species List of Federally Endangered and Threatened Species online screening tool, *https://www.fws.gov/ipac/*, accessed August 2020.

20 U.S. Natural Resources Conservation Service, Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture, Web Soil Survey, 2020, *http://websoilsurvey.sc.egov.usda.gov/*, accessed August 2020.

21 National Wetland Inventory, National Wetlands Inventory website, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C, 2020, *http://www.fws.gov/wetlands/*, accessed August 2020

database that provides maps and information on the characteristics, extent, and status of the wetlands and waters.

Special-status plant species are those listed as endangered, threatened, or rare by the USFWS and/or by the CDFW. Regulatory statutes that have designated certain plant species as having special-status include: FESA, CESA, California Fish and Game Code, and the Native Plant Protection Act (NPPA) of 1977.In addition, CNPS has developed and maintains a list of rare, threatened, and endangered plants of California. This information is published in the *Inventory of Rare and Endangered Vascular Plants of California*. The CNPS list is endorsed by the CDFW and effectively serves as its list of “candidate” plant species. The following identifies the definitions of the CNPS listings:

- List 1A: Plants presumed to be extinct in California;
- List 1B: Plants that are rare, Threatened, or Endangered in California and elsewhere;
- List 2: Plants that are rare, Threatened, or Endangered in California, but are more numerous elsewhere;
- List 3: Plants about which more information is needed (a review list); and
- List 4: Plants of limited distribution (a watch list).

CNPS List 1B and List 2 species are considered eligible for state listing as Endangered or Threatened pursuant to the California Fish and Game Code. As part of the CEQA process, such species should be fully considered, as they meet the definition of Threatened or Endangered under the NPPA and Sections 2062 and 2067 of the California Fish and Game Code. CNPS List 3 and List 4 species are considered to be either plants about which more information is needed or are uncommon enough that their status should be regularly monitored. Such plants may be eligible or may become eligible for state listing, and CNPS and CDFW recommend that these species be evaluated for consideration during the preparation of CEQA documents, as some of these species may meet NPPA and CESA criteria as threatened or endangered.

Locally rare plant species are those considered to be: (1) at the outer limits of their known distribution; (2) a range extension; (3) a rediscovery; or (4) rare or uncommon in a local context. All of these are tracked in San Mateo County by the Santa Clara Valley and Yerba Buena chapters of CNPS. Although not regarded as special-status species by the USFWS or CDFW, locally rare plants can receive regulatory protection, through CEQA Guidelines § 15125(c) (“Special emphasis should be placed on environmental resources that are rare or unique to that region and would be affected by the project.”) and § 15380. CNPS also has the stated goal of “preserving plant biodiversity on a regional and local scale.” For the purposes of this assessment, *special-status plant species* were defined as species with federal or state listing of rare, threatened, or endangered and/or a California Rare Plant Ranking, and locally significant species, to address impacts on these species based on such factors as location within the species’ range or local abundance.

Special-status wildlife species include those listed as endangered, threatened, rare, or as candidates for listing by USFWS and/or CDFW, and other wildlife species regarded as having special status according to the CDFW July 2020 Special Animals List. Additionally, some bird species receive special protection under the federal Bald and Golden Eagle Protection Act and MBTA. Federal Species of Concern is not defined in the FESA; however, USFWS maintains a website[22] that lists plant and wildlife species that are declining or appear to be in need of conservation and designates species of special concern or a similar status. In addition, NMFS maintains a Species of Concern list, identifying those species about which NMFS has concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the FESA.

Based on review of the biological literature of the region, information presented in previous environmental documentation, and an evaluation of the habitat conditions of the study area, special-status plant and wildlife species were assessed for their potential to occur within the study area.

A species was designated as having “no potential” to occur if:

- There is no suitable habitat present within the study area; or
- The study area is outside of the known range of the species.

A species was designated as having a “low potential” for occurrence if:

- The study area is within the known range of the species; however,
- The species is presumed to be extirpated from the study area or region; or
- Only marginally suitable habitat is present within the study area.

A species was designated as having a “moderate potential” for occurrence if:

- There is suitable habitat present within the study area; and
- The study area is within the known range of the species; but
- There are few or no recent documented occurrences of the species in the vicinity of the study area.

A species was designated as having a “high potential” for occurrence if:

- There is suitable habitat present within the study area; and
- The study area is within the known range of the species; and
- There are recent documented occurrences of the species in the vicinity of the study area.

Species assessed as having no potential or a low potential to occur within the study area were eliminated from further discussion.

[22] U.S. Fish and Wildlife Service, Environmental Conservation Online System, *ECOS: Home (fws.gov)*, accessed August 12, 2020.

2.1.2 Field Surveys and Mapping

A reconnaissance-level assessment of the study area for sensitive wildlife resources was conducted by ESA biologists Erika Walther and Amanda McCarthy on August 14, 2020. For safety and security reasons, ESA's survey included Reaches 1 through 6, up to the security gate on North Access Road separating the airside portion of the Airport, consisting of the runway area, from the landside portion of the Airport. ESA's survey also included Reach 15; the Aviador Lot staging area; and the staging areas within Reaches 1, 2, 3, and 4. Reach 14 was viewed from the publicly accessible Bayfront Park on Old Bayshore Highway. The remainder of the study area—from the northeast end of Reach 6, and Reaches 7 through 14—were photographed by SFO wildlife biologist Natalie Reeder on August 10 and 11, 2020, and the photos were provided to ESA. Ms. Reeder also provided information to ESA regarding biological resources within the study area, such as the species of birds known to use the study area. The entire landside portion of the study area was surveyed on foot and the marine resources were assessed via desktop.

Vegetation communities and wildlife habitats in the study area were mapped using ArcGIS Pro image classification tools[23] and refined based on field observations and prior wetland delineation data (**Appendix B**). Vegetation communities were classified into vegetation alliances as defined in *A Manual of California Vegetation, online*[24] to the extent that was feasible. Sensitive natural communities were identified and described according to the CDFW list of California Sensitive Natural Communities.[25]

2.2 Results

2.2.1 Soils

The U.S. Natural Resources Conservation Service's Web Soil Survey map shows that approximately 65 percent of the study area contains the following soil type: Urban land–Orthents, reclaimed complex, 0 to 2 percent slopes (134) (**Appendix C**). This soil unit is primarily tidal flat and consists of a complex that is approximately 65 percent urban land, 30 percent Orthents and similar soils, and 4 percent minor components. Minor components are made up of Novato, Reyes, and Orthents (cut and fill). The remaining 30 percent of the study area is mapped as Water.

[23] Environmental Systems Research Institute, ArcGIS Pro 2.6.1, 2020, *https://www.esri.com/en-us/arcgis/products/arcgis-pro/*, accessed August 12, 2020.

[24] California Native Plant Society, A Manual of California Vegetation Online, 2020, *https://vegetation.cnps.org/*, accessed August 12, 2020.

[25] California Department of Fish and Wildlife, California Sensitive Natural Communities, 2018, *https://wildlife.ca.gov/Data/VegCAMP/Natural-Communities/List*, accessed August 12, 2020.

2.2.2 Vegetation Communities

Vegetation communities in the study area are described below and shown in Appendix B.

Developed/Barren

Developed landscape is present in all project reaches. Within the study area, developed landscape includes sheet pile and riprap, which provides the existing shoreline protection. Other developed areas include the U.S. Coast Guard Air Station in Reach 4; the entirety of Reach 2, including the wastewater treatment plant and a building occupied by the City College of San Francisco; the Bay Trail along Reach 1; the San Francisco Police Department shooting range in Reach 6; and other Airport infrastructure such as buildings, roads, parking lots, pump stations, outfalls, lighting trestles (piers with navigation lights), boat ramps, and one covered boat dock. Predominantly barren landscape is also present within the study area in Reach 7 southwest and southeast of North Access Road. Several paved or barren lots are proposed as staging areas (near North Access Road and the U.S. 101 ramp, the tanks at the wastewater treatment plant, the U.S. Coast Guard Air Station, Plot 41 adjacent to North Access Road, and the Saint Francis Lot adjacent to Reach 14). In addition, the Aviador Lot, located west of U.S. 101 between Aviador Avenue and the freeway, would be used for construction staging. This lot is currently used for spoil piles and other construction-related uses and is largely barren. Vegetated areas are delineated with orange FESA fencing to prevent disturbance of sensitive resources.

Hardscape areas generally do not provide wildlife habitat; however, the lighting trestles in Sub-reaches 7B and Reach 12 and the Marine Emergency Response Facility (ERF), Building 1030, in Reach 4 could potentially support nesting birds. In addition, oysters and barnacles were observed on riprap, which could provide food for some species of birds, such as black oystercatchers (*Haematopus bachmani*) and western gulls (*Larus occidentalis*). In some portions of the study area (e.g., between the concrete boat ramp and the ERF in Reach 4), riprap is interspersed with native saltmarsh vegetation, including pickleweed (*Salicornia pacifica*), marsh rosemary (*Limonium californicum*), saltgrass (*Distichlis spicata*), and marsh gumplant (*Grindelia stricta* var. *angustifolia*); however, the extent of this vegetation is not sufficient to provide habitat to any of the wildlife species being analyzed here. If left undisturbed by vehicular traffic for weeks or months during the nesting bird season, barren lots, such as habitat near the facilities and tanks at the wastewater treatment plant, Saint Francis Lot, and Aviador Lot, may be used by killdeer (*Charadrius vociferus*) for nesting.

Landscaped/Non-native Trees

Areas of landscape vegetation and non-native trees are present in the study area adjacent to the Bay Trail along Reach 1, the water treatment plant in Sub-reach 2B, and around the building and parking lots at the U.S. Coast Guard Air Station in Reach 4. Landscape plants observed along the Bay Trail include the non-native cultivar sea lavender (*Limonium* sp.), and native species including flannel bush (*Fremontodendron californicum*), California lilac (*Ceanothus* sp.), coyote brush (*Baccharis pilularis*), California poppy (*Eschscholzia californica*), and toyon (*Heteromeles arbutifolia*). Junipers (*Juniperus* sp.) and date palms (*Phoenix dactylifera*) are present adjacent to a proposed access route within the wastewater treatment plant in Sub-reach 2B. In addition, several large eucalyptus (*Eucalyptus* sp.) trees are present along the Reach 4 shoreline, east of the U.S. Coast Guard Air Station. Myoporum (*Myoporum parvifolium*) is present along the shoreline and is the most prevalent non-native tree. Other landscaped areas include succulents, ice plant varieties, pampas grass (*Cortaderia jubata*), and pride of Madeira (*Echium candicans*).

Landscaped areas in an otherwise urban environment can provide cover, foraging, and nesting habitat for a variety of bird species, as well as reptiles and small mammals, especially those that are tolerant of disturbance and human presence. Birds commonly found in such habitat include non-native species, such as house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*), and native birds such as house finch (*Haemorhous mexicanus*), California scrubjay (*Aphelocoma californica*), mourning dove (*Zenaida macroura*), and Anna's hummingbird (*Calypte anna*). Peregrine falcons, which commonly breed in cities in the San Francisco Bay area, have successfully nested multiple times inside or on the United Airlines Maintenance Operations Center (MOC) hangar, Building 800B, adjacent to Reach 1, since 2011. Larger non-native landscape trees such as eucalyptus may support nesting raptors, such as red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*B. jamaicensis*), and great-horned owl (*Bubo virginianus*), as well as roosting bat species. Reptiles such as western fence lizard (*Sceloporus occidentalis*) and small mammals such as house mice (*Mus musculus*) may use landscaped areas for cover or foraging.

Mixed Ruderal

Ruderal vegetation is composed of plants that are often the first to colonize a disturbed area, and spontaneously arise and spread widely without human intervention. In California, ruderal vegetation is often composed of an assemblage of non-native grasses and forbs. The study area contains long, narrow strips of mixed ruderal habitat in the upland area adjacent to riprap and shoreline habitat, and adjacent to roads and staging areas. Ruderal vegetation is also present in the upland area around the outfall east of the U.S. Coast Guard Air Station in Reach 4, and upland of the marsh and mudflats in Reach 14. In addition, the Millbrae Channel in Reach 15 is sparsely vegetated, with ruderal vegetation along the top of the bank.

Ruderal vegetation observed in the study area includes wild oat (*Avena* sp.), California bur clover (*Medicago polymorpha*), fennel (*Foeniculum vulgare*), cheeseweed (*Malva parviflora*), black mustard (*Brassica nigra*), short-podded mustard (*Hirschfeldia incana*), and bristly ox-tongue (*Helminthotheca echioides*). Tall, sturdy ruderal vegetation such as fennel can provide nesting habitat for common birds such as song sparrow (*Melospiza melodia*) and red-winged blackbird (*Agelaius phoeniceus*) and foraging habitat for migrant songbirds.

California Annual Grassland

California annual grassland (annual grassland) is present on the inboard side of the existing sheetpile shoreline protection in Reaches 9, 10, 11, and 13 as long, narrow strips between the road and runway. Within Reach 12, annual grassland is present as a series of roughly 0.5- to 1-acre areas of grassland separated by runways and roads, and sometimes interspersed with barren landscape. Within the 50-foot buffer of the study area, the existing road extends approximately 25 feet from the project alignment; therefore, only about 25 feet of the grassland sections are within the study area. All annual grassland areas adjacent to runways and roads on the inboard side of the existing sheetpile shoreline are mowed annually in spring/summer. Annual grassland within the study area is composed of wild oat, ripgut brome (*Bromus diandrus*), wild barley (*Hordeum vulgare*), and other non-native, annual grasses.

Airport staff have observed horned lark (*Eremophila alpestris*) singing on the airfield during the breeding season but have not confirmed nesting in the grasslands within the airfield, possibly because of regular mowing.[26] The areas of annual grassland within and adjacent to the study area may be extensive enough to support breeding grassland birds; however, mowing before or during the breeding season may restrict nesting in these areas.

Iceplant Mats

Iceplant (*Carpobrotus edulis*) and sea fig (*Carpobrotus chilensis*) mats are present in several locations within the study area: the upland area around the stormwater outfall east of the U.S. Coast Guard Air Station in Reach 4; above the shoreline in Sub-reach 2B; on the outboard side of the concrete wall where Reach 10 transitions to Reach 11; on the southeast side of Building 1080 at the intersection of Reaches 13 and 14; and in portions of the upland habitat adjacent to the marsh in Reach 14.

Iceplant is a non-native species rated as highly invasive by the California Invasive Plant Council. Iceplant spreads easily and forms a large, thick mat that prevents the growth of other plants and increases soil organic matter over time, allowing new non-native species to invade. While it may provide cover for some wildlife species, such as western fence lizard and California vole (*Microtus californicus*), iceplant generally provides only marginally suitable habitat for wildlife.

Mixed Coastal Saltmarsh

Mixed coastal saltmarsh (coastal saltmarsh) is a wetland type that is located in the zone between high and low tides and composed of a variety of species. Coastal saltmarshes can be fully tidal or brackish if they are located near the mouth of a freshwater source. Coastal saltmarsh is present in Reaches 1, 2 (including Sub-reaches 2A, 2B, and 2C), 6, 9, 13, and 14. These areas include small patches of pickleweed monocultures. Other species observed in coastal saltmarsh in the study area include alkali heath (*Frankenia salina*), saltgrass, marsh jaumea (*Jaumea carnosa*), seablite (*Suaeda* sp.), marsh rosemary, and marsh gumplant. Within the study area, these species are sometimes interspersed with ruderal species, such as fennel, as in Sub-reach 2B in the transition zone to upland habitat.

Salt marshes in the Central and South Bay are mere remnants of their former extent. Where extensive salt marshes are still present, they support high densities and fairly high diversity of wildlife species, including several San Francisco Bay endemics. However, the narrow strips of salt marsh within the study area provide relatively low-quality habitat for salt marsh animals. The

[26] Natalie Reeder, Wildlife Biologist, San Francisco International Airport, email communication, August 12, 2020.

California Ridgway's rail, which is a federally and state-listed endangered species, is known to occur in low densities in salt marsh habitat along Reach 14.

Unvegetated Salt Panne

Salt pannes are topographic depressions occurring within salt marsh habitat that are typically seasonally inundated. The accumulated salts associated with seasonal inundation and drying can inhibit the establishment of vegetation, leaving the area barren. Wildlife species associated with this habitat type are typically those that are associated with the adjacent salt marsh. Areas of unvegetated salt flat are present in the study area in Sub-reach 2B. On the day of the field survey, this area included a shallow inundated depression with fairy shrimp (*Artemia* sp.) present.

Emergent Wetland

Two small and separate areas of emergent, non-tidal wetlands are present within the study area. Emergent wetland habitat consisting of cattail (*Typha* sp.) and tule (*Schoenoplectus acutus*) occurs adjacent to (i.e., within 50 feet of) the proposed construction staging area in Sub-reach 2B, east of the wastewater treatment plant. These areas occur within depressions as a result of drainage swales and culverts and likely pond for long durations, but were dry during the August 2020 site visit.

In addition, emergent wetland comprising cordgrass (*Spartina* sp.) and cattail is present in the study area where the Millbrae Channel empties into San Francisco Bay in Reach 14. California Ridgway's rail, a federally and state-listed endangered and CDFW fully protected species, was documented during breeding season surveys in this marsh annually from 2007 through 2019,[27] and in 2021.[28]

Mixed Coastal Scrub

The structure and composition of mixed coastal scrub varies within the study area, with sparse patches of toyon and coyote brush occurring throughout the proposed alignment. Variation in coastal influence at a given latitude produces less pronounced composition changes. Two types of northern coastal scrub are usually recognized. The first type occurs as low-growing patches of bush lupine and many-colored lupine at exposed, oceanside sites. The second, more common type of northern coastal scrub usually occurs at less exposed sites. Here coyote brush dominates the overstory. Other common overstory species are blue blossom ceanothus (*Ceanothus thyrsiflorus*), coffeeberry (*Rhamnus californica*), salal (*Gaulthoria shallon*), bush monkeyflower (*Mimulus aurantiacus*), blackberry (*Rubus* spp.), poison-oak (*Toxicodendron diversilobum*), and wooly sunflower (*Eriophyllum lanatum*). Bracken fern (*Pteridium aquilinum*) and swordfern (*Polystichum munitum*) are dominant in the understory; common cowparsnip (*Heracleum*

---

[27] Olofson Environmental, Inc., *California Ridgway's Rail Surveys for the San Francisco Estuary Invasive Spartina Project. Reports to California Coastal Conservancy*, July 6, 2007; June 30, 2009; November 2009; February 2011; December 2011; December 18, 2012; November 23, 2013; October 2014; September 24, 2015; November 30, 2016; January 23, 2018; November 12, 2018; January 13, 2020.

[28] Natalie Reeder, Wildlife Biologist, San Francisco International Airport, personal communication, February 22, 2021.

maximum), Indian paintbrush (*Castilleja* spp.), yerba buena (*Clinopodium douglasii*), and California oatgrass (*Danthonia californica*) are typically present.[29] Around the study area, western hazelnut (*Corylus cornuta*), Pacific bayberry (*Myrica californica*), and sagebrush (*Artemisia californica*) are also present.

Intertidal

Intertidal habitats within the study area—the regions of the bay that lie between high and low tides—include beaches, riprap, and mudflats. Beaches are present in Reaches 6, 10, and 12. Reach 12 includes a small pebble beach that extends into a long, narrow spit. All beaches are relatively shallow, on the order of 50 feet or less, and are subject to significant tidal inundation. Tidal inundation, and the assumed presence of terrestrial predators common to the fringes of developed areas, such as raccoon (*Procyon lotor*) and red fox (*Vulpes vulpes*), prevent these small beaches from being viable bird nesting sites. However, the beaches and spit provide resting habitat for species such as double-crested cormorant (*Phalacrocorax auritus*), and the federally listed (threatened) western snowy plover (*Charadrius alexandrinus nivosus*) has been observed in Reach 12 during the non-breeding season.[30]

Mudflats, also referred to as tidal flats, are areas where sediments have been deposited by tides or rivers. These areas are alternately inundated by high tides twice per day and are barren to some extent the remainder of the day. Mudflats are present adjacent to the San Bruno Channel in Reach 1, and extensive mudflats are present in Reach 14. Mudflats are devoid of vegetation, but they may be adjacent to vegetated tidal wetlands, as is the case in Reach 14. Mudflats that are exposed at low tide in the lower reaches of the channels may provide foraging habitat for bird species such as snowy egret (*Egretta thula*) and great blue heron (*Ardea herodias*).

Mudflats provide important resting and feeding grounds for migratory and resident waterbirds. Species observed foraging on mudflats included ring-billed gull (*Larus delawarensis*), long-billed curlew (*Numenius americanus*), dowitcher (*Limnodromus* sp.), willet (*Tringa semipalmata*), black-bellied plover (*Pluvialis squatarola*), marbled godwit (*Limosa fedoa*), American avocet (*Recurvirostra americana*), least sandpiper (*Calidris minutilla*), and snowy egret.

Subtidal Habitat

Central San Francisco Bay contains both soft sediment and hard substrate subtidal (below the low-tide line) habitat. Soft bottom substrate ranges between soft mud with high silt and clay content and areas of coarser sand. The latter areas tend to occur in locations subjected to high tidal or current flow. Soft mud locations are typically located in areas of reduced energy that enable the deposition of sediments that have been suspended in the water column, such as in protected slips, under wharfs, and behind breakwaters and groins.

---

[29] Heady, H.F., T.C. Foin, M.M. Hektner, et al., Coastal prairie and northern coastal scrub, pp. 733–762 in: M.G. Barbour and J. Major (eds.), *Terrestrial Vegetation of California*. Wiley-Interscience, New York, 1977.

[30] Natalie Reeder, Wildlife Biologist, San Francisco International Airport, online meeting communication, August 5, 2020.

Hard substrate areas provide habitat for an assemblage of marine algae, invertebrates, and fishes, similar to the hard substrate in the intertidal zone of the Central Bay. Submerged hard bottom substrate is typically covered with a mixture of turf organisms dominated by hydroids, bryozoans, tunicates, encrusting sponges, encrusting diatoms, and anemones. In the intertidal and near subtidal zones, the barnacles (*Balanus glandula*, *Amphibalanus amphitrite*, and *A. improvisus*) are commonly present along with the bay mussel (*Mytilus trossulus/galloprovincialis*), the invasive Asian mussel (*Musculista senhousia*), and Olympia oyster (*Ostrea lurida*). Barnacles can also be found subtidally on pier pilings, exposed rock outcropping, and debris.[31] At least six species of sponges, seven species of bryozoans, and the hydrozoans (*Ectopleura crocea*) and (*Garveia franciscana*) are found inhabiting both natural and man-made hard substrate.[32] Marine isopods and amphipods include surface deposit feeders, algae grazers, and carnivores.[33]

In addition, three species of caprellids (detritivores, carnivores, and deposit feeders) are commonly observed only in the Central Bay.[34] Pacific rock crab (*Cancer antennarius*) and the red rock crab (*C. productus*) inhabit rocky intertidal and subtidal areas in the Pacific Ocean, and likely use San Francisco Bay as an extension of their coastal habitats.[35] Adult (age 1+) Pacific rock crabs are most commonly found in the Central Bay in both the fall and spring months. Juveniles are most common in the Central Bay from January to May and in the South Bay from July to December.[36] Pacific rock crabs move seasonally from channels (January to April) to shoals (June to December).[37]

The predominant seafloor habitat on the San Francisco waterfront is unconsolidated soft sediment composed of combinations of mud/silt/clay, but in lesser quantities; portions of the substrate also include sand and pebble/cobble, with varying amounts of intermixed shell fragments.[38] Exposure to wave and current action, temperature, salinity, and light penetration determine the composition and distribution of organisms within these soft sediments.[39] Based on many geologic and marine biological studies conducted within the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta), unconsolidated sediments are present throughout the Bay-Delta and are the predominant substrate type.

The muddy-sand benthic community of the Central Bay consists of a diverse polychaete community represented by several subsurface deposit feeding capitellid species, a tube dwelling filter feeding species (*Euchone limnicola*), a carnivorous species (*Exogone lourei*), and the

31 National Oceanic and Atmospheric Administration, *Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay*, June 2007.
32 Ibid.
33 Ibid.
34 Ibid.
35 Hieb, K., Cancer Crabs. In: James J. Orsi, *Report on the 1980–1995 Fish, Shrimp, and Crab Sampling in the San Francisco Estuary, California*, 1999, *http://www.estuaryarchive.org/archive/orsi_1999*, accessed August 12, 2020.
36 Ibid.
37 Ibid.
38 National Oceanic and Atmospheric Administration, *Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay*, June 2007.
39 Ibid.

maldanid polychaete *Sabaco elongatus*. Also, several surface deposit–feeding *Ameana* spp. persist throughout the year.[40]

The harbor and main channel areas of the Central Bay are characterized as a mix of the benthic communities from surrounding areas (deep and shallow water and slough marine communities) and include the obligate amphipod filter-feeder *Ampelisca abdita* and the tube dwelling polychaete *Euchone limnicola*. As a result of increased water flow and sedimentation in the harbor areas of the Central Bay, the majority of the species reported inhabiting seafloor sediments in this region of San Francisco Bay are deposit and filter feeders, including the amphipods *Grandidierella japonica*, *Monocorophium acherusicum*, and *M. alienense*, and the polychaetes *Streblospio benedicti* and *Pseudopolydora diopatra*. There is also a relatively high number of subsurface deposit feeding polychaetes and oligochaetes in these areas including *Tubificidae* spp., *Mediomastus* spp., *Heteromastus filiformis*, and *Sabaco elongatus*. There is also sufficient community complexity and abundance to support relatively high abundances of three carnivorous polychaete species: *Exogone lourei*, *Harmothoe imbricata*, and *Glycinde armigera*.

The most common large mobile benthic invertebrate organisms in the Central Bay include blackspotted shrimp (*Crangon nigromaculata*), the bay shrimp (*C. franciscorum*), Dungeness crab (*Metacarcinus magister*), and the slender rock crab (*Cancer gracilis*). Although other species of shrimp are present in the Central Bay, their numbers are substantially lower compared to the number of bay and blackspotted shrimp present.[41] All of these mobile invertebrates are present throughout the Central Bay and provide an important food source for carnivorous fishes, marine mammals, and birds in San Francisco Bay's food web. Dungeness crabs use most of the bay as an area for juvenile growth and development before returning to the ocean as sexually mature adults.[42]

Because of the strong ocean influence in the Central Bay, additional species of red and brown algae are found attached to submerged intertidal hard substrate, including pier pilings. These include *Cladophora sericea*, *Codium fragile*, *Fucus gardneri*, *Laminaria sinclairii*, *Egregia menziesii*, *Halymenia schizymenioides menziesii*, *Sargassum muticum*, *Polyneura latissima*, *Cryptopleura violacea*, and *Gelidium coulteri*.[43] In addition, *Codium fragile* subsp. *tomentosoides*, *Bryopsis hypnoides*, *Chondracanthus exaspertatus*, and *Ahnfeltiopsis leptophyllus* can be found inhabiting either hard or soft substrate.[44] Aquatic vegetation observed in the study area includes brown algae (*Fucus* spp.) and may also include green algae (*Ulva/Enteromorpha, Gracillaria verrucosa*, *Ruppia maritima*, and *Potamogeton pectinatus*), which are common in subtidal habitats.

40 Ibid.

41 Ibid.

42 Tasto, R. N., "San Francisco Bay: Critical to the Dungeness Crab?" In: T. J. Conomos, editor, *San Francisco Bay: The Urbanized Estuary*, 1979, Pacific Div Am Ass Adv Sci, San Francisco, California: 479–490.

43 National Oceanic and Atmospheric Administration, *Report on the Subtidal Habitats and Associated Biological Taxa in San Francisco Bay*, June 2007.

44 Ibid.

Open Water (Pelagic)/Channels

Open water is found in San Francisco Bay surrounding the project site (Reaches 2 through 14) and in the San Bruno Channel (Reach 1) and Millbrae Channel (Reach 15). San Francisco Bay is the largest estuary on the West Coast, encompassing approximately 61 square miles. Pelagic habitat is the predominant marine habitat in Central San Francisco Bay and includes the area between the water surface and the seafloor. Eelgrass (*Zostera marina*) beds are discontinuously distributed throughout San Francisco Bay; however, none are documented on the west side of Central San Francisco Bay.[45] A large variety of invertebrates, such as polychaetes (marine worms), crustaceans (e.g., crabs, amphipods, and isopods), and mollusks (e.g., clams and mussels) provide a prey base for a wide variety of fishes, including special-status species such as steelhead, Chinook salmon, and green sturgeon, as well as non-listed species including northern anchovy (*Engraulis mordax*), pacific herring (*Clupea pallasii*), and jacksmelt (*Atherinopsis californiensis*). Although it is not federally or state-listed, the San Francisco Bay Pacific herring fishery is one of the last remaining fisheries in San Francisco Bay, and is currently suffering significant declines. Because of its commercial importance, the fishery is regulated by CDFW, and the population and spawning success of Pacific herring in San Francisco Bay is closely monitored. Marine vegetation, such as eelgrass and algae, are the preferred substrate for herring spawning. However, pier pilings, riprap, and other rigid, smooth structures within bay waters also serve as spawning substrate.[46]

Open waters in the study area provide refuge and foraging habitat for a variety of resident and migratory birds. San Francisco Bay is identified as one of only 13 "Hemispheric Reserves" certified by the Western Hemisphere Shorebird Reserve Network, has been noted as a high-priority area for waterfowl by the North American Waterfowl Management Plan, and includes several "Important Bird Areas" identified by the National Audubon Society.[47] The Bay-Delta is an important wintering and stopover site for the Pacific Flyway. More than 300,000 wintering waterfowl use the bay and associated salt ponds. Bird guilds that use the open waters of the bay include fish-eating bird species such as osprey (*Pandion haliaetus*), brown pelican, double-crested cormorant, western grebe (*Aechmophorus occidentalis*), and Caspian tern (*Hydroprogne caspia*). In addition, diving and dabbling ducks such as bufflehead (*Bucephala albeola*), surf scoter (*Melanitta perspicillata*), greater scaup (*Aythya marila*), and green-winged teal (*Anas crecca*) are present.

In general, the presence of marine mammals in San Francisco Bay is related to the presence and distribution of prey species. Marine mammals known to occur in San Francisco Bay that may be found in the study area include California sea lion and harbor seal. These species haul themselves out of the water onto various intertidal substrates (e.g., rocky beaches) that are exposed at low to

---

45 Boyer, K.E. and S. Wyllie-Echeverria, *Eelgrass Conservation and Restoration in San Francisco Bay: Opportunities and Constraints—Final Report for the San Francisco Bay Subtidal Habitat Goals Project*, November 19, 2010.

46 Goals Project, *Baylands Ecosystem Species and Community Profiles Life Histories and Environmental Requirements of Key Plants, Fish and Wildlife*. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. P.R. Olofson, ed., San Francisco Bay Regional Water Quality Control Board, Oakland, California, 2000.

47 San Francisco Bay Joint Venture, 2020, *https://www.sfbayjv.org/about-san-francisco-bay.php*, accessed September 1, 2020.

medium tide levels for resting and breeding; however, no haul-out sites large enough to support breeding marine mammals are present in the study area.

The San Bruno Channel and Millbrae Channel carry freshwater from the upland watershed to San Francisco Bay, but also receive salt water through tidal action, creating a brackish environment in the channels' lower reaches within the study area. The habitat in these lower reaches can support fish species that may enter the channels from the Bay, as well as western pond turtle (*Actinemys marmorata*) and mallard ducks (*Anas platyrhynchos*).

2.2.3 Sensitive Natural Communities

A *sensitive natural community* is a biological community that is regionally rare, provides important habitat opportunities for wildlife, is structurally complex, or is in other ways of special concern to local, state, or federal agencies. Most sensitive natural communities are given special consideration because they perform important ecological functions, such as maintaining water quality and providing essential habitat for plants and wildlife. Some plant communities support a unique or diverse assemblage of plant species and therefore are considered sensitive from a botanical standpoint. Until the mid-1990s, CDFW tracked sensitive natural community occurrences in CNDDB. These occurrences were classified according to "Preliminary Descriptions of the Terrestrial Natural Communities of California."[48]

Four sensitive natural communities are recorded within the San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles. One of these communities, northern coastal salt marsh, is present in the study area. Northern coastal salt marsh is a highly productive plant community dominated by herbaceous, suffrutescent (subshrubby), salt-tolerant hydrophytes (water plants) that typically form dense mats up to 3 feet high. The most characteristic plant of this community is pickleweed.

2.2.4 Wildlife Movement Corridors

Wildlife movement corridors are considered an important ecological resource by CDFW and USFWS and under CEQA. Movement corridors may provide favorable locations for wildlife to travel between different habitat areas such as foraging sites, breeding sites, cover areas, and preferred summer and winter range locations. They may also function as dispersal corridors, allowing animals to move between various locations within their range. Topography and other natural factors, in combination with human disturbance or urban development, can fragment or separate large open-space areas and wildlife habitats, thus impeding wildlife movement between areas of suitable habitat. This fragmentation creates isolated "islands" of vegetation that may not provide sufficient area to accommodate sustainable populations and can adversely affect genetic and species diversity. Movement corridors mitigate the effects of this fragmentation by allowing animals to move between remaining habitats, which in turn allows depleted populations to be replenished and promotes genetic exchange between separate populations.

---

[48] R. F. Holland, Preliminary descriptions of the terrestrial natural communities of California. State of California, The Resources Agency, Department of Fish and Game, 1986.

The project site is not part of an established terrestrial wildlife movement corridor because it does not provide a connection between different habitat areas; rather, project site conditions are consistent with surrounding industrial use areas within the terrestrial study area that provide the same or similar habitat opportunities for local wildlife. Migrating birds that forage in intertidal and marine environments may use San Francisco Bay during migration and may utilize the existing small pockets of habitat to move between larger, contiguous habitat both north and south of the Airport; however, because the terrestrial study area and reinforced shoreline are developed or highly disturbed, these areas do not offer high-quality habitat for migrating birds. Numerous marine species utilize open bay habitat outside of the project site as a migratory corridor.

2.2.5 Wetlands and Other Waters

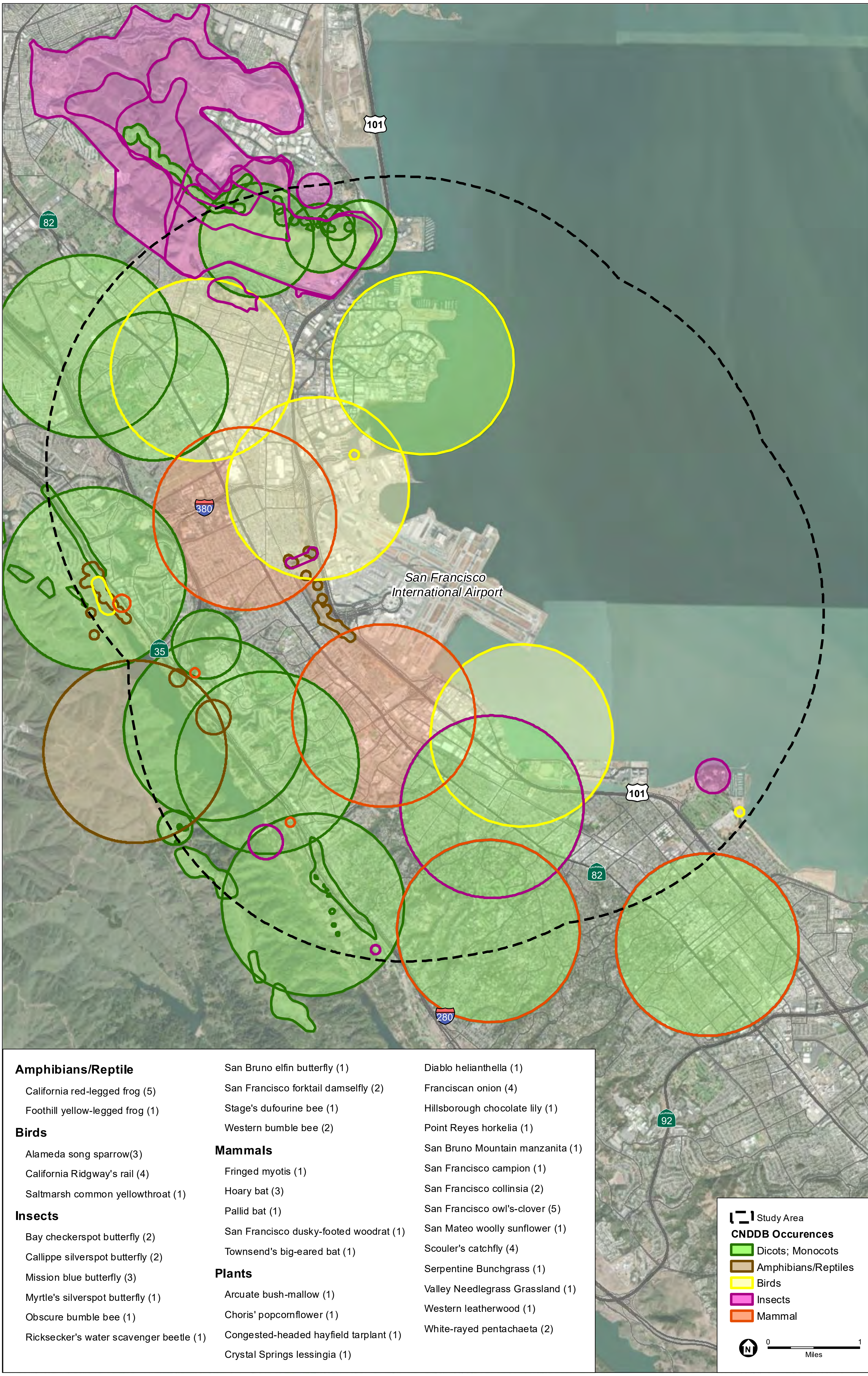
Coastal saltmarsh is present in Reaches 1, 2 (including Sub-reaches 2A, 2B, and 2C), 6, 9, 13, and 14. Emergent wetlands are present along Sub-reach 2B. The project site is adjacent to San Francisco Bay, which USACE classifies as navigable “waters of the United States.” “Navigable waters of the United States” refer to non-wetland aquatic features (other waters), which are regulated by the federal Clean Water Act. “Waters of the state” are defined as “any surface water or groundwater, including saline waters, within the boundaries of the State” (California Water Code section 13050[e]) and include all federally jurisdictional waters.

As navigable waters of the United States, San Francisco Bay is regulated by USACE under section 10 of the Rivers and Harbors Appropriation Act up to the mean high-water mark, and under section 404 of the Clean Water Act up to the high-tide line. These waters are also regulated by the San Francisco Bay Regional Water Quality Control Board as waters of the state. In addition, the San Francisco Bay Conservation and Development Commission regulates the fill, extraction of materials, and substantial changes in use of land, water, and structures within the Bay and within 100 feet of the Bay shoreline (100 feet inland of the mean high-water mark), which includes some of the terrestrial or landside portions of the project site. See Section 1.2, “Regulatory Considerations,” for additional discussion of federal and state waters, and jurisdiction over San Francisco Bay and near-shore areas.

Other jurisdictional waters within the study area include the Millbrae Highline Canal, a trapezoidal, 45-foot-wide (25-foot-wide at the water line), concrete-lined stormwater channel located within Reach 15. The canal carries runoff from the South Lomita Canal on the West-of-Bayshore property and other watershed lands within the City of Millbrae to the west, and transports flows through tide gates to San Francisco Bay. No vegetation grows within the channel.

2.2.6 Special-Status Plant Species

To identify special-status plant species with potential to occur in the study area, ESA queried databases and reviewed available survey reports. These include the CNPS, CNDDB, and USFWS species databases for the study area and surrounding San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles (**Appendix D)**. Special-status plant species known to occur within a 5-mile radius of the study area are shown in **Figure 2**. ESA reviewed the results of a 2011 botanical assessment and rare plant survey for



SOURCE: MAXAR, 2017; CNDDB, 2020; ESA, 2020

SFO Shoreline Protection Program

Figure 2
CNDDB Plant and Wildlife Species Occurrences within a 5-Mile Radius of the Study Area

This page intentionally left blank

SFO's Proposed Runway Safety Project.[49] This survey included portions of Reaches 7 and 11 through 15 and was focused on eleven special-status plant species, none of which were observed. The report concluded that these species were unlikely to occur at SFO. ESA also reviewed local collections for special-status plant species using the California Consortium of Herbaria,[50] as well as observations recorded in iNaturalist.[51]

To further refine the list of special-status plant species that may occur in the study area, ESA considered the database and survey results described above within the context of the known geographic range of the species and observed habitat conditions in the study area. During an August 2020 field survey, ESA documented the vegetation communities present, invasive plant species, and the presence of associated plant species that typically co-occur with rare plants to further evaluate the quality of habitat for special-status plant species.

Appendix E presents *Special-Status Species Potential to Occur within the Study Area*, including a full list of considered species and their regulatory status, habitat requirements, and an assessment of potential to occur within the study area. Based on the above considerations, each species was given a potential to occur rating of no potential, low, moderate, or high. No species were determined to have a high potential to occur within the study area, and one species, California seablite (*Suaeda californica*), was determined to have a moderate potential to occur within the study area. This species is discussed in more detail below. No further consideration is needed for special-status plant species considered to have no potential or a low potential to occur. **Appendix F** contains a full list of all plant species observed in and adjacent to the study area during the reconnaissance-level survey.

California Seablite (*Suaeda californica*)

Status

Federally endangered. California Rare Plant Rank 1B.1.

General Ecology and Distribution

California seablite is a flowering shrub in the Chenopodiaceae family, which is native and endemic to California. California seablite occurs at the margins of coastal salt marshes and blooms from July to October. This species was formerly widespread in the San Francisco Bay Area, but now occurs in fragmented populations. California seablite is threatened by development, recreational activities, erosion, non-native plants, and alteration of marsh habitat.

---

[49] LSA Associates, Inc., Results of Botanical Assessment and Focused Survey for Special-status Plants for the Proposed Runway Safety Area Project, San Francisco International Airport, 2011.

[50] California Consortium of Herbaria, CCH2 Portal, 2020, *https://www.cch2.org/portal/index.php*, accessed August 12, 2020.

[51] iNaturalist, 2020, *https://www.inaturalist.org/*, accessed December 2020.

Study Area Occurrence

Suitable habitat for this species is present at the margins of tidal salt marshes in the study area. Although this species was not observed during the 2011 surveys, most of the current project study area was not surveyed during that survey. This species was also not observed during ESA's 2020 reconnaissance-level survey; however, that was not a floristic survey[52] and does not indicate absence of this species. The nearest occurrence is approximately 6 miles from the study area. San Francisco Bay provides a high degree of connectivity between tidal marshes, which facilitates the colonization of plants in the bay's tidal marshes. Because of this colonization potential and the presence of suitable tidal marsh margin habitat, this species has a moderate potential to occur in the study area.

2.2.7 Special-Status Animal Species

The results of CNDDB and USFWS species database searches for the study area and surrounding San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles are provided in Appendix D. The special-status species derived from these lists, along with additional species that have been documented in the study area vicinity, were assessed for their potential to occur within the study area. Appendix E presents these special-status species and their status and habitat requirements and ranks the potential for each species to occur within the study area as no potential, low, moderate, or high. Of these species, those that were determined to have a moderate or high potential to occur within the study area are shown in **Table 1** and discussed below. In addition, the California red-legged frog and San Francisco garter snake are discussed, which are documented on the Airport's West-of-Bayshore property, but which have a low potential to occur in the study area due to significant barriers to entering the study area. Also discussed is the salt marsh harvest mouse, which has a low potential to occur in the study area despite the presence of limited tidal marsh habitat in the study area. Special-status animal species known to occur within a 5-mile radius of the study area are shown in Figure 2, p. 2-15. **Appendix F** contains a full list of all animal species observed in and adjacent to the study area during the reconnaissance-level survey.

Amphibians

California Red-Legged Frog (*Rana draytonii*)

Status

California red-legged frog (CRLF) is federally listed as threatened throughout its range in California and is a CDFW Species of Special Concern.

52 A floristic survey involves walking transects to allow full visual coverage of the survey area and identification of every plant to the taxonomic level necessary to determine presence or absence of plant species.

TABLE 1
SPECIAL-STATUS WILDLIFE SPECIES WITH A MODERATE OR HIGH POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Listing Status
Western Pond Turtle	*Actinemys marmorata*	CDFW: SSC
Alameda Song Sparrow	*Melospiza melodia pusillula*	CDFW: SSC
American peregrine falcon	*Falco peregrinus anatum*	CDFW: FP
California black rail	*Laterallus jamaicensis coturniculus*	ST, CDFW: FP
California brown pelican	*Pelecanus occidentalis californicus*	CDFW: FP
California Ridgway's rail	*Rallus obsoletus obsoletus*	FE, SE, CDFW: FP
Double-crested cormorant	*Phalacrocorax auritus*	CDFW: WL
Merlin	*Falco columbarius*	CDFW: WL
Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	CDFW: SSC
Western snowy plover	*Charadrius alexandrinus*	FT, CDFW: SSC
White-tailed kite	*Elanus leucurus*	CDFW: FP
Pallid bat	*Antrozous pallidus*	WBWG: H
Hoary bat	*Lasiurus cinereus*	WBWG: M
Fringed myotis	*Myotis thysanodes*	WBWG: H
Yuma myotis	*Myotis yumanensis*	WBWG: L-M
Green sturgeon	*Acipenser medirostris*	FT, CDFW: SSC
Pacific herring	*Clupea pallasii*	CDFW managed species; protected within San Francisco Bay under the Marine Life Management Act
Central California coast DPS steelhead	*Oncorhynchus mykiss irideus*	FT, AFS: TH
Longfin smelt	*Spirinchus thaleichthys*	ST
Pacific harbor seal	*Phoca vitulina richardii*	MMPA

Federal Status (listed under the Endangered Species Act) – FE = Federally Endangered; FT = Federally Threatened; FC = Candidate for federal listing; FD = Delisted. State Status (listed under California Endangered Species Act) – SE = State Endangered; ST = State Threatened. California Department of Fish and Wildlife Species of Special Concern = SSC; Fully Protected = FP; Watch List = WL. Western Bat Working Group (WBGW) Rank Low = L; Medium = M, High = H. Marine Mammal Protection Act (MMPA). American Fisheries Society (AFS) Threatened = TH.

General Ecology and Distribution

This frog historically occurred over much of the state, from the Sierra Nevada foothills to the coast and from Mendocino County to the Mexican border. CRLF typically inhabit ponds, slow-moving creeks, and streams with deep pools that are lined with dense emergent marsh or shrubby riparian vegetation. Submerged root masses and undercut banks are important habitat features for this species. However, this species is capable of inhabiting a wide variety of perennial aquatic habitats. CRLF is known to survive in ephemeral streams, though only if deep pools with vegetative cover persist through the dry season. Factors that have contributed to the decline of CRLF include destruction of riparian habitat from development, agriculture, flood control practices, or the introduction of exotic predators such as American bullfrog (*Lithobates catesbeianus*), crayfish, and a variety of non-native fish.

Study Area Occurrence

Optimal habitat for CRLF is not present within the study area, but wetlands west of SFO and U.S. 101 on SFO's West-of-Bayshore property provide suitable habitat. A known CRLF breeding population occurs in this area (Occurrence No. 33). U.S. 101, North McDonnell Road, and SFO lie east of the West-of-Bayshore property, creating a barrier for amphibian movement to the study area on the northern, eastern, and southern edges of SFO. The Millbrae Channel, which flows directly south of the West-of-Bayshore property, is a concrete-lined channel that provides poor-quality habitat for CRLF. Similarly, the San Bruno Channel, which flows north of the West-of-Bayshore property, provides only marginally suitable habitat west of the tidal gates and poor-quality habitat east of the tidal gates primarily due to brackish water conditions. While it may be possible for CRLF to enter the San Bruno and Millbrae Channels from the West-of-Bayshore property, the saline bay waters present in these channels and general lack of suitable upland and aquatic habitat within the study area make the potential for CRLF to occur within the study area low.

Reptiles

San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*)

Status

San Francisco garter snake (SFGS) is federally and state-listed as endangered and is a CDFW Fully Protected species.

General Ecology and Distribution

This snake historically occurred in wetland areas on the San Francisco Peninsula from approximately the San Francisco County line, south along the eastern and western bases of the Santa Cruz Mountains at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point, San Mateo County, and Waddell Creek, Santa Cruz County.[53,54] Currently, the species has been reduced to only six significant populations in San Mateo County and northern Santa Cruz County, which were described in the USFWS *San Francisco Garter Snake 5-Year Review Summary and Evaluation*.[55] The preferred habitat for San Francisco garter snake is a densely vegetated pond that hosts its prey base of CRLF, American bullfrog, and Sierran treefrog (*Pseudacris sierra*) near an open hillside with access to sun and rodent burrows for cover. Temporary ponds and other seasonal freshwater bodies are also used. Emergent bankside vegetation such as cattails, bulrushes (*Schoenoplectus* spp.), and rushes (*Juncus* spp.) are preferred and used for cover. Adult garter snakes sometimes aestivate in rodent burrows during

[53] S.J. Barry, The Distribution, habitat, and evolution of the San Francisco garter snake, *Thamnophis sirtalis tetrataenia*. Unpublished M.A. Thesis, University of California Davis, 1994.

[54] US Fish and Wildlife Service, Recovery Plan for the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*). US Fish and Wildlife Service, Portland, Oregon, 1985.

[55] US Fish and Wildlife Service, San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) 5-Year Review: Summary and Evaluation. US Fish and Wildlife Service, Sacramento Field Office, Sacramento, California, 2006.

the summer months when the ponds are dry. On the coast, the snakes hibernate during the winter; but farther inland, if the weather is suitable, garter snakes may be active year-round.[56,57,58]

Study Area Occurrence

The exact locations of SFGS occurrences are considered sensitive by CDFW. There are multiple extant suppressed records for SFGS within the San Francisco South, Montara Mountain, and San Mateo Quadrangles.[59] Optimal habitat is not present within the study area, but wetlands west of SFO and U.S. 101 on SFO's West-of-Bayshore property provide suitable habitat. SFGS is known to occur in these wetlands.[60] The Millbrae Channel, which flows directly south of this area, is a concrete-lined channel that lacks emergent aquatic vegetation and provides poor-quality habitat for SFGS. Similarly, the San Bruno Channel, which flows north of the West-of-Bayshore property, provides only marginally suitable habitat west of the tidal gates and poor-quality habitat east of the tidal gates primarily due to brackish water conditions. SFGS is known to avoid brackish marsh areas because their preferred prey (CRLF) cannot survive in saline water.[61] While it may be possible for SFGS to enter the San Bruno and Millbrae Channels from the West-of-Bayshore property, the saline bay waters present in these channels and general lack of suitable upland and aquatic habitat within the study area make the potential for SFGS to occur within the study area low.

Western Pond Turtle (*Actinemys marmorata*)

Status

Western pond turtle is a CDFW Species of Special Concern.

General Ecology and Distribution

This species is normally associated with permanent ponds, lakes, streams, irrigation ditches, or permanent pools along intermittent streams. Storer[62] suggested that two distinct habitats may be used for oviposition: (1) along large slow-moving streams, in which eggs are deposited in nests constructed in sandy banks; and (2) along foothill streams, where females may climb hillsides, sometimes moving considerable distances to find a suitable nest site. This species can tolerate full-strength seawater for a short period of time, but normally is found in freshwater.

---

56 S. McGinnis, P. Keel, and E, Burko, The use of upland habitats by snake species at Año Nuevo State Reserve. Report to California Department of Fish and Game, Sacramento, California, 13 pp., 1987.

57 S. McGinnis, Distribution and feeding habitat requirements of the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*). Draft of Final Report, submitted to California Department of Fish and Game. 40 pp., 1989.

58 US Fish and Wildlife Service, San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) 5-Year Review: Summary and Evaluation. US Fish and Wildlife Service, Sacramento Field Office, Sacramento, California, 2006.

59 California Department of Fish and Wildlife, California Natural Diversity Database RareFind version 5 query of the San Francisco South, Montara Mountain, Hunters Point, and San Mateo USGS 7.5-minute topographic quadrangles, Commercial Version, 2020, accessed August 12, 2020.

60 San Francisco International Airport, San Francisco Garter Snake Recovery Action Plan 2019-2029. West-of-Bayshore Property, San Francisco International Airport, San Mateo County, California. prepared by Dudek for the San Francisco International Airport Planning and Environmental Affairs, July 2019.

61 U.S. Fish and Wildlife Service, Species Account San Francisco Garter Snake *Thamnophis sirtalis tetrataenia*. US Fish and Wildlife Service, Sacramento Fish & Wildlife Office, Sacramento, California 2007.

62 Storer, T.I., "Notes on the Range and Life History of the Pacific Fresh-Water Turtle, Clemmys Marmorata," University of California Press, 1930.

Study Area Occurrence

The nearest occurrence was recorded in 2006, approximately 3.1 miles southwest of the study area in a creek linking San Andreas Lake and Crystal Springs Reservoir (Occurrence No. 350). Optimal habitat is not present within the study area. Wetlands west of SFO and adjacent to U.S. 101 on SFO's West-of-Bayshore property provide potentially suitable aquatic and upland aestivation habitat. However, western pond turtle has not been observed in this area.[63] The Millbrae Canal and San Bruno Channel are located within the study area and provide marginally suitable habitat for western pond turtle. Both channels provide low-quality habitat because of the lack of basking sites (e.g., steep levee banks, concrete-lined channel in the Millbrae Canal) and upland areas for breeding.

Avian Species

Special-status avian species that have the potential to occur within or adjacent to the study area include Alameda song sparrow, American peregrine falcon, California Ridgway's rail, California brown pelican, double-crested cormorant, saltmarsh common yellowthroat, and western snowy plover. The study area may also provide suitable breeding habitat for many common avian species. The following is a brief description of special-status bird species that may occur within or immediately adjacent to the study area.

Alameda Song Sparrow (*Melospiza melodia pusillula*)

Status

Alameda song sparrow is a CDFW Species of Special Concern.

General Ecology and Distribution

Alameda song sparrow, a subspecies of song sparrow, is endemic to California. It is found in the brackish marshes vegetated with pickleweed along the southern portion of San Francisco Bay. This species is known to nest within tall vegetation or in pickleweed within its marsh habitat.

Study Area Occurrence

Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for Alameda song sparrow. The nearest record of this species occurred in 1947 in the vicinity of the study area (San Bruno) (Occurrence No. 32).

American Peregrine Falcon (*Falco peregrinus anatum*)

Status

American peregrine falcon is a state Fully Protected species and a federal Bird of Conservation Concern.

[63] Natalie Reeder, Wildlife Biologist, San Francisco International Airport, email communication, December 15, 2020.

General Ecology and Distribution

This falcon breeds near water at varied nest sites, including natural cliff ledges and potholes, tall metropolitan buildings and bridges, and former nests of common raven and osprey on electric transmission towers and boat navigation channel markers. American peregrine falcon primarily hunts birds and is known to eat a wide variety of bird species. Typical prey species include shorebirds, ducks, pigeons, and songbirds, although these falcons are also known to eat bats and occasionally fish and rodents.

Study Area Occurrence

American peregrine falcons have been documented to nest inside or outside of the United Airlines MOC maintenance hangar, Building 800B, located adjacent to Reach 1 in 2011, 2012, 2014 through 2017, 2019, and 2020. They are known to have fledged young in 2011, 2014, 2017, and 2020.[64,65] Foraging habitat for the American peregrine falcon is found throughout the length of the study area. Numerous bird species that American peregrine falcon preys upon forage in the marshes, mudflats, sloughs, and open bay habitats within the study area.

California Black Rail (*Laterallus jamaicensis coturniculus*)

Status

California black rail is state-listed as threatened under the CESA and is a CDFW Fully Protected species.

General Ecology and Distribution

More than 90 percent of California black rails are located in the marshes of northern San Francisco Bay, primarily San Pablo Bay and Suisun Bay;[66] however, they can occur in freshwater and brackish areas of the South Bay. Black rails prefer marshes that are close to water, are large (interior more than 165 feet from edge), away from urban areas, and saline to brackish with a high proportion of pickleweed, maritime bulrush (*Bolboschoenus maritimus*), gumplant (*Grindelia stricta*), rush, and cattails.[67]

Study Area Occurrence

Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for California black rail. Marsh bird surveys conducted for the San Francisco Estuary Invasive *Spartina* Project in 2017, 2018, and 2019 did not detect any California black rails within marshes in the Reach 14 area.[68] The nearest record of this species occurred in 1972, approximately 7 miles southeast of the study area (Occurrence No. 12).

---

64 Ibid.

65 Zeka Glucs, Director, Predatory Bird Research Group, University of California, Santa Cruz, email communication, September 16, 2020.

66 Spautz, H., Nur, N., Stralberg, D., California Black Rail (*Laterallus jamaicensis coturniculus*) Distribution and Abundance in Relation to Habitat and Landscape Features in the San Francisco Bay Estuary, 2005.

67 Ibid.

68 Olofson Environmental, Inc., *California Ridgway's Rail Surveys for the San Francisco Estuary Invasive Spartina Project. Reports to California Coastal Conservancy*, November 12, 2018; January 13, 2020.

California Brown Pelican (*Pelecanus occidentalis californicus*)

Status

California brown pelican is a CDFW Fully Protected Species.

General Ecology and Distribution

California brown pelicans occur in estuarine, marine subtidal, and marine pelagic waters throughout coastal California.[69] Important habitat for pelicans during the nonbreeding season includes roosting and resting areas, such as offshore rocks, islands, sandbars, breakwaters, and pilings. Suitable areas need to be free of disturbances, including regular human activity. This species rests temporarily on the water or isolated rocks, but roosting requires a dry location near food and a buffer from predators and humans. The California brown pelican is a common post-breeding resident (May through November) of the open waters of Central San Francisco Bay.

Study Area Occurrence

Nesting habitat does not occur in the study area; San Francisco Bay is located outside of the species' breeding range, which is limited to the Channel Islands south to central Mexico. The presence of California brown pelicans within or near the study area is limited to loafing on piers and foraging in the Bay and adjacent environs.

California Ridgway's Rail (*Rallus obsoletus obsoletus*)

Status

California Ridgway's rail is federally and state-listed as endangered.

General Ecology and Distribution

California Ridgway's rail ranges along the Pacific Coast in Monterey and San Luis Obispo counties and inhabits tidal mudflats and sloughs. It is a year-round resident of the tidal marshes in the San Francisco Estuary. Preferred habitat for California Ridgway's rail is emergent salt and brackish tidal marshlands subject to direct tidal circulation and characterized by predominant coverage of pickleweed and cordgrass.[70]

Study Area Occurrence

California Ridgway's rails are known to occur in marsh habitat within the Reach 14 area. A small number of individuals were documented during breeding season surveys in this marsh annually from 2007 through 2019.[71] Although the marsh provides lower quality habitat because of its

---

69 Zeiner D.C., W.F. Laudenslayer, Jr., K.E. Mayer, M. White, California's Wildlife Volume II, Birds, California Department of Fish and Game, California brown pelican, 1990.

70 Goals Project, Baylands Ecosystem Species and Community Profiles Life Histories and Environmental Requirements of Key Plants, Fish and Wildlife. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. P.R. Olofson, ed. San Francisco Bay Regional Water Quality Control Board, Oakland, California, 2000.

71 Olofson Environmental, Inc., *California Ridgway's Rail Surveys for the San Francisco Estuary Invasive Spartina Project. Reports to California Coastal Conservancy*, July 6, 2007; June 30, 2009; November 2009; February 2011; December 2011; December 18, 2012; November 23, 2013; October 2014; September 24, 2015; November 30, 2016; January 23, 2018; November 12, 2018; January 13, 2020.

narrow, linear configuration, the established presence of individuals in the breeding season indicates that these individuals may attempt to breed in this area.

Double-Crested Cormorant (*Phalacrocorax auritus*)

Status

Nesting colonies of the double-crested cormorant are on the CDFW Watch List.

General Ecology and Distribution

This species requires undisturbed nest sites beside water, on islands, or on a mainland. It feeds mainly on fish,[72] but also on crustaceans and amphibians, and breeds mostly April to July or August. It uses wide rock ledges on cliffs as well as rugged slopes and live or dead trees, especially tall ones; perching sites must be barren of vegetation.[73] Double-crested cormorants nest within San Francisco Bay, including in breeding colonies on Alcatraz, the Richmond–San Rafael Bridge, the electrical towers of the South Bay, and the eastern span of the Bay Bridge.[74,75]

Study Area Occurrence

This species forages and nests within San Francisco Bay. Although unlikely, the species has the potential to nest on the trestles within the study area.

Merlin (*Falco columbarius*)

Status

Merlin is on the CDFW Watch List.

General Ecology and Distribution

This species winters in California, with the majority of individuals arriving in October and November.[76] Merlins forage in bay marshes, grassland, agricultural lands, dairies, savannas, and edges of deserts with open habitat and high density of bird prey. Some individuals overwinter in cities. Non-breeding individuals may also forage on birds in more open areas of urbanized landscapes, such as parks.

Study Area Occurrence

Overwintering merlins are known to occur at SFO based on records of aircraft strikes, and suitable foraging habitat is present in the tidal marshes around the Airport and open areas

---

72 H.L. Cogswell, *Water birds of California* (Vol. 40). Univ of California Press, 1977.

73 G.A. Bartholomew, The daily movements of cormorants on San Francisco Bay, *The Condor*, 45(1), pp. 3–18, 1943.

74 M. Cabanatuan, Bay Bridge bird colony settles in on new span, *San Francisco Chronicle*, May 20, 2017, *https://www.sfchronicle.com/bayarea/article/Bay-Bridge-bird-colony-settles-in-on-new-span-11160676.php*, accessed August 12, 2020.

75 Davis, C., The Double-crested Cormorant: Bad Rap for this Local Come-back Kid, San Francisco Bay National Wildlife Refuge Complex, *Tideline* Vol. 30, No.4, Winter 2009, *https://www.fws.gov/uploadedFiles/Region_8/NWRS/Zone_2/San_Francisco_Bay_Complex/tideline%20winter%2009.pdf*, accessed August 12, 2020.

76 Peeters, H. and Pam Peeters, *Raptors of California*. University of California Press, 2005.

between the runways where shorebirds or songbirds are present; however, the study area is outside of the merlin's breeding range.

Saltmarsh Common Yellowthroat (*Geothlypis trichas sinuosa*)

Status

Saltmarsh common yellowthroat is a CDFW Species of Special Concern.

General Ecology and Distribution

Saltmarsh common yellowthroat is found in Marin, Napa, Sonoma, Solano, San Francisco, San Mateo, Santa Clara, and Alameda counties within freshwater marshes, brackish marshes, and riparian woodland and swamps. This species utilizes areas of tall grasses, tules, and willow thickets for cover and nesting substrate. In brackish and saline tidal marsh habitat around San Francisco Bay, saltmarsh common yellowthroat abundance is associated with a high percent cover of rushes (*Scirpus* sp.), peppergrass (*Lepidium latifolium*), and *Juncus*.[77]

Study Area Occurrence

Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for saltmarsh common yellowthroat. The nearest record of this species occurred in 2001, approximately 3 miles west of the study area around San Andreas Lake (Occurrence No. 79).

Western Snowy Plover (*Charadrius nivosus nivosus*)

Status

In 1993, the Pacific Coast distinct population segment of western snowy plovers was listed as threatened by USFWS under the FESA. The western snowy plover is also listed as a "species of special concern" by the State of California.

General Ecology and Distribution

The coastal population breeds along the Pacific coast from southern Washington to southern Baja California, Mexico, with the majority of birds breeding along the California coast. Nesting season runs from mid-March through mid-September. At beaches, western snowy plovers forage above and below the mean high-water line, gathering food from the sand surface, kelp, marine mammal carcasses, or low foredune vegetation.[78] On Pacific coast beaches, plovers are thought to feed on

---

[77] W.D. Shuford, and T. Gardali, eds., California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. *Studies of Western Birds* 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento, 2008.

[78] G.W. Page, J. S. Warriner, J. C. Warriner, and P.W.C. Paton, Snowy Plover (*Charadrius alexandrinus*). In: *The birds of North America*, no. 154 (A. Poole, and F. Gill, eds.). Academy of Natural Sciences, Philadelphia, PA, and American Ornithologists' Union, Washington, D.C., 1995.

mole crabs (*Emerita analoga*), crabs (*Pachygrapsus crassipes*), polychaetes, amphipods, sand hoppers (*Orchestoidea*), tanadacians (*Leptochelia dubia*), flies, beetles, clams, and ostracods.[79]

Study Area Occurrence

Suitable nesting habitat is not present within the study area. Overwintering individuals have been observed foraging within the study area on a spit located at the corner of Reach 12 and Reach 13.

White-tailed kite (*Elanus leucurus*)

Status

White-tailed kite is a California fully protected species.

General Ecology and Distribution

White-tailed kites are found throughout California in a range of habitats including marshes, grassland, and oak woodlands, and commonly perches on top of treetops, wires and fenceposts. When foraging, the white-tailed kite frequently flies fairly slowly in arcs and circles, then hovers distinctively before dropping onto small mammal prey. Its diet consists almost entirely of mice and voles.

Study Area Occurrence

The study area provides suitable foraging habitat for white-tailed kite in the tidal and non-tidal marshes and this species is regularly observed in the study area.[80] Trees within the study area could provide nesting or roosting habitat for white-tailed kites, but are probably too low and close to human activity for white-tailed kites to nest there. White-tailed kites are known to occur within the study area.

Other Resident and Migratory Birds

Although many native birds are not considered to be special-status species, their nests are protected by the MBTA and the California Fish and Game Code. Many resident and migratory birds could nest in existing trees, shrubs, and ruderal vegetation or in existing buildings within the study area. Cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), and black phoebe (*Sayornis nigricans*) could build mud nests on the outside of existing buildings. Canada geese have been known to nest within the study area, including along Reach 14.[81] Other passerine species, such as house finch, mourning doves, and Anna’s hummingbird, could build nests in fennel, shrubs, or other woody vegetation within areas such as Bayfront Park, while killdeer build nests on the ground.

---

79 Ibid.

80 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, personal communication, February 22, 2021.

81 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, online meeting communication, August 5, 2020.

Terrestrial Mammals

Special-Status Bat Species

Special-status bats with the potential to occur within or adjacent to the study area include hoary bat (*Lasiurus cinereus*), pallid bat (*Antrozous pallidus*), fringed myotis (*Myotis thysanodes*), and Yuma myotis (*M. yumanensis*). Small cavities and exfoliating bark on trees and crevices in buildings and other structures may provide roosting habitat for bats within the study area. The status, general ecology, distribution, and occurrences in the study area vicinity for each of these species are discussed below.

Pallid Bat (*Antrozous pallidus*)

Status

The pallid bat is a CDFW Species of Special Concern and a Western Bat Working Group (WBWG) High Priority species.

General Ecology and Distribution

Pallid bat occurs throughout California except for the high Sierra Nevada from Shasta to Kern counties, and the northwestern portion of the state from Del Norte and western Siskiyou counties to northern Mendocino County. This species occurs in various habitats including grasslands, scrubs, woodlands, and forests from sea level up through mixed conifer forests, but it is most common in open, dry habitats with rocky areas for roosting. Day roosts for pallid bats include hollow trees, buildings, caves, crevices, and mines.

Study Area Occurrence

Trees and structures within the study area provide potential roosting habitat. The nearest record for this species is adjacent to the project site (Millbrae) and was recorded in 1947 (Occurrence No. 294).

Hoary Bat (*Lasiurus cinereus*)

Status

The hoary bat is a WBWG Medium Priority species.

General Ecology and Distribution

This bat species is the most widespread North American bat and may be found at any location in California, although distribution is patchy in the southeastern deserts.[82] The hoary bat generally roosts in dense foliage of medium to large trees with preferred sites hidden from above, with few branches below, and that have ground cover of low reflectivity.[83]

---

82 D.C. Zeiner, W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds., *California's Wildlife*. Vol. I–III. California Department of Fish and Game, Sacramento, California, 1988–1990.

83 Ibid.

Study Area Occurrence

Trees within the study area provide potential roosting habitat. The study area also provides foraging habitat. The nearest record for this species was collected just east of the project site (San Bruno) in 1990 (Occurrence No. 119).

Fringed Myotis (*Myotis thysanodes*)

Status

The fringed myotis is a WBWG High Priority species.

General Ecology and Distribution

The fringed myotis ranges through much of western North America from southern British Columbia, Canada, south to Chiapas, Mexico, and from Santa Cruz Island in California, east to the Black Hills of South Dakota. This species roosts in crevices in buildings, underground mines, rocks, cliff faces, and bridges. Roosting in decadent trees and snags, particularly large ones, is common throughout its range in the western U.S. and Canada.[84]

Study Area Occurrence

Trees within the study area provide potential roosting habitat. The nearest record for this species was collected approximately 2.3 miles west of the project site near Crystal Springs Reservoir in 2005 (Occurrence No. 44).

Yuma Myotis (*Myotis yumanensis*)

Status

The Yuma myotis is a WBWG Low-Medium Priority species.

General Ecology and Distribution

The Yuma myotis is found throughout most of California at lower elevations, and in the southern and western half of Nevada, primarily at low to mid elevations. It is found in a wide variety of habitats from the coast to mid elevation. Yuma myotis is one of the bat species most tolerant of human habitation, and one of the few that survives in a relatively urbanized environment (e.g., occurs within the city limits of San Francisco), and it is associated with most low-elevation reservoirs in California. It is found both in buildings and in heavily forested settings. It is a year-round resident and hibernates, although no large winter aggregations have been found.

The Yuma myotis has day roosts in buildings, trees, mines, caves, bridges, and rock crevices. Night roosts are usually associated with buildings, bridges, or other man-made structures. Colonies have been found inside hollow redwoods in coastal California.

Yuma myotis have one young per year, with birth occurring in June to July. Maternity colonies can be large, 200 to several thousand, and contain only adult females and their young. Males roost singly or in small groups. Feeding is primarily on emergent aquatic insects, such as caddis

---

84 Western Bat Working Group, Western Species Accounts, 2017, *http://wbwg.org/western-bat-species/*, accessed August 14, 2020.

flies and midges. Foraging occurs directly over the surface of open water and above vegetation, and over relatively still water, including ponds, reservoirs, or pools in streams and rivers.

Study Area Occurrence

Bat surveys of San Francisco's parks and natural areas conducted in 2009 found that the three most commonly encountered species in the area are Yuma myotis, Mexican free-tailed bat (*Tadarida brasiliensis*), and western red bat (*Lasiurus blossevillii*).[85] Yuma myotis and western red bat were much less abundant than Mexican free-tailed bat and generally were restricted to parks with lakes. However, Yuma myotis is also known to forage over salt marshes and estuaries in San Francisco Bay.[86] Aquatic habitats present within the study area provide foraging habitat for this species.

Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)

Status

The salt marsh harvest mouse is federally and state-listed as endangered and is a CDFW Fully Protected species.

General Ecology and Distribution

The salt marsh harvest mouse is a rodent endemic to the salt and brackish marshes, and adjacent tidally influenced areas, of the San Francisco Bay estuary. The salt marsh harvest mouse has evolved to a life in tidal marshes and depends mainly on dense pickleweed as its primary cover and food source, although it may utilize a broader source of food and cover that includes saltgrass, alkali bulrush, and other vegetation typically found in the salt and brackish marshes of this region. In natural systems, salt marsh harvest mice can be found in the middle tidal marsh and upland transition zones. Upland refugia are an essential habitat component during high-tide events, when the marsh plain is inundated, as salt marsh harvest mice are highly dependent on cover. Cover-dependent salt marsh harvest mice are unlikely to move long distances over bare areas.

Study Area Occurrence

There are no known records of salt marsh harvest mouse in the vicinity of the study area. The nearest record of this species is approximately 7 miles south of the study area and was recorded in 1960 (Occurrence No. 57). Tidal marsh habitat in the Reach 14 area provides only marginally suitable habitat because of its narrow, linear configuration and lack of high-tide refugia, and isolation from known populations in south San Francisco Bay. Therefore, the potential for salt marsh harvest mouse to occur within the study area is considered low.

2.2.8 Marine Resources

This section provides background information on marine resources of the study area, specifically species with potential to occur within 0.5 miles offshore from SFO.

---

[85] J.K. Krauel, *Foraging Ecology of Bats in San Francisco*, M.S. Thesis, San Francisco State University, San Francisco, California, August 2009.

[86] D. Johnston, Bats and the San Francisco Bay. Tideline, San Francisco Bay National Wildlife Refuge Complex, Winter 07–08, Volume 28, Number 4, 2008.

Essential Fish Habitat

Essential fish habitat includes coral reefs, kelp forests, bays, wetlands, rivers, and even areas of the deep ocean that are necessary for fish reproduction, growth, feeding, and shelter. Congress established the EFH mandate in 1996 to improve the nation's main fisheries law—the Magnuson-Stevens Fishery Conservation and Management Act—highlighting the importance of healthy habitat for commercial and recreational fisheries. NMFS collaborates with partners, especially regional fishery management councils, and uses the best available science to identify, describe, and map EFH for all federally managed fish. The habitat off of SFO is listed as EFH for Chinook salmon under the Pacific Coast Salmon FMP, benthic fish and sharks under the Pacific Coast Groundfish FMP, and other commercially important fish species under the Coastal Pelagic Species FMP.

Coastal Pelagic EFH: The Coastal Pelagic FMP is designed to protect habitat for a variety of fish species that are associated with open coastal waters. Fish managed under this plan include planktivores and their predators. Those common in Central San Francisco Bay include Pacific herring and jacksmelt.[87]

Pacific Groundfish EFH: The Pacific Groundfish FMP is designed to protect habitat for more than 90 species of fish, including rockfish, flatfish, groundfish, some sharks and skates, and other species that associate with the underwater substrate. Eight species are commonly reported in Central San Francisco Bay waters: English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), starry flounder (*Platichthys stellatus*), lingcod (*Ophiodon elongatus*), brown rockfish (*Sebastes auriculatus*), kelp greenling (*Hexagrammos decagrammus*), leopard shark (*Triakis semifasciata*), and big skate (*Raja binoculata*).[88]

Pacific Salmon EFH: The Pacific Salmon FMP is designed to protect habitat for commercially important salmonid species. Sacramento Chinook salmon is the only one of these species that may be seasonally present in the study area, although historically Coho salmon (*Oncorhynchus kisutch*) were common in San Francisco Bay.[89]

Habitat Areas of Particular Concern

Along the West Coast, NMFS relies on fishery management councils to identify habitats that fall within Habitat Areas of Particular Concern—discrete subsets of EFH that provide important ecological functions and/or are especially vulnerable to degradation.

Within the Bay-Delta region, eelgrass beds have been identified as a Habitat Area of Particular Concern. These habitat areas of particular concern are considered high-priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. No eelgrass beds exist within the study area, so the potential

[87] Interagency Ecological Program for the San Francisco Estuary, *San Francisco Bay Study*, 2010–2014 Unpublished Midwater and Bottom Trawl Data, 2015.

[88] Ibid.

[89] Ibid.

for this sensitive natural community and the fish that reside within such habitat to occur in the study area is considered low.[90]

Critical Habitat

USFWS can designate critical habitat for species that have been listed by the federal government as threatened or endangered. *Critical habitat* is defined in Section 3(5)(A) of the FESA as those lands (or waters) within a listed species' current range that contain the physical or biological features that are considered essential to its conservation. Critical habitat for green sturgeon and Central California coast steelhead is designated in the San Francisco Bay and includes the waters within the study area.

Special-Status Fish Species

Special-status fish species known to occur within San Francisco Bay include green sturgeon, steelhead, Chinook salmon, longfin smelt, and Pacific herring.

Green Sturgeon (*Acipenser medirostris*)

Status

The southern Distinct Population Segment (DPS) of this species is federally listed as threatened and also is a CDFW Species of Special Concern.

General Ecology and Distribution

This anadromous fish is found in nearshore waters ranging from Mexico to the Bering Sea. Locally, adult green sturgeon have the potential to occur in the Pacific Ocean off Ocean Beach and migrate into freshwater beginning in late February, with spawning occurring in March through July. This species requires cold, freshwater streams with suitable gravel for spawning.

Study Area Occurrence

Adult green sturgeon migrate into freshwater beginning in late February with spawning occurring in the Sacramento River in late spring and early summer (March through July), with peak activity in April and June. After spawning, juveniles remain in fresh and estuarine waters for one to four years and then begin to migrate out to the sea.[91] The upper Sacramento River has been identified as the only known spawning habitat for green sturgeon in the southern distinct population segment.[92] According to recent studies, green sturgeon adults begin moving upstream through the bay during the winter.[93] Adults in the Bay-Delta are reported to feed on benthic invertebrates

---

90 Merkel & Associates, *San Francisco Bay Eelgrass Inventory; October–November 2014*, prepared for the California Department of Transportation and NOAA National Marine Fisheries Service, November 2014.

91 Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake, 1995. Fish Species of Special Concern in California. Second edition. Final report to California Department of Fish and Game, contract 2128IF.

92 Moyle, P. B., 2002. Inland Fishes of California. University of California Press, Berkeley, California. 106 113 p.

93 Kelly, J. T., A. P. Klimley, and C. E. Crocker, 2003. Movements of adult and sub-adult green sturgeon in the San Francisco Estuary. San Francisco Bay Delta Estuary, 6th Biennial State of the Estuary Conference, Poster, Abstract.

including shrimp, amphipods, and occasionally small fish,[94] while juveniles have been reported to feed on opossum shrimp and amphipods. Within the bays and estuaries, sufficient water flow is required to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds. Subadult and adult green sturgeon occupy a diversity of depths within bays and estuaries for feeding and migration. Tagged adults and subadults within the Bay-Delta have been observed occupying waters over shallow depths of less than 33 feet, either swimming near the surface or foraging along the bottom. Green sturgeon may temporarily enter the study area during foraging periods between spawning migration; as such, they have the potential to occur year-round. This species has a moderate potential to occur in the study area while foraging.

Pacific Herring (*Clupea pallasii*)

Status

Pacific herring is a CDFW-managed species and is protected in San Francisco Bay under the Marine Life Management Act, which provides guidance, in the form of FMPs, for the sustainable management of California's historic fisheries. The department, in partnership with the fishing industry and conservation groups, is currently updating the Pacific Herring FMP, which will formalize a strategy for the future management of the fishery.

General Ecology and Distribution

The Pacific herring is a small schooling marine fish that enters estuaries and bays to spawn. This species is known to spawn along the Oakland and San Francisco waterfronts and attach its egg masses to eelgrass, seaweed, and hard substrates such as pilings, breakwater rubble, and other hard surfaces. An individual can spawn only once during the season, and the spent female returns to the ocean immediately after spawning. Spawning usually takes place between October and March, with a peak between December and February. After hatching, juvenile herring typically congregate in San Francisco Bay during the summer and move into deeper waters in the fall. During the 2015–2016 season, spawning was observed at multiple locations between the Bay Bridge and Islais Creek, approximately 8 miles north of the project site.[95] However, no spawning in these locations was observed during the 2016–2017 spawning season.[96]

Study Area Occurrence

Pacific herring are known to occur along the San Francisco waterfront to the north of the study area; however, a lack of suitable spawning and rearing habitat adjacent to the study area makes their occurrence less likely. This species has a moderate potential to occur in the marine waters of the study area.

---

94 Moyle, et al. 1995. ibid.

95 California Department of Fish and Wildlife, Summary of the 2015–2016 Pacific Herring Spawning Population and Commercial Fisheries in San Francisco Bay, November 2016.

96 Ibid.

Central California coast DPS Steelhead (*Oncorhynchus mykiss*)

Status

The Central California Coast steelhead DPS is listed by NMFS as threatened and includes all naturally spawned populations of steelhead (and their progeny) in streams from the Russian River to Aptos Creek, Santa Cruz County, California (inclusive). It also includes the drainages of San Francisco and San Pablo bays.

California Central Valley steelhead are listed as threatened under the FESA. This DPS includes naturally spawned anadromous steelhead originating below natural and man-made impassable barriers from the Sacramento and San Joaquin rivers and their tributaries; it excludes such fish originating from San Francisco and San Pablo bays and their tributaries. This DPS does include steelhead from two artificial propagation programs: the Coleman National Fish Hatchery Program and the Feather River Fish Hatchery Program.

General Ecology and Distribution

Steelhead are born in freshwater streams where they spend their first one to three years of life. They then emigrate to the ocean, where they spend one to four years. They return to their native freshwater stream to spawn, typically during the rainy season in California. Unlike salmon, steelhead may not die after spawning and are able to spawn more than once.

Study Area Occurrence

Little is known about transit times and migratory pathways of steelhead within San Francisco Bay. A 2008-2009 study on the migration and distribution of juvenile hatchery-raised steelhead released in the lower Sacramento River show that steelhead spend an average of 2.5 days in transit time within San Pablo and San Francisco bays. The study concluded that transit time was greater in the upper estuary than in the lower estuary (San Francisco Bay).[97] This could be due to the lower salinity in the upper estuary that serves as a transition zone between freshwater and saltwater, allowing steelhead to adjust from freshwater to saltwater. Once steelhead reach San Francisco Bay, salinities are similar to ocean water, which may lead steelhead to spend less time in this portion of the estuary. Although information on migratory pathways of juvenile steelhead were largely inconclusive, a positive correlation between smolt captures and water depth was observed between 3 and 37 feet,[98] suggesting that the deeper the water the more fish were present (up to 37 feet deep). Studies conducted by NMFS[99] and CDFW[100] indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Strait and north of Yerba Buena Island). Additionally, a recent study evaluating 30 years of Interagency

---

97 Klimley, P., D. Tu, W. Brostoff, P. LaCivita, A. Bremner, and T. Keegan, Juvenile Salmonid Outmigration and Distribution in the San Francisco Estuary: 2006–2008 Interim Draft Report, prepared for U.S. Army Corps of Engineers, 2009.

98 Klimley et al. 2009, ibid.

99 National Marine Fisheries Service, *Biological Opinion for the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project*, 2001.

100 Baxter, R., Hieb, K., DeLeon, S., Fleming, K., and J. Orsi, *Report on the 1980–1995 fish, shrimp, and crab sampling in the San Francisco estuary, California*. Prepared for The Interagency Ecological Program for the Sacramento-San Joaquin Estuary. California Department of Fish and Game, Stockton, California, 2009.

Ecological Program monthly mid-water fish trawl data and three years of acoustic tag data of hatchery-raised salmonids suggests that the presence of out-migrating juvenile salmonids (steelhead and salmon) along the San Francisco waterfront appeared to be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the bay.[101] Within the study area, steelhead are unlikely to occur outside of in-migration and out-migration periods, but have a moderate potential to occur on a transient basis during migration.

Longfin Smelt (*Spirinchus thaleichthys*)

Status

This species is state-listed as threatened and is a federal candidate species.

General Ecology and Distribution

The longfin smelt is a small, slender-bodied pelagic fish that measures about 3 inches in length as an adult. The species generally lives for two years although some three-year smelt have been observed.

Pre-spawning longfin smelt migrate upstream into the lower reaches of rivers during the late fall and winter. Smelt have adhesive eggs, which are deposited on sand, gravel, rocks, submerged aquatic vegetation, and other hard substrates during spawning. Spawning typically occurs during the late winter and early spring (mid- to late February) but varies among years in response to factors such as seasonal water temperatures. During spawning each female produces approximately 5,000 to 24,000 eggs, and it is estimated that total reproduction within a year is in the hundreds of millions of eggs or more.[102] As with most fish, mortality rates for eggs and larvae in longfin smelt are high. Those that survive to the planktonic larval stage are transported into the western Bay-Delta and Suisun Bay during the late winter and spring where juveniles rear.

Longfin smelt have a two-year lifecycle and reside as juveniles and pre-spawning adults in the more saline habitats within San Pablo Bay and Central Bay during a majority of their life.[103] Movement patterns based on catches in CDFW fishery sampling suggest that longfin smelt actively avoid water temperatures greater than 22°C (72°F).[104] These conditions occur within the Bay-Delta during the summer and early fall, when longfin smelt inhabit more marine waters further downstream in the bays and are not present within the Bay-Delta.

Study Area Occurrence

Longfin smelt are most common in Central San Francisco Bay during the late summer months before migrating upstream in fall and winter. During winter months, when fish are moving upstream to spawn, high outflows may push many back into San Francisco Bay.[105] This species has a high potential to occur in the study area.

---

101 Jahn, A., *Young Salmonid Out-migration Through San Francisco By with Special Focus on their Presence at the San Francisco Waterfront*. Draft Report. Prepared for the Port of San Francisco, January 2011.

102 Moyle, P.B., *Inland Fishes of California*. University of California Press, 2002.

103 Ibid.

104 Baxter et al., 1999. op. cit.

105 Moyle, P.B., 2002.

2.2.9 Marine Mammals

The Marine Mammal Protection Act (MMPA) was enacted on October 21, 1972, to protect all marine mammals. In addition to protection under the MMPA, some of the marine mammal species are listed under the FESA. California sea lion and Pacific harbor seal are observed throughout the year in San Francisco Bay, primarily in the Central Bay (the area bounded by the Golden Gate Bridge, the Bay Bridge, and the Richmond–San Rafael Bridge), outside the study area; however, these species are the most commonly observed marine mammals in San Francisco Bay and have been observed at SFO. These species have a moderate potential to occur in the study area. Harbor porpoise is also observed regularly in San Francisco Bay, but is rarely observed in areas outside of the Golden Gate Bridge and Richardson Bay,[106] and have a low likelihood to occur in the study area; therefore, harbor porpoise is not discussed further.

Pacific Harbor Seal (*Phoca vitulina richardii*)

Status

Pacific harbor seal is afforded protection by the MMPA of 1972. Pacific harbor seals in the U.S. are not listed as "endangered" or "threatened" under the Endangered Species Act nor designated as "depleted" under the MMPA.[107]

General Ecology and Distribution

There are up to 500 haul-out sites for the harbor seal distributed along their Pacific coast range. California's population is estimated at 30,968 individuals.[108] The harbor seal is a permanent resident in San Francisco Bay. Harbor seals have established haul out sites at Castro Rocks in San Pablo Bay, Yerba Buena Island in the Central Bay, and Mowry Slough in the South Bay.[109]

San Francisco Bay Pacific harbor seal counts ranged from 524 to 641 seals from 1987 to 1999.[110] Marine mammal monitoring conducted by the California Department of Transportation from May 1998 to February 2002 reported that at least 500 harbor seals populate San Francisco Bay.[111] The

---

106 Port of San Francisco, 2018. Mission Bay Ferry Landing and Water Taxi Landing Incidental Harassment Authorization, June 2018.

107 National Oceanic and Atmospheric Association. 2019; U.S. Pacific Marine Mammal Stock Assessments, 2018, *https://www.fisheries.noaa.gov/resource/document/us-pacific-marine-mammal-stock-assessments-2018*, accessed February 22, 2021.

108 National Oceanic and Atmospheric Association. 2019; U.S. Pacific Marine Mammal Stock Assessments, 2018, *https://www.fisheries.noaa.gov/resource/document/us-pacific-marine-mammal-stock-assessments-2018,* accessed February 22, 2021.

109 National Oceanic and Atmospheric Association. 2007. Citing Grigg, E. K., S. G. Allen, D. E. Green, and H. Markowitz. 2004. Harbor Seal, *Phoca vitulina richardii*, Population Trends in the San Francisco Bay Estuary, 1970–2002. California Fish and Game 90(2): pp 51-70.

110 Goals Project. 2000. Baylands Ecosystem Species and Community Profiles: Life Histories and Environmental Requirements of Key Plants, Fish, and Wildlife of the San Francisco Bay Area. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project, P.R. Olofson, ed. San Francisco Bay Regional Water Quality Control Board, Oakland, CA, *http://cdm15024.contentdm.oclc.org/cdm/singleitem/collection/p178601ccp2/id/2561*.

111 Green, D.E., E. Grigg, S. Allen, and H. Markowitz. 2006. Monitoring the potential impact of the seismic retrofit construction activities at the Richmond-San Rafael Bridge on harbor seals (*Phoca vitulinarichardsi)* May 1, 1998–September 15, 2005.

San Francisco Estuary Partnership in their 2015 Status update reported a mean of 328 harbor seals, excluding pups, which was based on the annual maximum number of seals counted at Yerba Buena Island and Castro Rocks from 2000 to 2010.[112]

Study Area Occurrence

The main pupping areas in San Francisco Bay are at Mowry Slough and Castro Rocks.[113] Pupping season for harbor seals in San Francisco Bay spans from approximately March 15 through May 31, with pup numbers generally peaking in late April or May. Births of harbor seals have not been observed at Corte Madera Marsh and Yerba Buena Island, but a few pups have been seen at these sites. The Bay-Delta harbor seal population is estimated at between 500 and 700 individuals.[114] Harbor seals have been observed somewhat regularly throughout the year in the study area between 2015 and 2020 and have a moderate potential to occur in the study area.

California Sea Lion (*Zalophus californianus*)

Status

California sea lion is afforded protection by the MMPA of 1972. California sea lions in the U.S. are not listed as “endangered” or “threatened” under the Endangered Species Act nor designated as “depleted” under the MMPA.[115]

General Ecology and Distribution

The California sea lion population is estimated at 257,606 individuals. [116] The species generally ranges from Baja California, Mexico to Vancouver Island; however, their breeding range is restricted from Año Nuevo Island in Central California in the north, to the tip of Baja California in the south, with the Farallon and Channel Islands being their primary breeding areas. California sea lions forage in nearshore coastal waters and generally remain within 20 miles of land. This species may travel up large rivers, such as the Sacramento River. California sea lions prefer to haul out on islands, such as the Farallon Islands and Año Nuevo, but will also use mainland areas, such as the Point Reyes Headlands, and man-made structures, such as Pier 39 in San Francisco, the Monterey Bay breakwater, and buoys.[117] The greatest numbers of sea lions occur in the Bay-

[112] San Francisco Estuary Partnership. 2015. State if the Estuary 2015. Status and Trends Updates on 33 indicators of Ecosystem Health, *http://www.sfestuary.org/our-estuary/soter/*.

[113] California Department of Transportation, 2012. Request for Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting from Activities Associated with the Dismantling of the Existing East Span of the San Francisco-Oakland Bay Bridge.

[114] National Oceanic and Atmospheric Association, 2007. op. cit.

[115] National Oceanic and Atmospheric Association. 2019; U.S. Pacific Marine Mammal Stock Assessments, 2018, *https://www.fisheries.noaa.gov/resource/document/us-pacific-marine-mammal-stock-assessments-2018,* accessed February 22, 2021.

[116] Ibid.

[117] Allen, S.G., Mortenson, J., Webb, S. *Field Guide to Marine Mammals of the Pacific Coast*. University of California Press, 2011.

Delta during their migration to and from their primary breeding areas in spring and late summer, and when Pacific herring inhabit the Bay-Delta to spawn from November through March.[118]

Study Area Occurrence

Pier 39 is the only California sea lion haul-out site identified within San Francisco Bay and there are no known breeding sites within the bay. The study area is not along a migration route; however, California sea lions may enter the study area to forage. A California sea lion has been found on the SFO airfield at least twice, most recently in 2020.[119]

118 Ibid.

119 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, personal communication, February 22, 2021.

Appendix A
Additional Reviewed Resources

<u>**Additional Reviewed Resources for the SFO Shoreline Protection Study Biological Resources Technical Memorandum**</u>

City and County of San Francisco. 2016. San Francisco Sea Level Rise Action Plan. March, 2016.

Dudek, 2018. Biological Assessment San Francisco International Airport Proposed Taxi Runway Improvements Project. Submitted to Federal Aviation Administration San Francisco Airports District Office. Prepared for City and County of San Francisco San Francisco Airport Commission. May 2018.

LSA Associates, Inc. 2011. Results of Botanical Assessment and Focused Survey for Special-status Plants for the Proposed Runway Safety Area Project, San Francisco International Airport. October 27, 2011.

———, 2011. Biological Assessment. San Francisco International Airport Runway Safety Area Project. Submitted to San Francisco International Airport Bureau of Planning and Environmental Affairs and Federal Aviation Administration Airports Division, Western Pacific Region. LSA Project No. SFI0901. May 17, 2011.

———, 2016. Request for Verification of Clean Water Act Jurisdictional Delineation Adjacent to Runway 1R, San Francisco International Airport. April 28, 2017.

National Marine Fisheries Service, 2011. Endangered Species Act Section 7(a)(2) Consultation Letter Response for the Runway Safety Areas (RSA) Project at the San Francisco International Airport in San Mateo County, California. 2011/02063. November 3, 2011.

———, 2018. Endangered Species Act Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Taxiway Improvements Project at the San Francisco International Airport in San Mateo County, California. NMFS No: WCR-2018-10404. September 21, 2018.

San Francisco International Airport. 2013. SFO Shoreline Protection Study San Francisco, CA. Coastal Engineering Analysis Report – Administrative Draft.

———, 2013. SFO Shoreline Protection Study San Francisco, CA. Initial Site Assessment Report – Administrative Draft.

———, 2014. Wildlife Hazard Assessment. Prepared for San Francisco International Airport Bureau of Planning and Environmental Affairs and Operations and Security – Airfield Operations. Prepared by Albion Environmental, Inc. Updated/revised by LSA Associates, Inc. October 2012, updated/revised June 2014.

———, 2016. Biological Assessment. San Francisco International Airport Wildlife Hazard Management Plan. Submitted to Federal Aviation Administration Airports Division, Western Pacific Region and Federal Aviation Administration Airports Division, San Francisco Airports District Office. Prepared by San Francisco International Airport Planning and Environmental Affairs and LSA Associates, Inc. May 4, 2016.

———, 2016. Wildlife Hazard Management Plan. Prepared in association with ICF Jones & Stokes and LSA Associates, Inc. April 12, 2016.

———, 2018. San Francisco International Airport Shoreline Protection Program Conceptual Design Development Report. Volume 1. Prepared by Telemon Engineering Consultants, Inc. and AECOM. March 30, 2018.

———, 2018. San Francisco International Airport Shoreline Protection Program Conceptual Design Study. Prepared by AECOM, Environmental Science Associates, and Telemon Engineering Consultants, Inc. March, 2018.

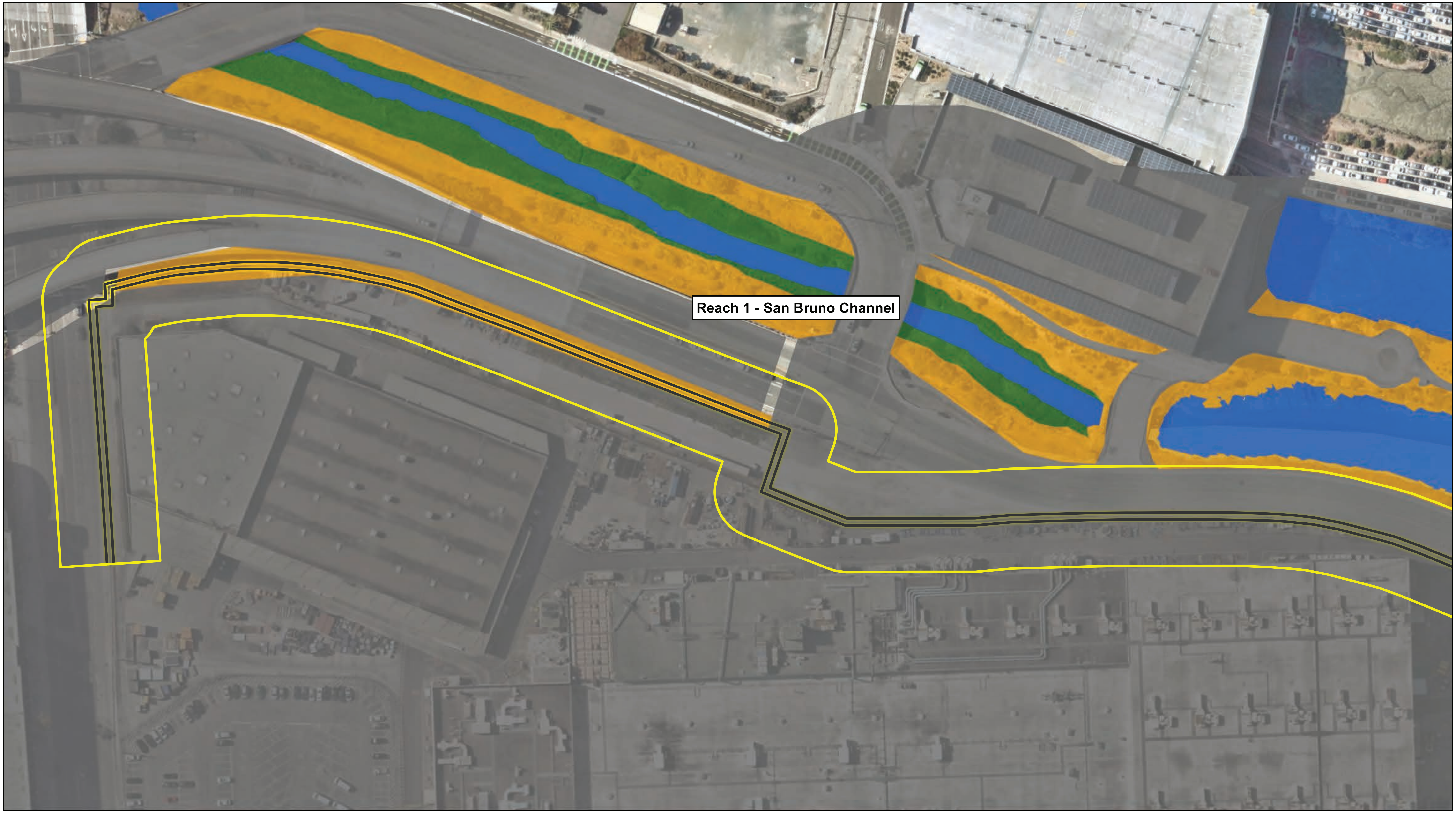
San Francisco Planning Department. 1991. San Francisco International Airport Master Plan Final Environmental Impact Report. City and County of San Francisco Planning Department. SCH #90030535.

———, 2011. Initial Study. San Francisco International Airport Runway Safety Area Program. Case No. 2010.0755E. November 2011.

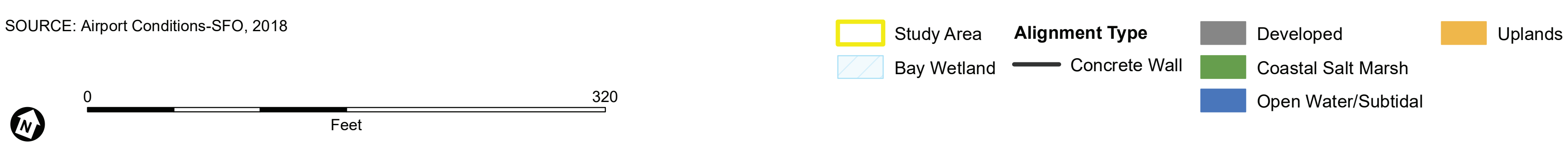
U.S. Fish and Wildlife Service. 2016. Informal Consultation on the San Francisco International Airport Wildlife Hazard Management Plan in San Mateo County, California. No. 08ESMF00-2016-I-1786. July 17, 2016.

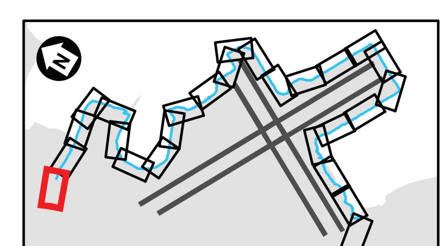
———, 2018. Informal Section 7 Consultation on the San Francisco International Airport Proposed Taxiway Improvement Project in San Mateo County, California. No. 08FBDT00-2018-1-0291. October 12, 2018.

Appendix B
Habitats within the Shoreline Protection Program Study Area



SOURCE: Airport Conditions-SFO, 2018

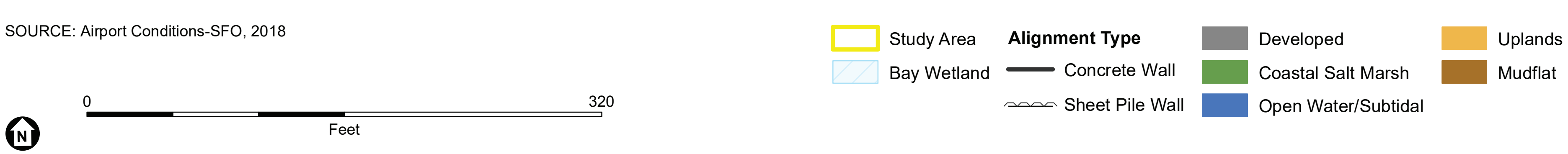


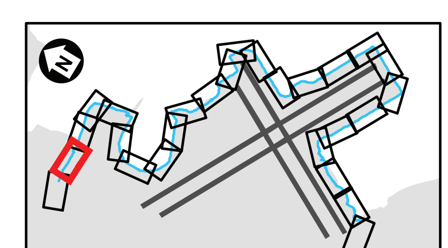


SFO Shoreline Protection Program Project

Appendix B-1
Reach 1

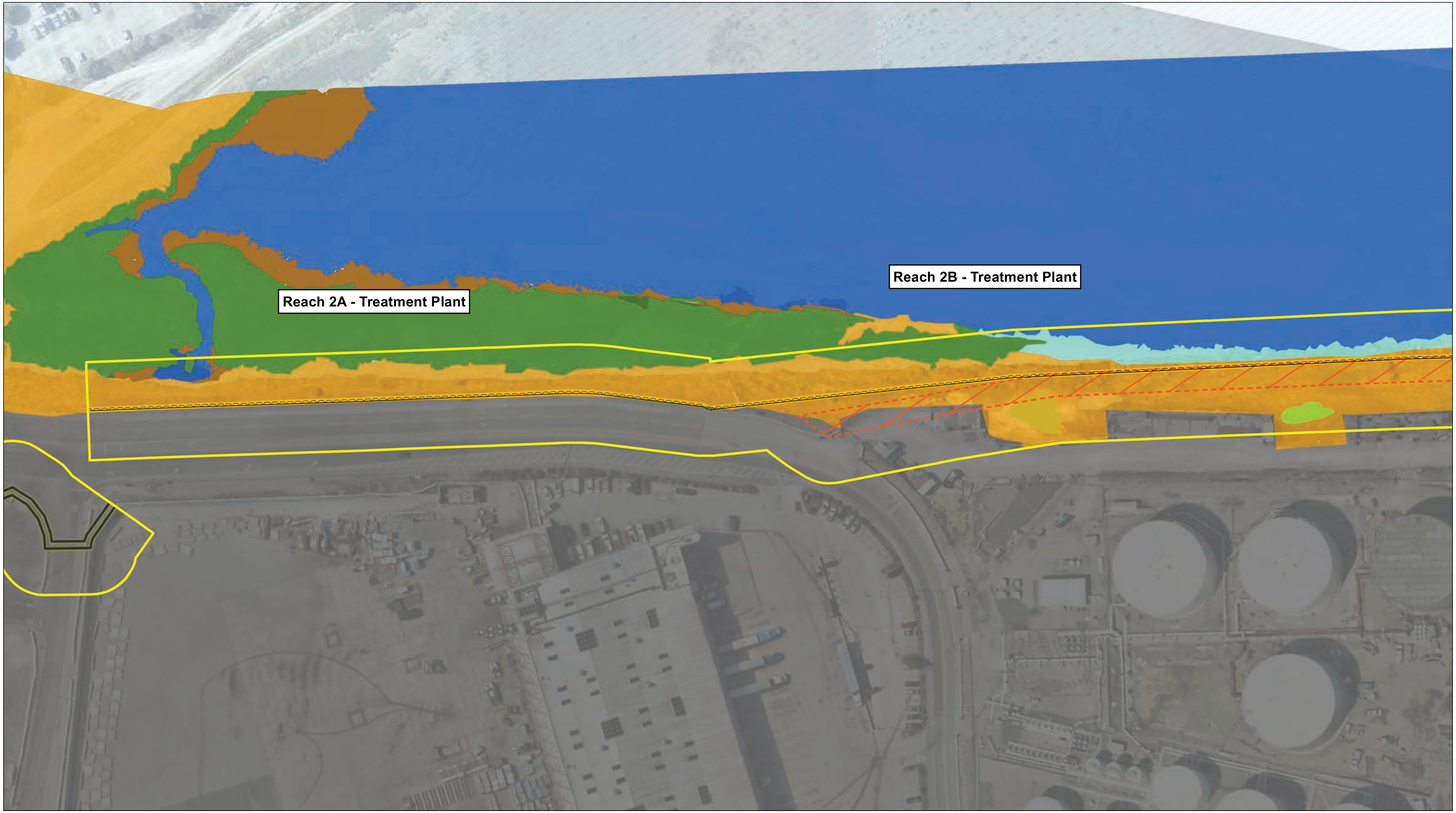
SOURCE: Airport Conditions-SFO, 2018





SFO Shoreline Protection Program Project

Appendix B-2
Reach 1



SOURCE: Airport Conditions-SFO, 2018

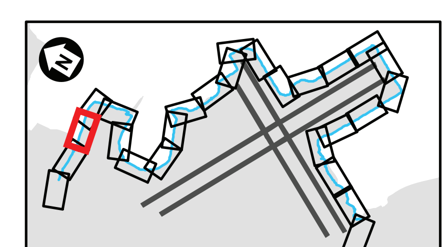
0 320
Feet

Study Area
Proposed Access Road
Bay Wetland

Alignment Type
Concrete Wall
Sheet Pile Wall

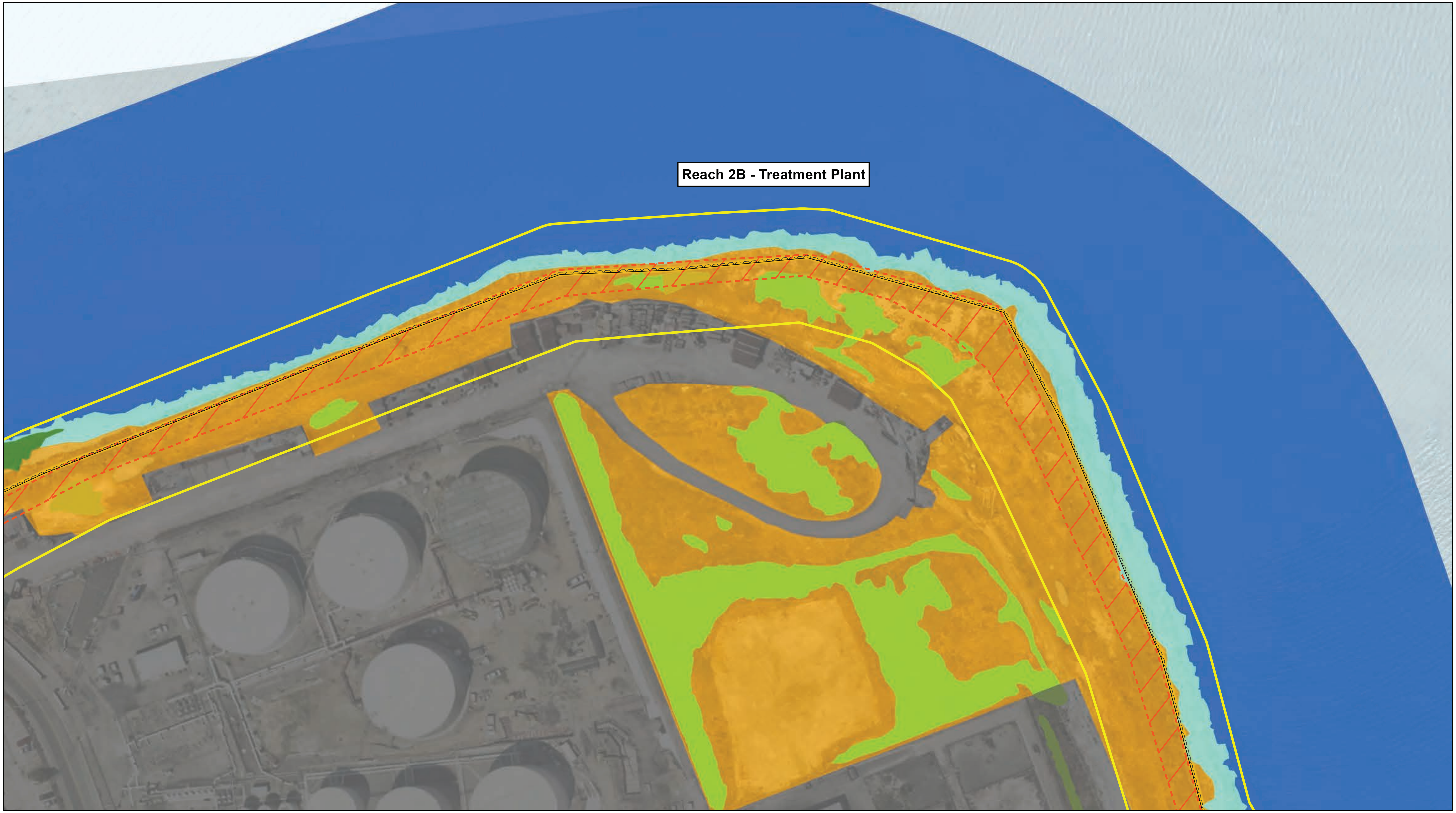
Developed
Coastal Salt Marsh
Seasonal Wetland
Rock/Intertidal
Open Water/Subtidal

Uplands
Mudflat

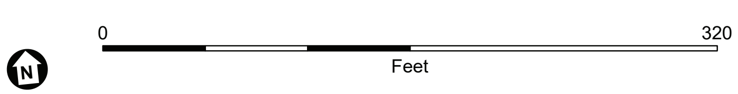


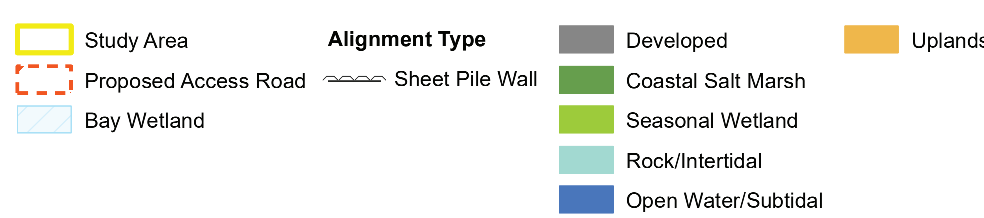
SFO Shoreline Protection Program Project

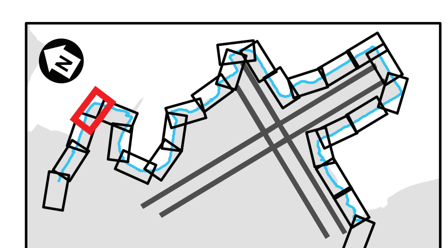
Appendix B-3
Reach 2A and 2B



SOURCE: Airport Conditions-SFO, 2018

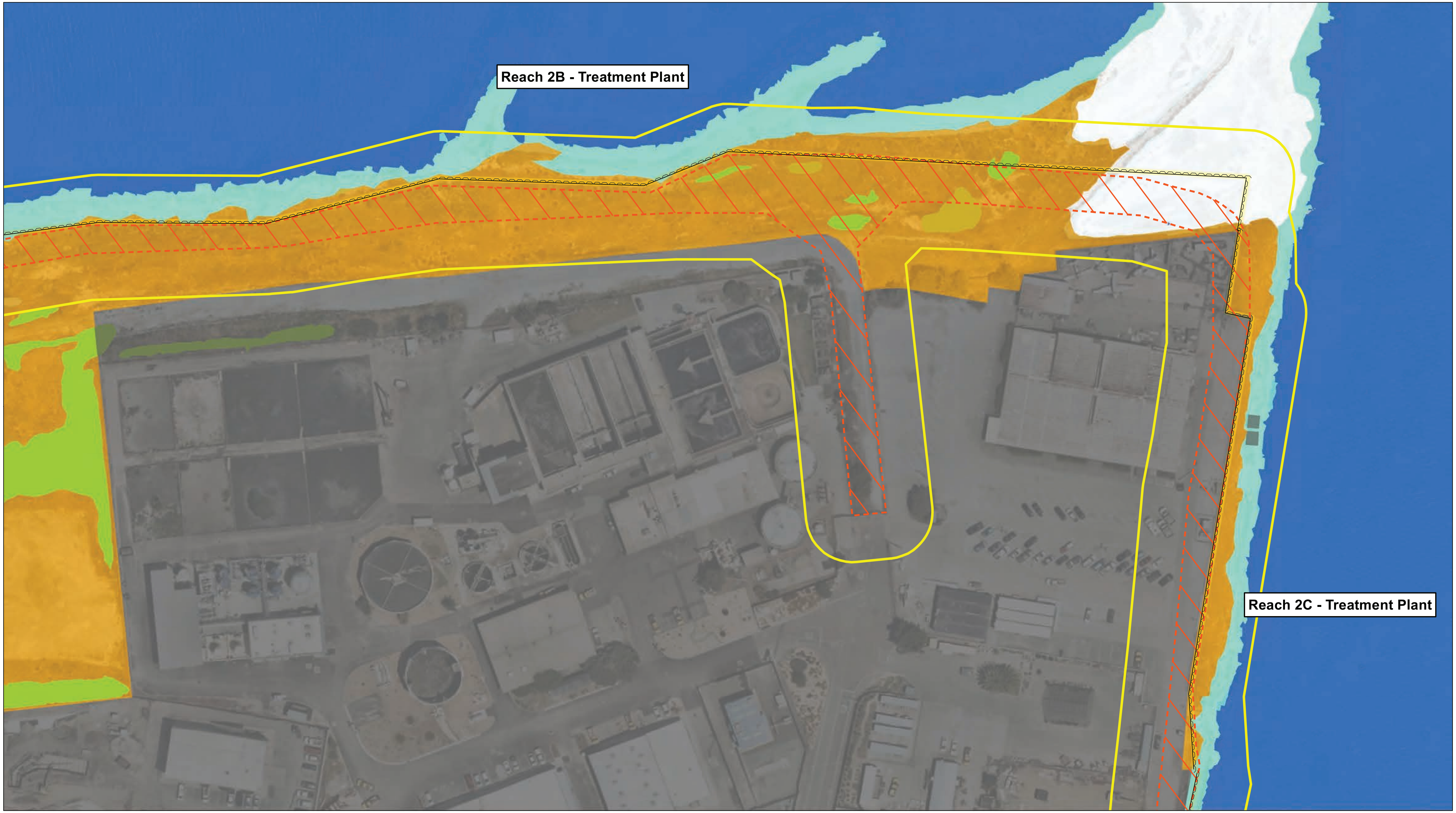






SFO Shoreline Protection Program Project

Appendix B-4
Reach 2B

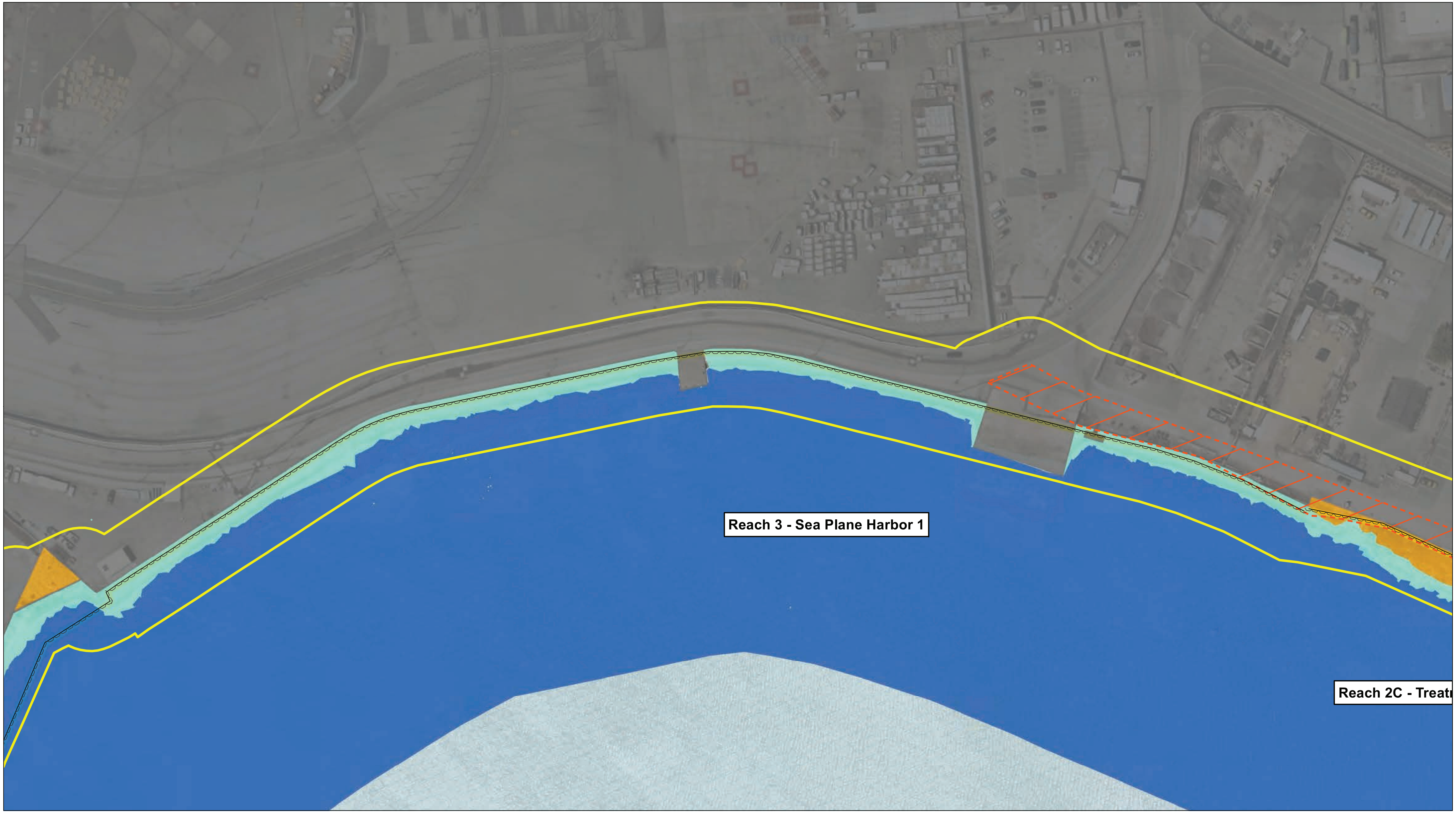


SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Proposed Access Road
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Seasonal Wetland
Rock/Intertidal
Open Water/Subtidal
Uplands
Salt Panne/Unvegetated

Appendix B-5
Reach 2B and 2C

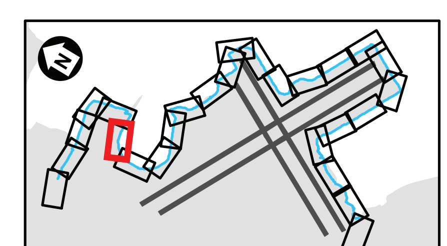


SOURCE: Airport Conditions-SFO, 2018

Study Area
Proposed Access Road
Bay Wetland

Alignment Type
Sheet Pile Wall

Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

Appendix B-6
Reach 3

SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands

SFO Shoreline Protection Program Project

Appendix B-7
Reach 4

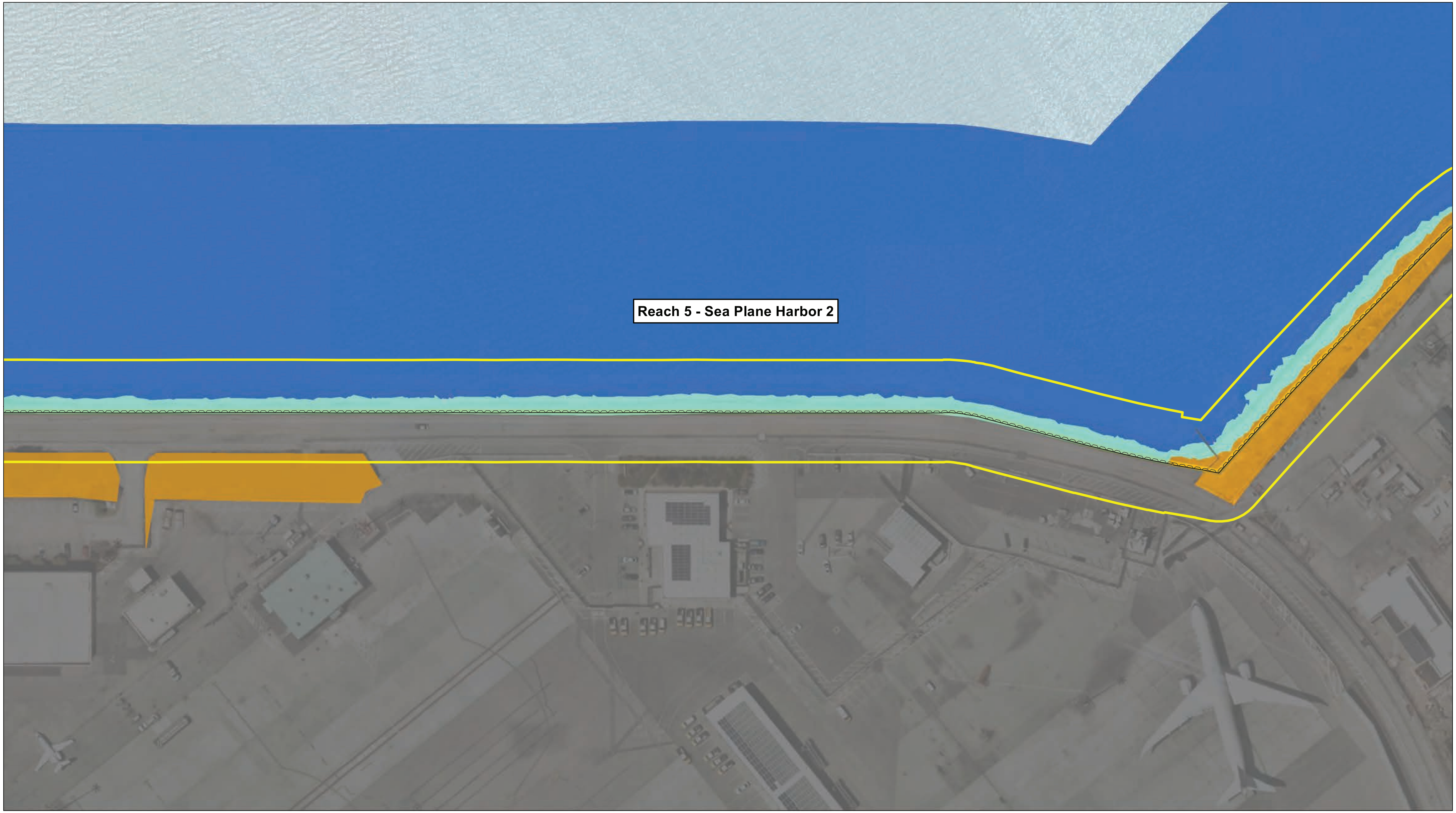
SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands

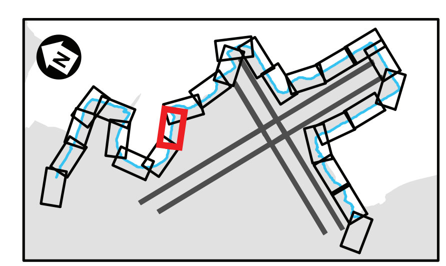
SFO Shoreline Protection Program Project

Appendix B-8
Reach 5



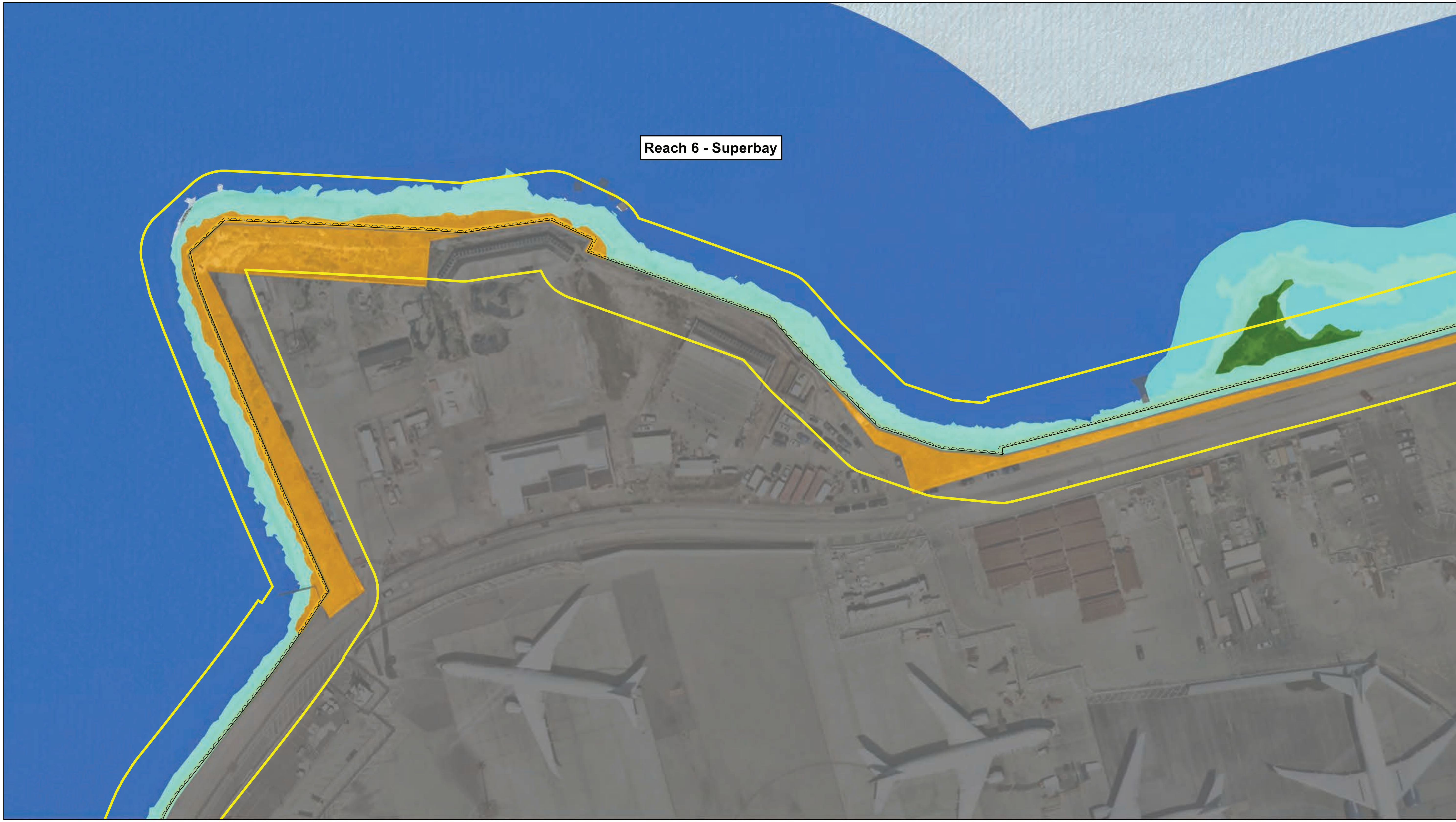
SOURCE: Airport Conditions-SFO, 2018

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

Appendix B-9
Reach 5



SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands

SFO Shoreline Protection Program Project

Appendix B-10
Reach 6

SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

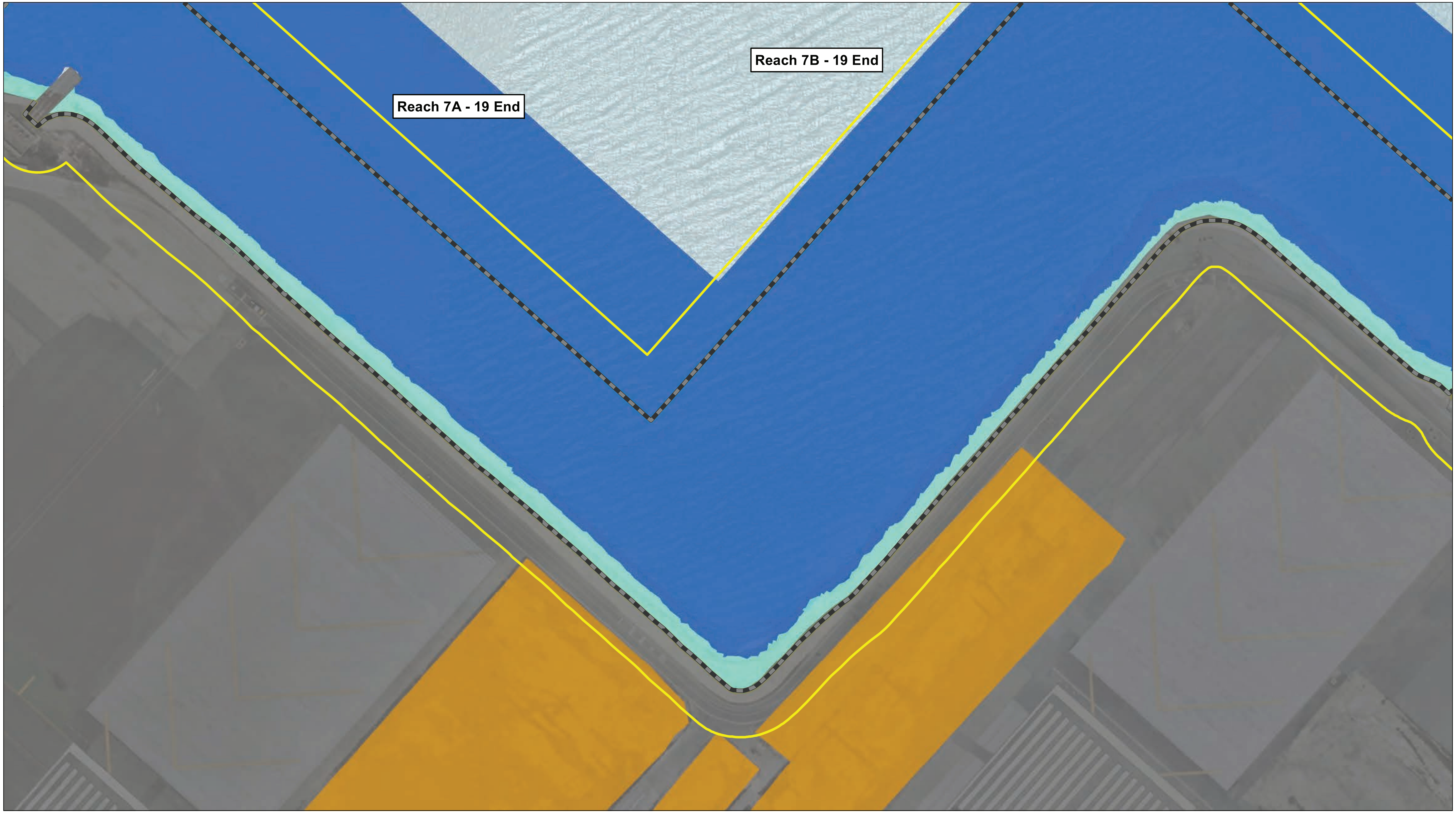
Study Area
Bay Wetland

Alignment Type
King Pile
Sheet Pile Wall

Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands

SFO Shoreline Protection Program Project

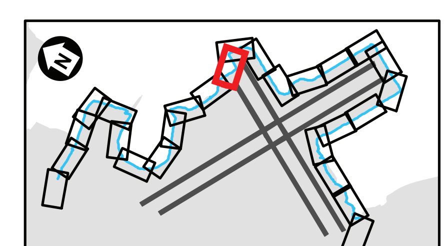
Appendix B-11
Reach 6 and 7A



SOURCE: Airport Conditions-SFO, 2018

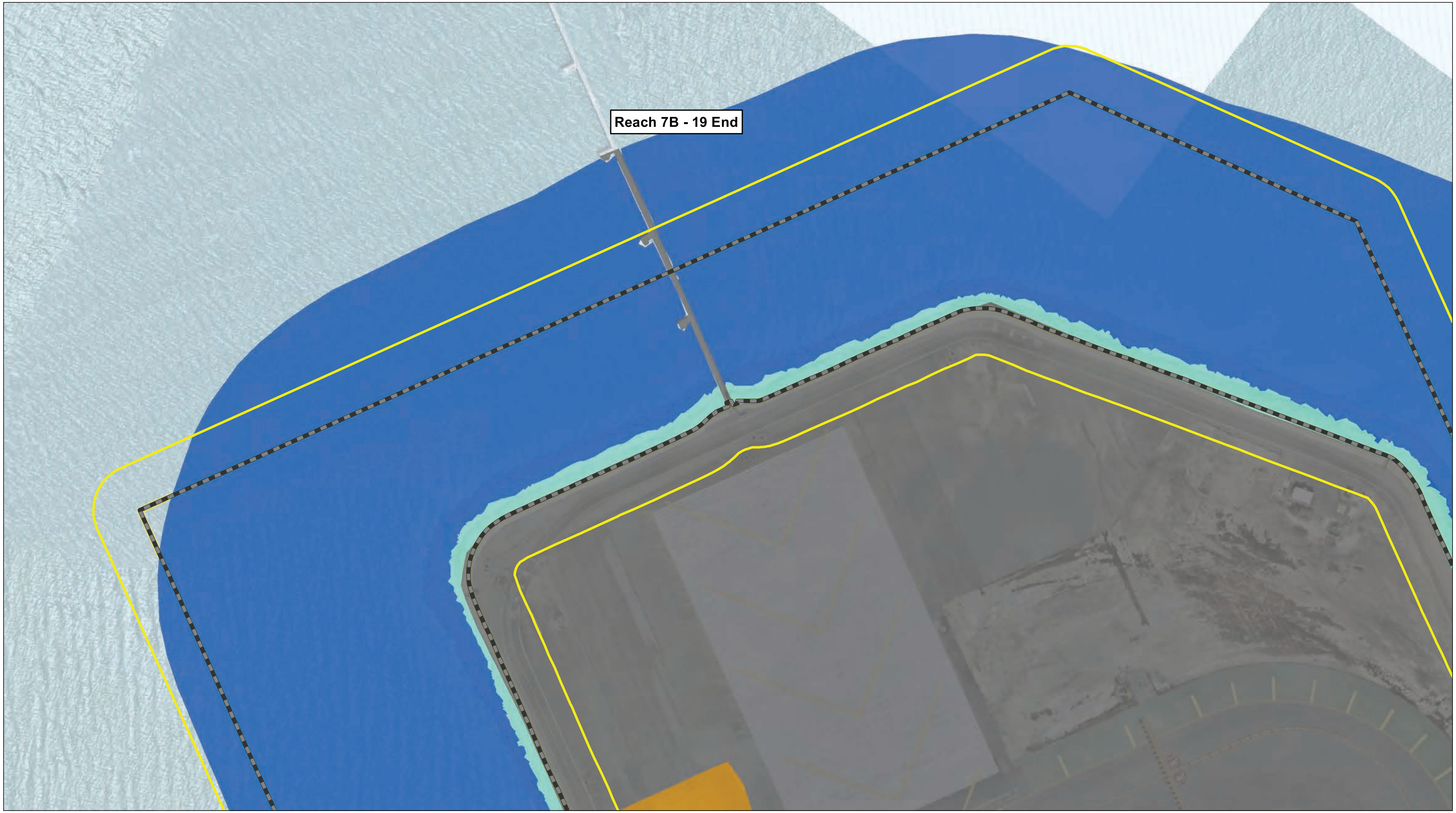
0 320
Feet

Study Area
Bay Wetland
Alignment Type
King Pile
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

Appendix B-12
Reach 7A and 7B



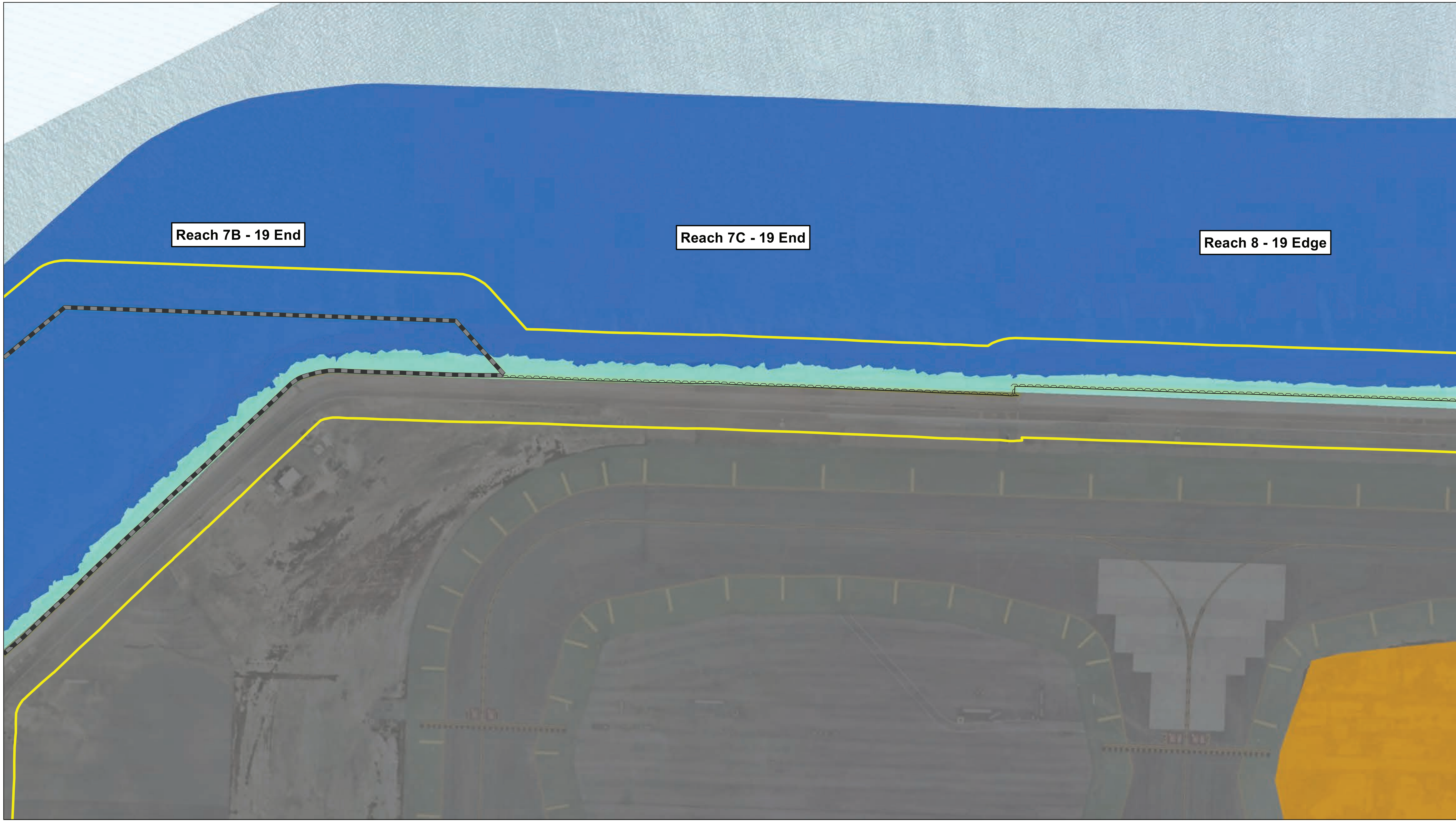
SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
King Pile
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands

SFO Shoreline Protection Program Project

Appendix B-13
Reach 7B



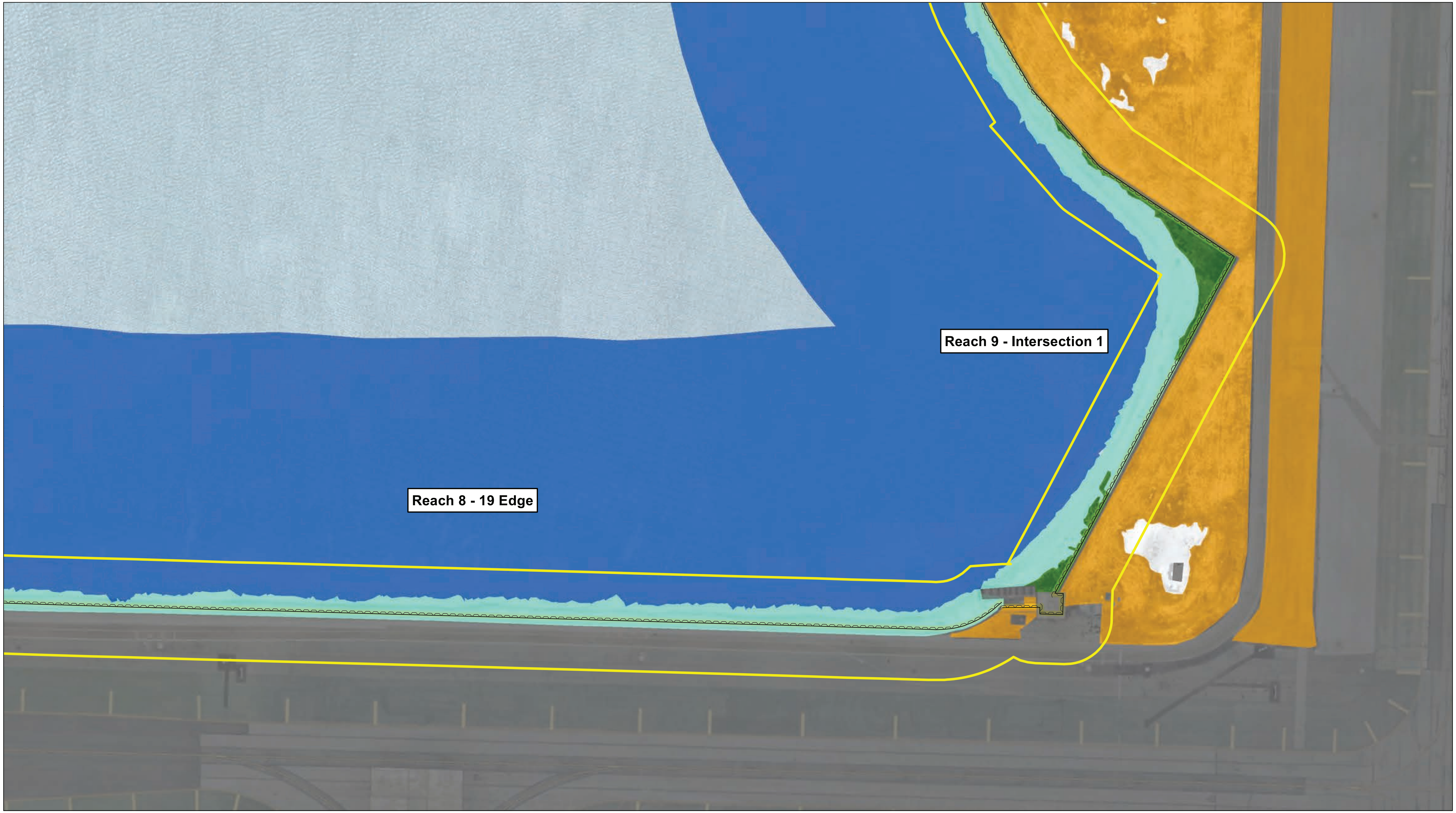
SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
King Pile
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands

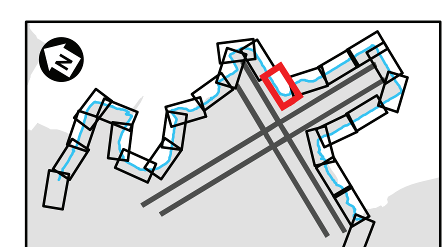
SFO Shoreline Protection Program Project

Appendix B-14
Reach 7B, 7C and 8



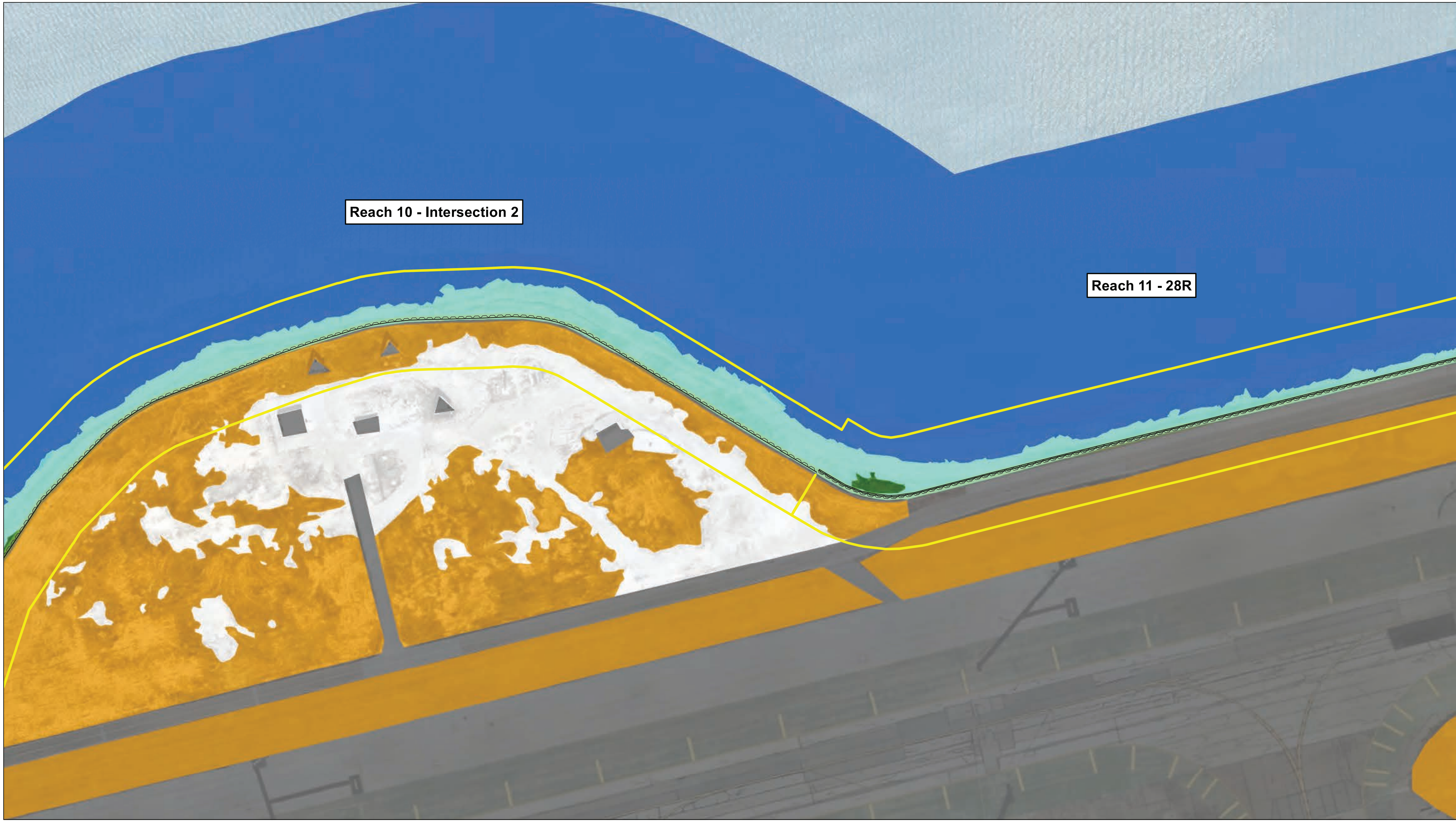
SOURCE: Airport Conditions-SFO, 2018

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands
Salt Panne/Unvegetated



SFO Shoreline Protection Program Project

Appendix B-15
Reach 8 and 9 s



SOURCE: Airport Conditions-SFO, 2018

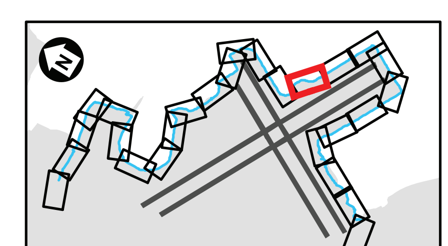
0 320
Feet

Study Area
Bay Wetland

Alignment Type
Sheet Pile Wall

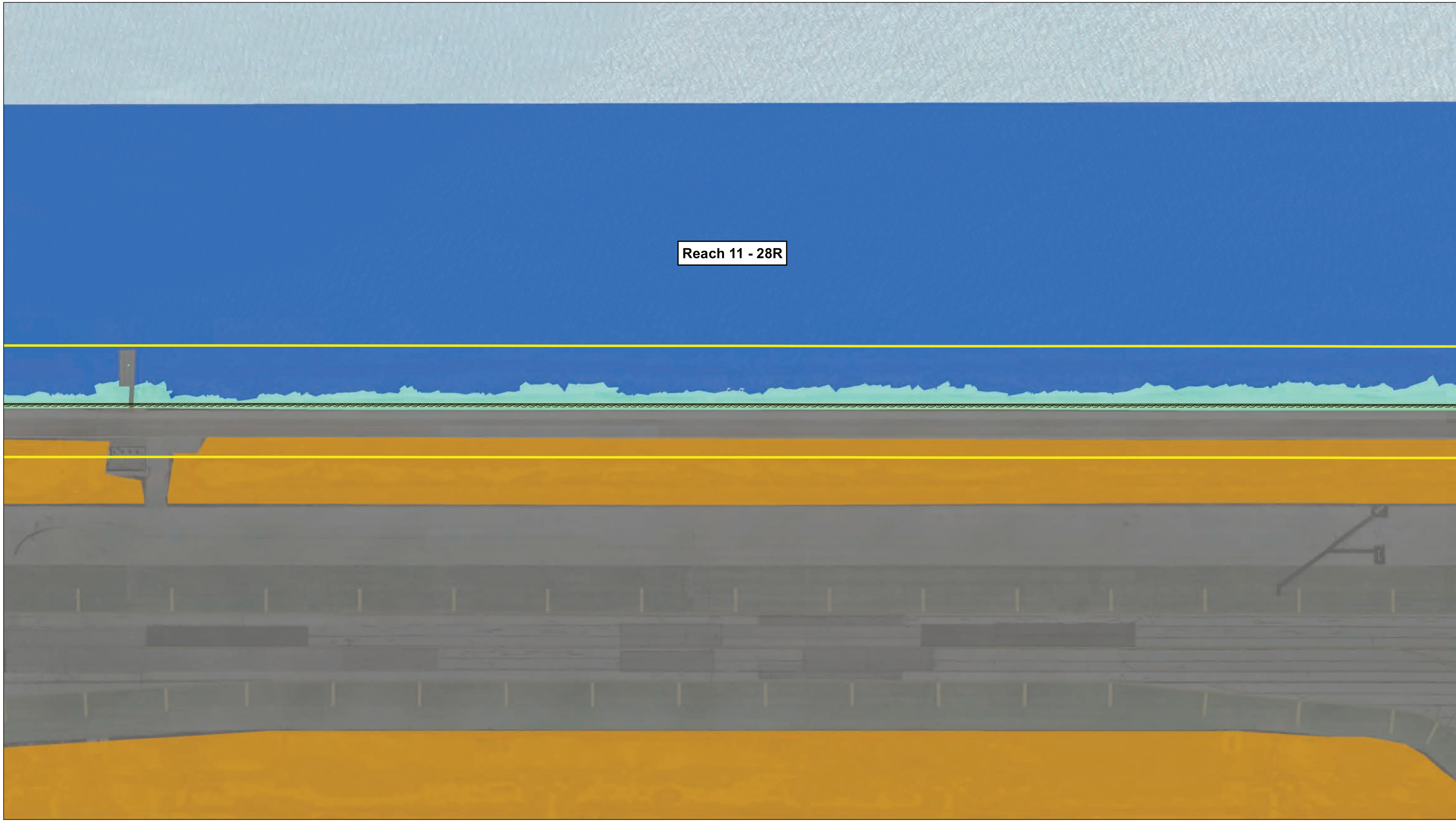
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal

Uplands
Salt Panne/Unvegetated



SFO Shoreline Protection Program Project

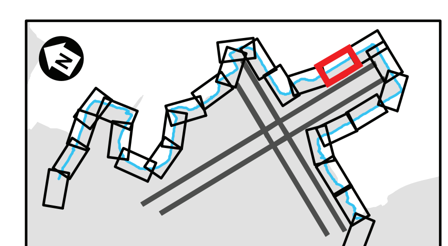
Appendix B-16
Reach 10 and 11



SOURCE: Airport Conditions-SFO, 2018

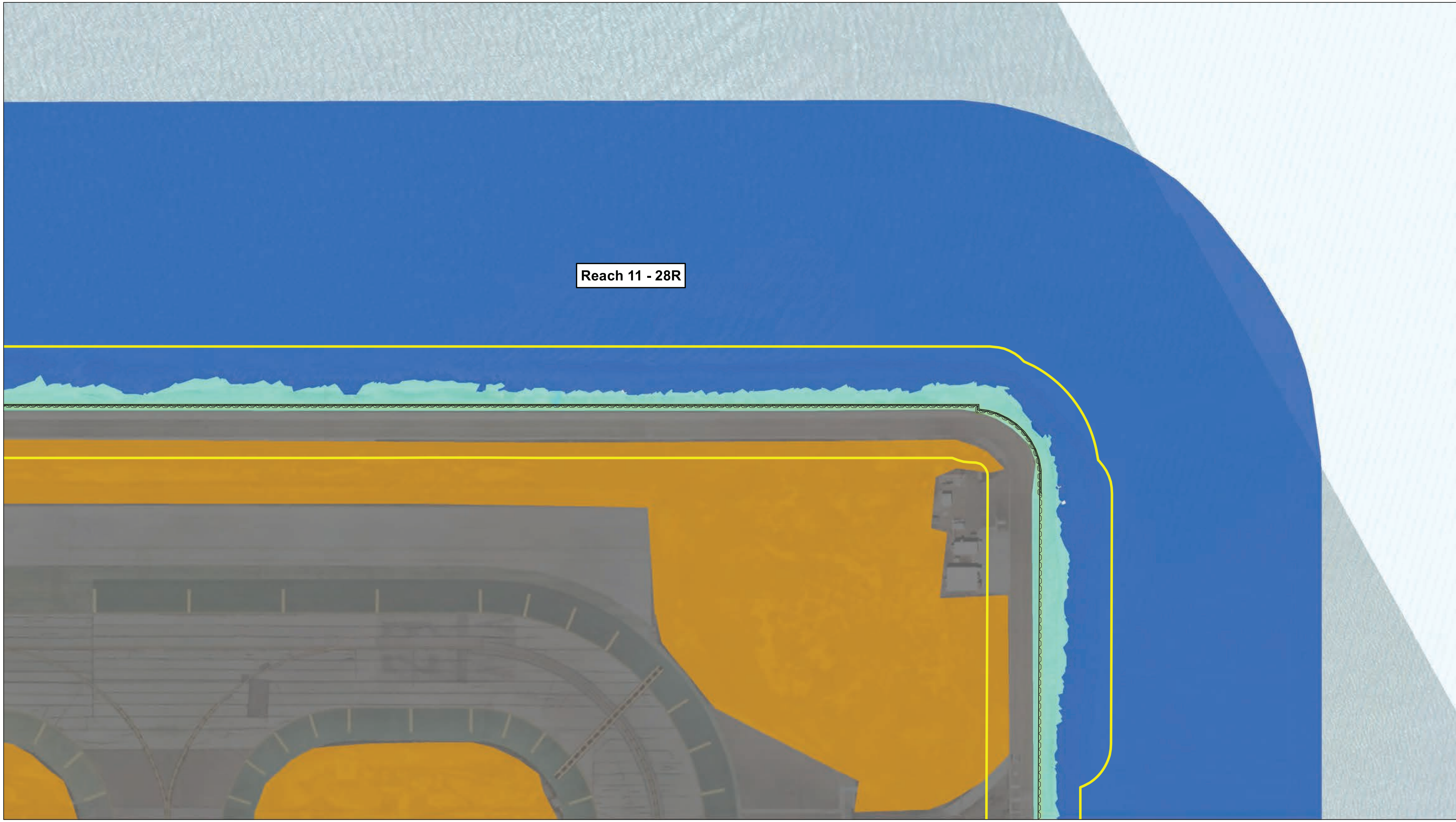
0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

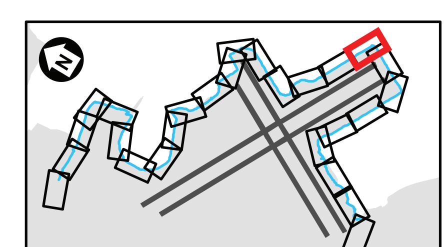
Appendix B-17
Reach 11



SOURCE: Airport Conditions-SFO, 2018

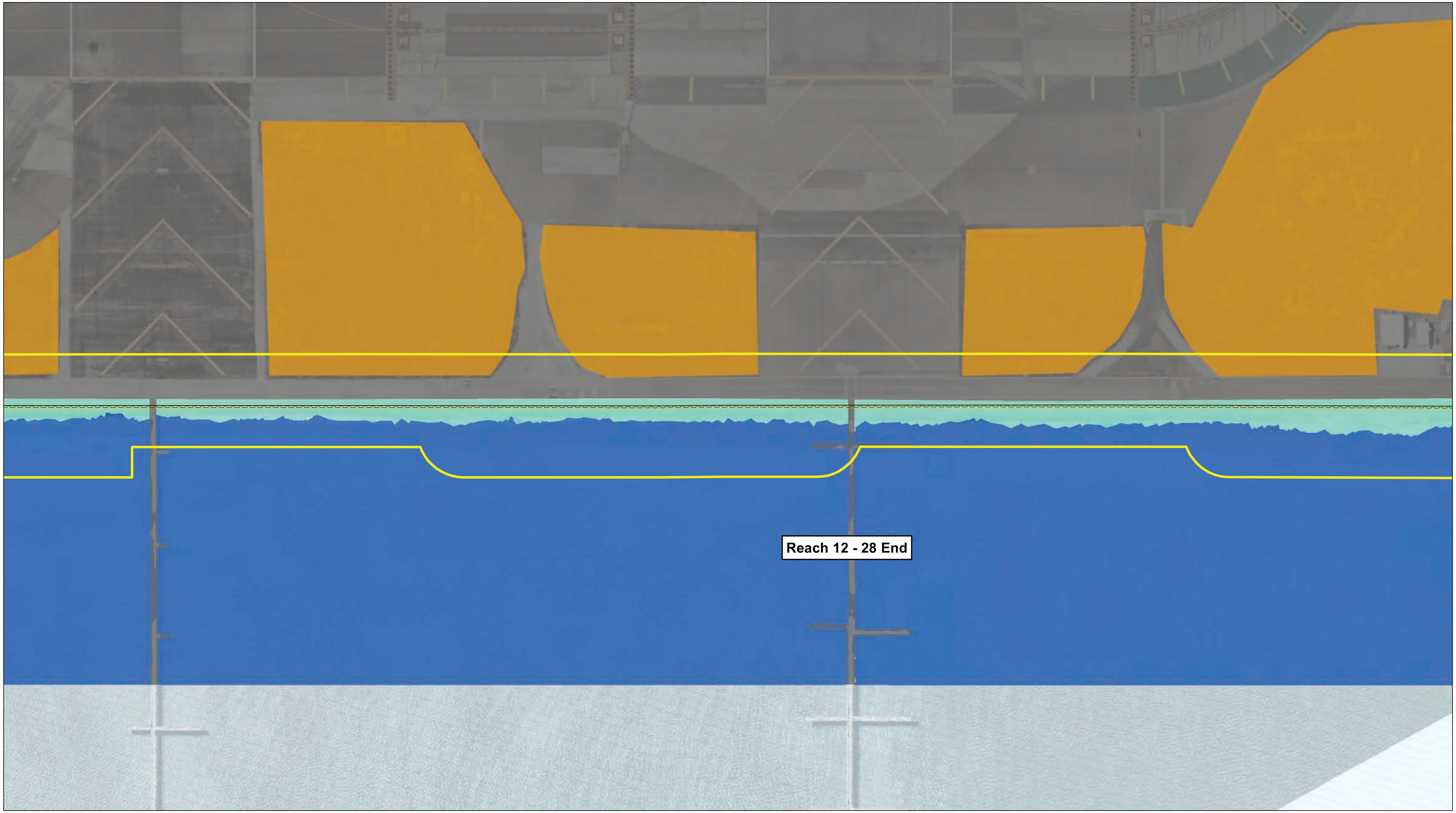
0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

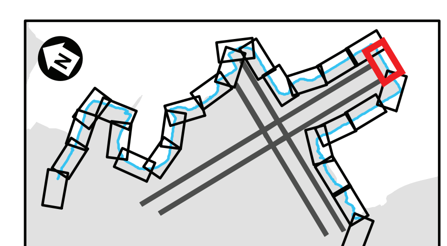
Appendix B-18
Reach 11



SOURCE: Airport Conditions-SFO, 2018

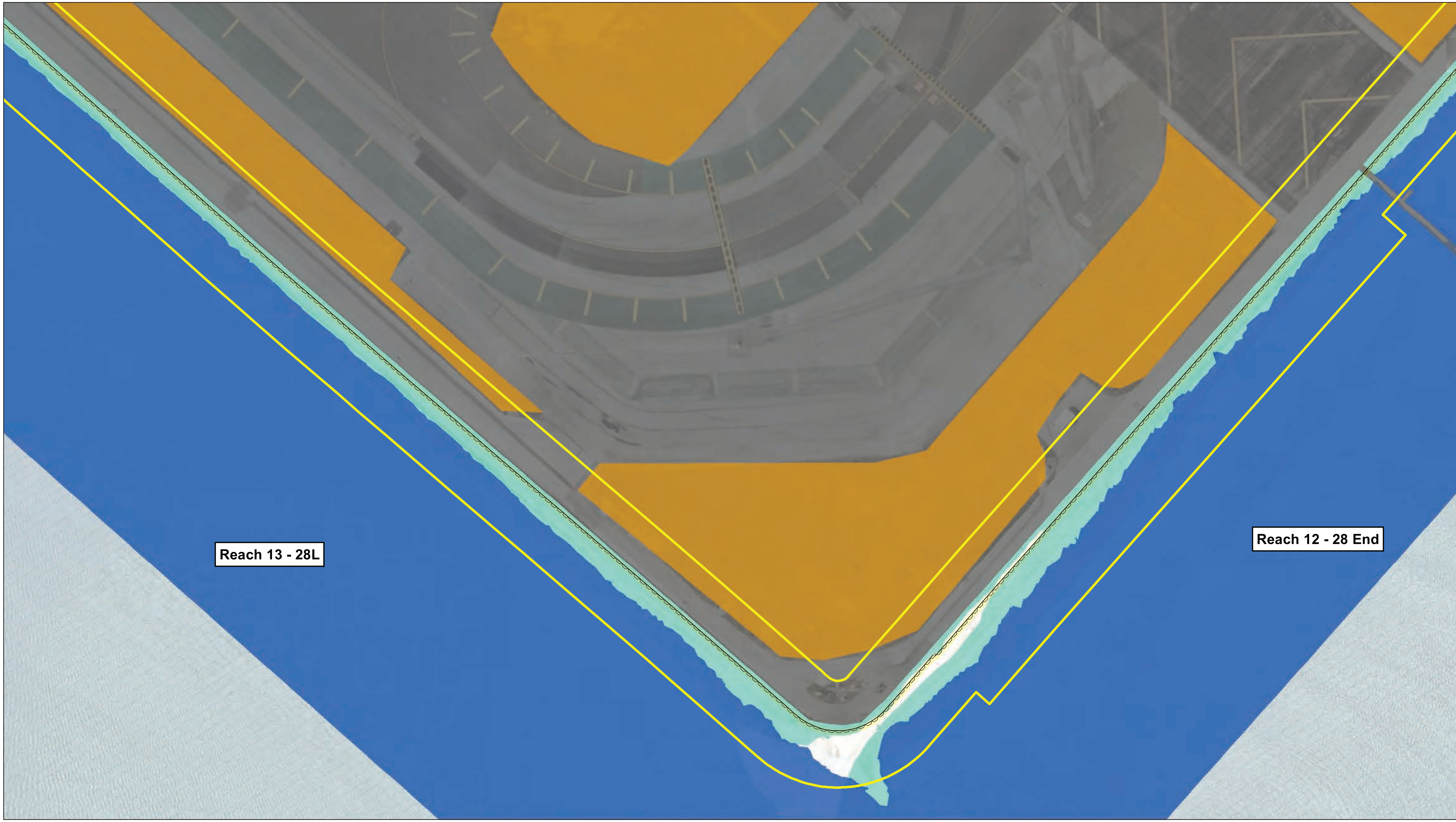
0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

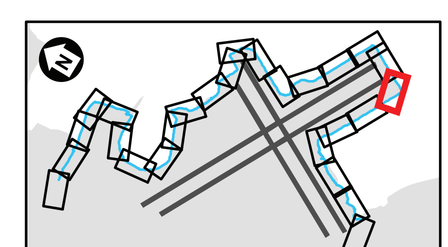
Appendix B-19
Reach 12



SOURCE: Airport Conditions-SFO, 2018

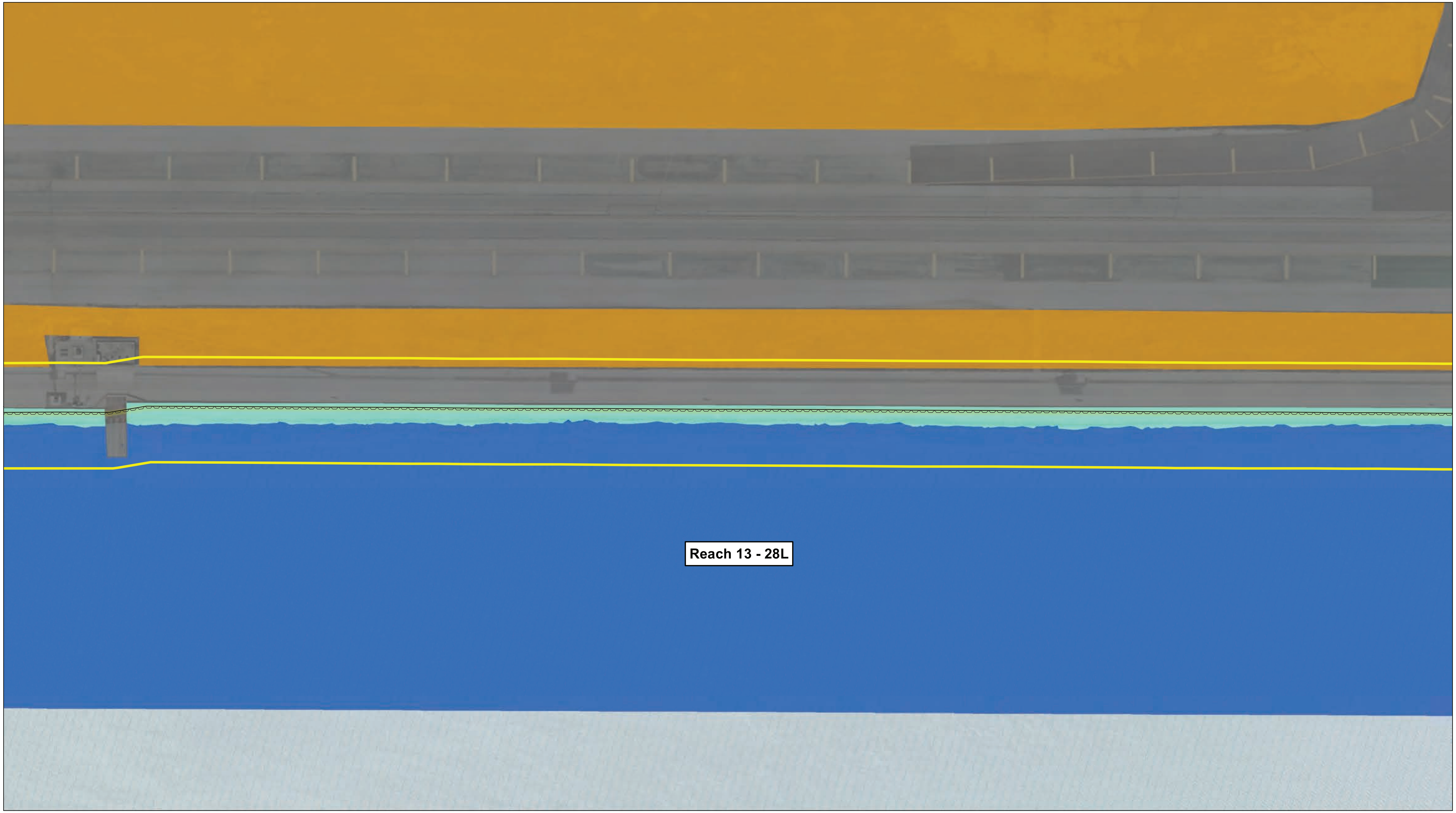
0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Rock/Intertidal
Open Water/Subtidal
Uplands
Salt Panne/Unvegetated

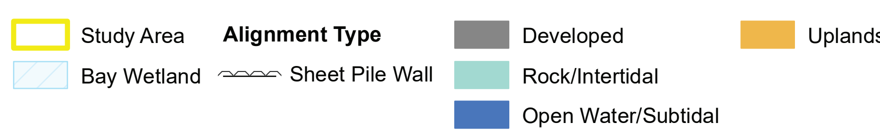


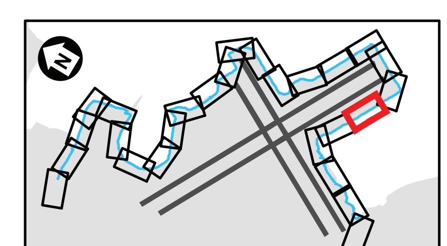
SFO Shoreline Protection Program Project

Appendix B-20
Reach 12 and 13



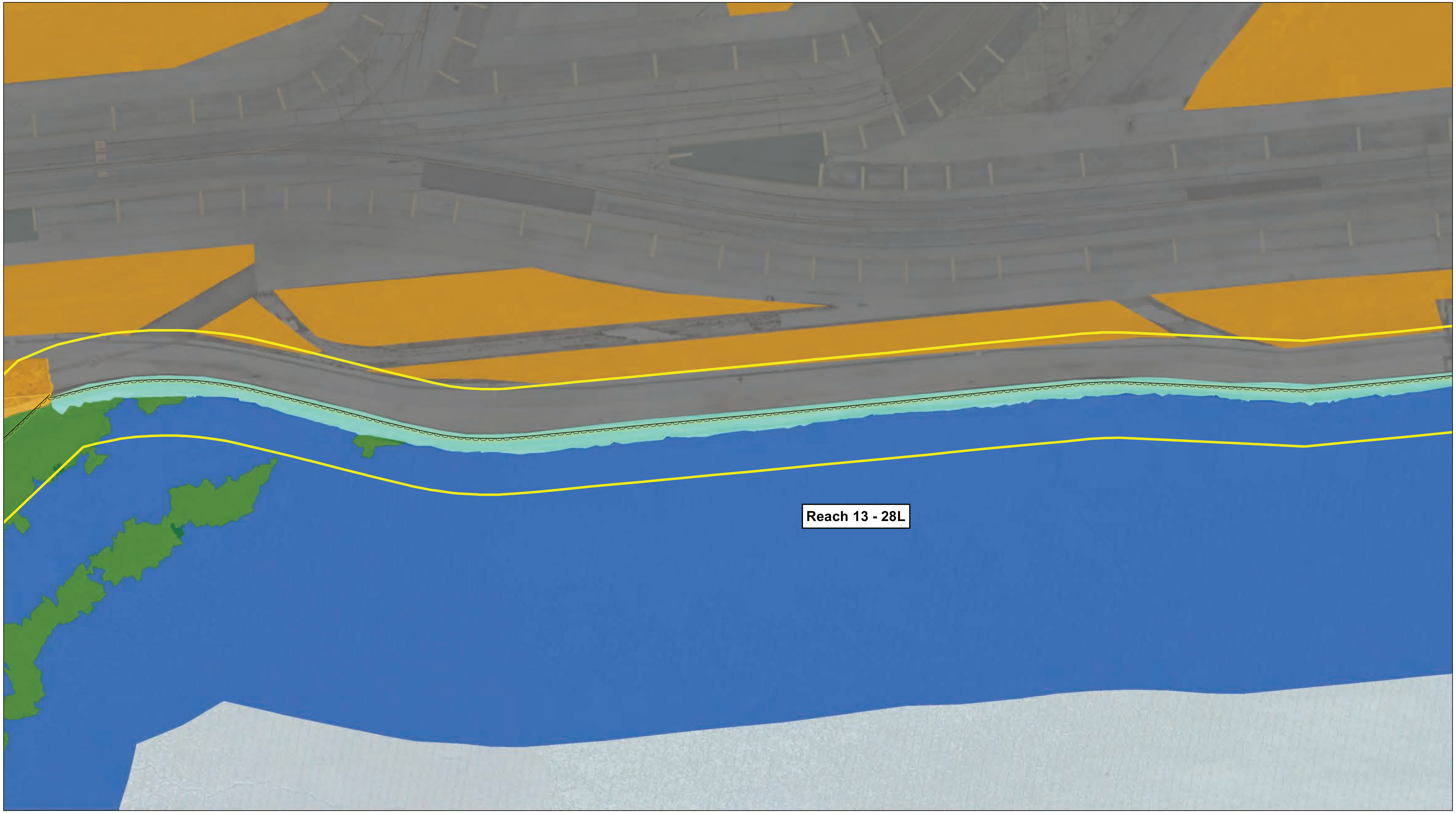
SOURCE: Airport Conditions-SFO, 2018



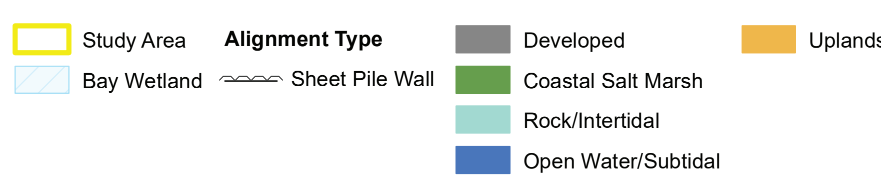


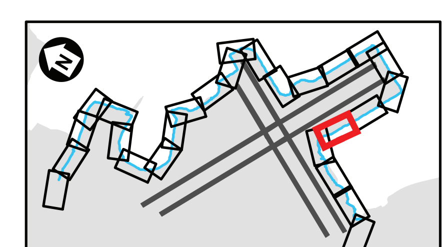
SFO Shoreline Protection Program Project

Appendix B-21
Reach 13



SOURCE: Airport Conditions-SFO, 2018





SFO Shoreline Protection Program Project

Appendix B-22
Reach 13

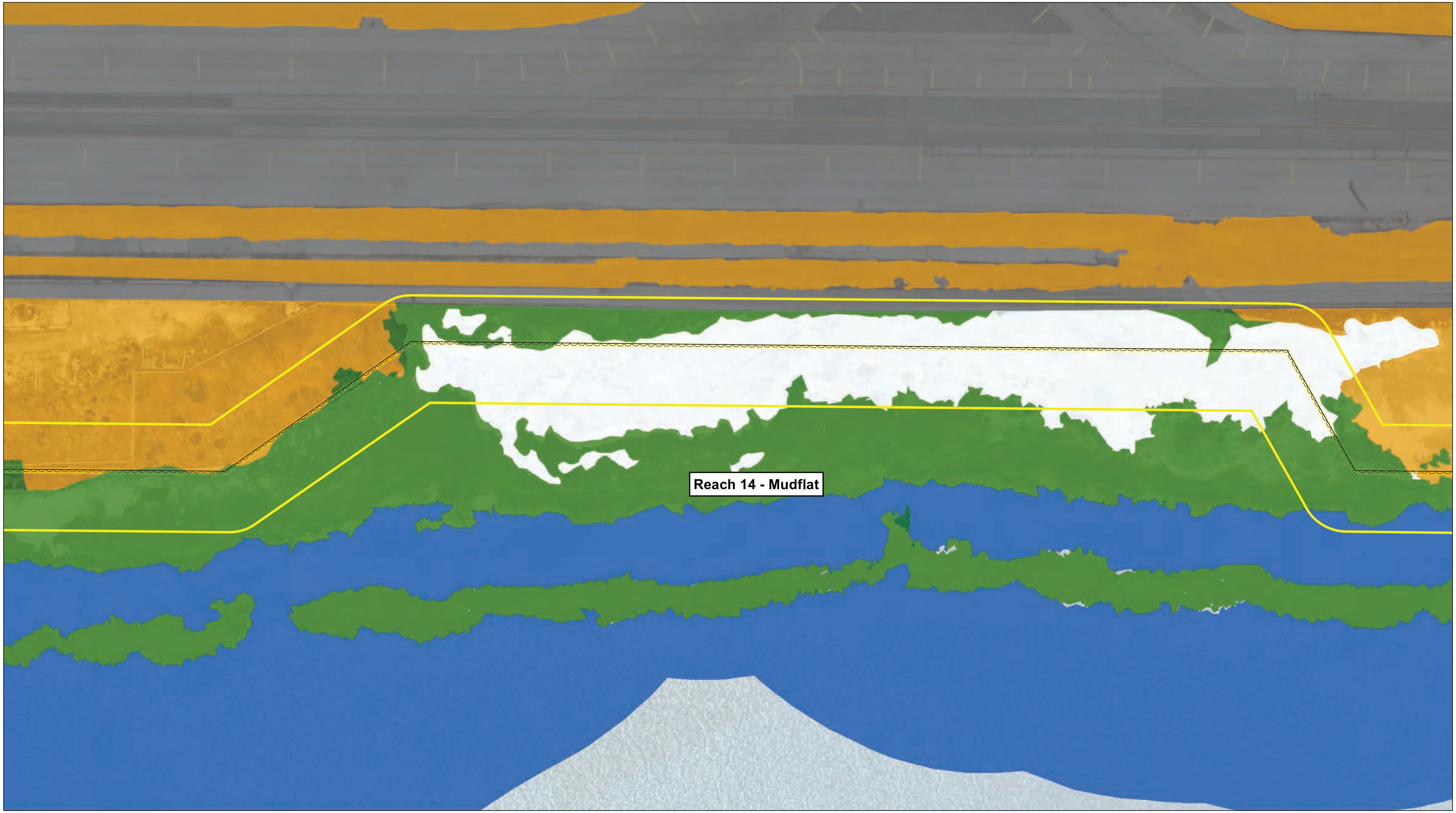
SOURCE: Airport Conditions-SFO, 2018

0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Rock/Intertidal
Open Water/Subtidal
Uplands
Salt Panne/Unvegetated

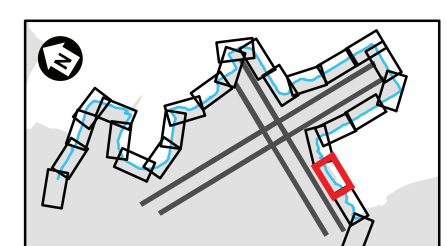
SFO Shoreline Protection Program Project

Appendix B-23
Reach 13 and 14



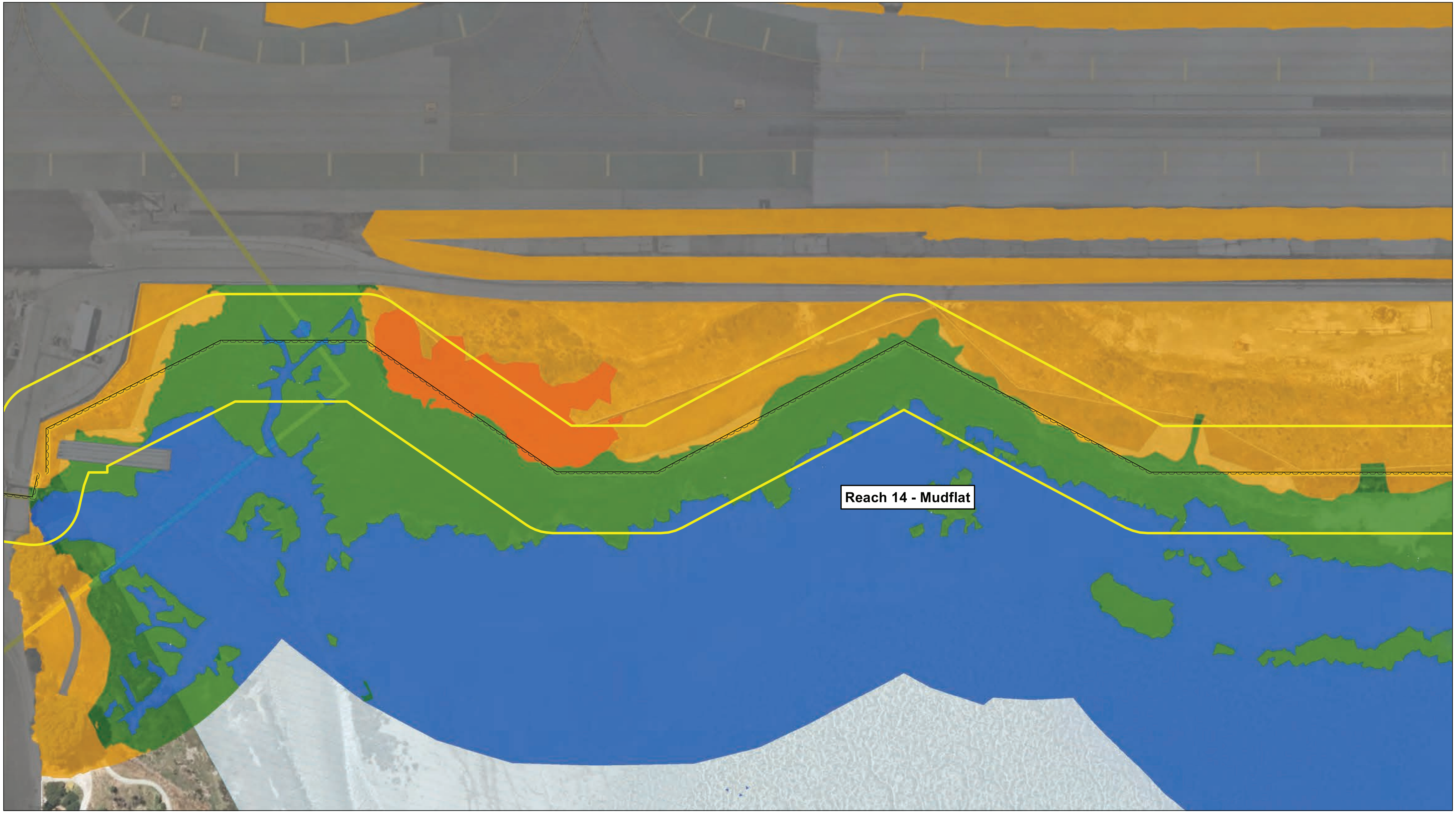
SOURCE: Airport Conditions-SFO, 2018

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Open Water/Subtidal
Uplands
Salt Panne/Unvegetated



SFO Shoreline Protection Program Project

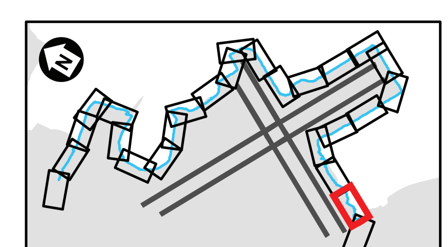
Appendix B-24
Reach 14



SOURCE: Airport Conditions-SFO, 2018

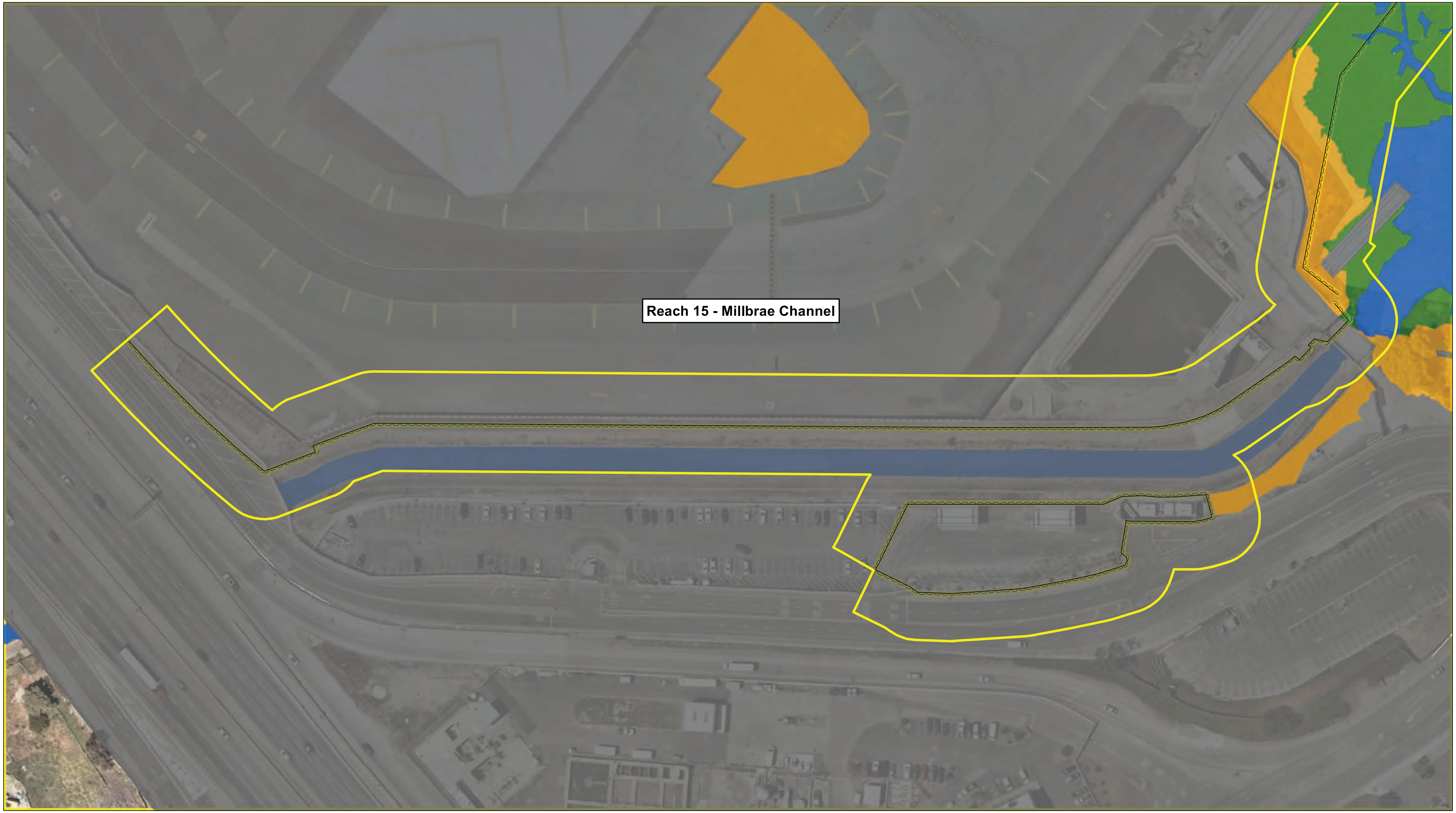
0 320
Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Open Water/Subtidal
Uplands
Iceplant Mat
Salt Panne/Unvegetated



SFO Shoreline Protection Program Project

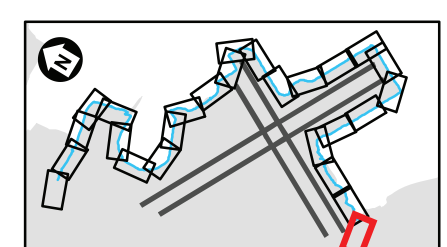
Appendix B-25
Reach 14



SOURCE: Airport Conditions-SFO, 2018

0 — 320 Feet

Study Area
Bay Wetland
Alignment Type
Sheet Pile Wall
Developed
Coastal Salt Marsh
Open Water/Subtidal
Uplands



SFO Shoreline Protection Program Project

Appendix B-26
Reach 14 and 15

Appendix C

U.S. Natural Resources Conservation Service Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Mateo County, Eastern Part, and San Francisco County, California

August 25, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

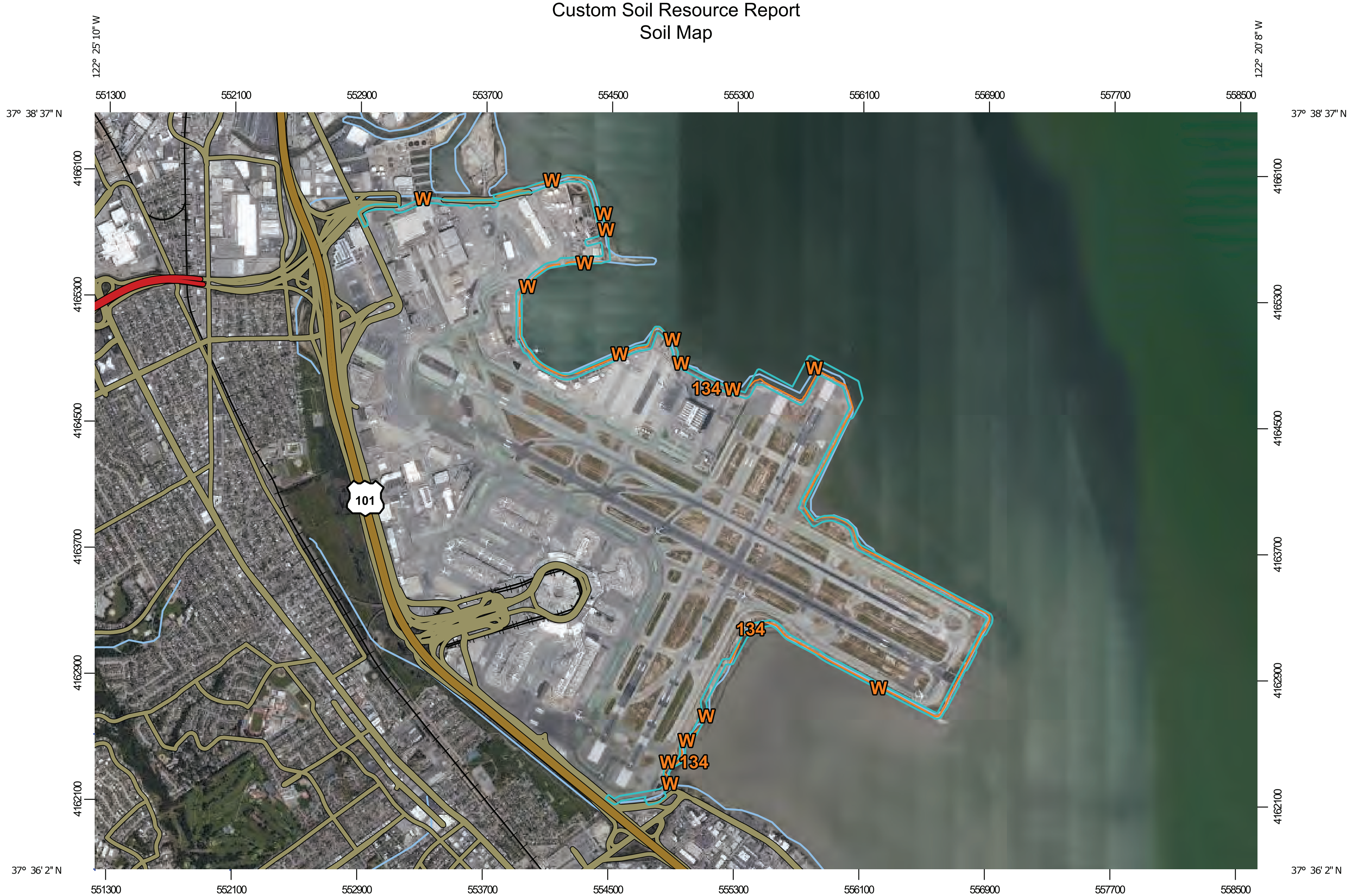
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:33,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Mateo County, Eastern Part, and San Francisco County, California
Survey Area Data: Version 16, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 12, 2019—Jun 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
134	Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes	77.4	64.9%
W	Water	41.9	35.1%
Totals for Area of Interest		**119.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Mateo County, Eastern Part, and San Francisco County, California

134—Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: h9hj
Elevation: 0 to 50 feet
Mean annual precipitation: 15 to 30 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 275 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Orthents and similar soils: 30 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Tidal flats

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Orthents

Setting

Landform: Tidal flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 40 inches: variable
H2 - 40 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Available water capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: C

Hydric soil rating: No

Minor Components

Novato

Percent of map unit: 2 percent
Landform: Salt marshes
Hydric soil rating: Yes

Reyes

Percent of map unit: 1 percent
Landform: Salt marshes
Hydric soil rating: Yes

Orthents, cut&fill

Percent of map unit: 1 percent
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix D

Special-Status Species Database Search Results

1. California Natural Diversity Database Report
2. California Native Plant Society Plant List
3. U.S. Fish and Wildlife Service Species Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

Query Summary:
Quad IS (Montara Mountain (3712254) OR San Francisco South (3712264) OR Hunters Point (3712263) OR San Mateo (3712253))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Acanthomintha duttonii	San Mateo thorn-mint	Dicots	PDLAM01040	5	2	Endangered	Endangered	G1	S1	1B.1	SB_UCBG-UC Botanical Garden at Berkeley	Chaparral, Ultramafic, Valley & foothill grassland
Adela oplerella	Opler's longhorn moth	Insects	IILEE0G040	14	1	None	None	G2	S2	null	null	Ultramafic, Valley & foothill grassland
Agrostis blasdalei	Blasdale's bent grass	Monocots	PMPOA04060	62	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_UCSC-UC Santa Cruz	Coastal bluff scrub, Coastal dunes, Coastal prairie
Allium peninsulare var. franciscanum	Franciscan onion	Monocots	PMLIL021R1	25	10	None	None	G5T2	S2	1B.2	null	Cismontane woodland, Ultramafic, Valley & foothill grassland
Amsinckia lunaris	bent-flowered fiddleneck	Dicots	PDBOR01070	93	5	None	None	G3	S3	1B.2	BLM_S-Sensitive, SB_UCBG-UC Botanical Garden at Berkeley, SB_UCSC-UC Santa Cruz	Cismontane woodland, Coastal bluff scrub, Valley & foothill grassland
Antrozous pallidus	pallid bat	Mammals	AMACC10010	420	2	None	None	G5	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland
Arctostaphylos franciscana	Franciscan manzanita	Dicots	PDERI040J3	4	1	Endangered	None	GHC	S1	1B.1	SB_UCBG-UC Botanical Garden at Berkeley	Chaparral, Ultramafic
Arctostaphylos imbricata	San Bruno Mountain manzanita	Dicots	PDERI040L0	2	2	None	Endangered	G1	S1	1B.1	null	Chaparral, Coastal scrub
Arctostaphylos montana ssp. ravenii	Presidio manzanita	Dicots	PDERI040J2	7	1	Endangered	Endangered	G3T1	S1	1B.1	null	Chaparral, Coastal prairie, Coastal scrub, Ultramafic
Arctostaphylos montaraensis	Montara manzanita	Dicots	PDERI042W0	4	4	None	None	G1	S1	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture	Chaparral, Coastal scrub
Arctostaphylos pacifica	Pacific manzanita	Dicots	PDERI040Z0	1	1	None	Endangered	G1	S1	1B.1	null	Chaparral, Coastal scrub
Arctostaphylos regismontana	Kings Mountain manzanita	Dicots	PDERI041C0	17	2	None	None	G2	S2	1B.2	null	Broadleaved upland forest, Chaparral, North coast coniferous forest
Astragalus pycnostachyus var. pycnostachyus	coastal marsh milk-vetch	Dicots	PDFAB0F7B2	25	2	None	None	G2T2	S2	1B.2	BLM_S-Sensitive, SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden, SB_UCBG-UC Botanical Garden at Berkeley	Coastal dunes, Coastal scrub, Marsh & swamp, Wetland

Astragalus tener var. tener	alkali milk-vetch	Dicots	PDFAB0F8R1	65	1	None	None	G2T1	S1	1B.2	null	Alkali playa, Valley & foothill grassland, Vernal pool, Wetland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	1	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Banksula incredula	incredible harvestman	Arachnids	ILARA14100	1	1	None	None	G1	S1	null	null	Chaparral, Talus slope
Bombus caliginosus	obscure bumble bee	Insects	IIHYM24380	181	5	None	None	G4?	S1S2	null	IUCN_VU-Vulnerable	null
Bombus occidentalis	western bumble bee	Insects	IIHYM24250	279	9	None	Candidate Endangered	G2G3	S1	null	USFS_S-Sensitive	null
Brachyramphus marmoratus	marbled murrelet	Birds	ABNNN06010	110	1	Threatened	Endangered	G3G4	S1	null	CDF_S-Sensitive, IUCN_EN-Endangered, NABCI_RWL-Red Watch List	Lower montane coniferous forest, Oldgrowth, Redwood
Caecidotea tomalensis	Tomales isopod	Crustaceans	ICMAL01220	6	2	None	None	G2	S2S3	null	null	Aquatic, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters
Calicina minor	Edgewood blind harvestman	Arachnids	ILARA13020	2	1	None	None	G1	S1	null	null	Ultramafic, Valley & foothill grassland
Callophrys mossii bayensis	San Bruno elfin butterfly	Insects	IILEPE2202	6	6	Endangered	None	G4T1	S1	null	null	Valley & foothill grassland
Carex comosa	bristly sedge	Monocots	PMCYP032Y0	29	1	None	None	G5	S2	2B.1	null	Coastal prairie, Freshwater marsh, Marsh & swamp, Valley & foothill grassland, Wetland
Centromadia parryi ssp. parryi	pappose tarplant	Dicots	PDAST4R0P2	39	2	None	None	G3T2	S2	1B.2	BLM_S-Sensitive	Chaparral, Coastal prairie, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Charadrius alexandrinus nivosus	western snowy plover	Birds	ABNNB03031	138	2	Threatened	None	G3T3	S2S3	null	CDFW_SSC-Species of Special Concern, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Great Basin standing waters, Sand shore, Wetland
Chloropyron maritimum ssp. palustre	Point Reyes salty bird's-beak	Dicots	PDSCR0J0C3	76	1	None	None	G4?T2	S2	1B.2	BLM_S-Sensitive	Marsh & swamp, Salt marsh, Wetland
Chorizanthe cuspidata var. cuspidata	San Francisco Bay spineflower	Dicots	PDPGN04081	17	8	None	None	G2T1	S1	1B.2	null	Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub
Chorizanthe robusta var. robusta	robust spineflower	Dicots	PDPGN040Q2	20	2	Endangered	None	G2T1	S1	1B.1	null	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal dunes
Cicindela hirticollis gravida	sandy beach tiger beetle	Insects	IICOL02101	34	1	None	None	G5T2	S2	null	null	Coastal dunes
Cirsium andrewsii	Franciscan thistle	Dicots	PDAST2E050	31	3	None	None	G3	S3	1B.2	null	Broadleaved upland forest, Coastal bluff scrub, Coastal prairie, Coastal scrub, Ultramafic
Cirsium fontinale var. fontinale	fountain thistle	Dicots	PDAST2E161	5	1	Endangered	Endangered	G2T1	S1	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Meadow & seep, Ultramafic,

												Valley & foothill grassland, Wetland
Cirsium occidentale var. compactum	compact cobwebby thistle	Dicots	PDAST2E1Z1	30	1	None	None	G3G4T2	S2	1B.2	BLM_S-Sensitive	Chaparral, Coastal dunes, Coastal prairie, Coastal scrub
Collinsia corymbosa	round-headed Chinese-houses	Dicots	PDSCR0H060	13	1	None	None	G1	S1	1B.2	null	Coastal dunes
Collinsia multicolor	San Francisco collinsia	Dicots	PDSCR0H0B0	36	16	None	None	G2	S2	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_UCSC-UC Santa Cruz	Closed-cone coniferous forest, Coastal scrub, Ultramafic
Corynorhinus townsendii	Townsend's big-eared bat	Mammals	AMACC08010	635	2	None	None	G3G4	S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Broadleaved upland forest, Chaparral, Chenopod scrub, Great Basin grassland, Great Basin scrub, Joshua tree woodland, Lower montane coniferous forest, Meadow & seep, Mojavean desert scrub, Riparian forest, Riparian woodland, Sonoran desert scrub, Sonoran thorn woodland, Upper montane coniferous forest, Valley & foothill grassland
Danaus plexippus pop. 1	monarch - California overwintering population	Insects	IILEPP2012	383	2	None	None	G4T2T3	S2S3	null	USFS_S-Sensitive	Closed-cone coniferous forest
Dicamptodon ensatus	California giant salamander	Amphibians	AAAAH01020	234	1	None	None	G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Aquatic, Meadow & seep, North coast coniferous forest, Riparian forest
Dipodomys venustus venustus	Santa Cruz kangaroo rat	Mammals	AMAFD03042	29	1	None	None	G4T1	S1	null	null	Chaparral
Dirca occidentalis	western leatherwood	Dicots	PDTHY03010	71	11	None	None	G2	S2	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden	Broadleaved upland forest, Chaparral, Cismontane woodland, Closed-cone coniferous forest, North coast coniferous forest, Riparian forest, Riparian woodland
Dufourea stagei	Stage's dufourine bee	Insects	IIHYM22010	1	1	None	None	G1G2	S1	null	null	Coastal scrub
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1396	10	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Erethizon dorsatum	North American porcupine	Mammals	AMAFJ01010	523	1	None	None	G5	S3	null	IUCN_LC-Least Concern	Broadleaved upland forest, Cismontane

												woodland, Closed-cone coniferous forest, Lower montane coniferous forest, North coast coniferous forest, Upper montane coniferous forest
Eriophyllum latilobum	San Mateo woolly sunflower	Dicots	PDAST3N060	8	6	Endangered	Endangered	G1	S1	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Ultramafic
Eucyclogobius newberryi	tidewater goby	Fish	AFCQN04010	127	1	Endangered	None	G3	S3	null	AFS_EN-Endangered, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable	Aquatic, Klamath/North coast flowing waters, Sacramento/San Joaquin flowing waters, South coast flowing waters
Euphydryas editha bayensis	Bay checkerspot butterfly	Insects	IILEPK4055	30	5	Threatened	None	G5T1	S1	null	null	Coastal dunes, Ultramafic, Valley & foothill grassland
Falco columbarius	merlin	Birds	ABNKD06030	37	1	None	None	G5	S3S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Estuary, Great Basin grassland, Valley & foothill grassland
Falco peregrinus anatum	American peregrine falcon	Birds	ABNKD06071	58	2	Delisted	Delisted	G4T4	S3S4	null	CDF_S-Sensitive, CDFW_FP-Fully Protected, USFWS_BCC-Birds of Conservation Concern	null
Fritillaria biflora var. ineziana	Hillsborough chocolate lily	Monocots	PMLIL0V031	2	2	None	None	G3G4T1	S1	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_UCBG-UC Botanical Garden at Berkeley, SB_USDA-US Dept of Agriculture	Cismontane woodland, Ultramafic, Valley & foothill grassland
Fritillaria liliacea	fragrant fritillary	Monocots	PMLIL0V0C0	82	6	None	None	G2	S2	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Cismontane woodland, Coastal prairie, Coastal scrub, Ultramafic, Valley & foothill grassland
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	Birds	ABPBX1201A	112	4	None	None	G5T3	S3	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Marsh & swamp
Gilia capitata ssp. chamissonis	blue coast gilia	Dicots	PDPLM040B3	37	4	None	None	G5T2	S2	1B.1	SB_UCBG-UC Botanical Garden at Berkeley	Coastal dunes, Coastal scrub
Gilia millefoliata	dark-eyed gilia	Dicots	PDPLM04130	54	3	None	None	G2	S2	1B.2	BLM_S-Sensitive	Coastal dunes
Grindelia hirsutula var. maritima	San Francisco gumplant	Dicots	PDAST470D3	15	9	None	None	G5T1Q	S1	3.2	SB_UCSC-UC Santa Cruz	Coastal bluff scrub, Coastal scrub, Ultramafic, Valley & foothill grassland
Helianthella castanea	Diablo helianthella	Dicots	PDAST4M020	107	2	None	None	G2	S2	1B.2	null	Broadleaved upland forest, Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	Dicots	PDAST4R065	52	2	None	None	G5T2	S2	1B.2	SB_UCBG-UC Botanical Garden at Berkeley	Valley & foothill grassland
Hesperevax sparsiflora var. brevifolia	short-leaved evax	Dicots	PDASTE5011	72	2	None	None	G4T3	S3	1B.2	BLM_S-Sensitive	Coastal bluff scrub, Coastal

												dunes, Coastal prairie
Hesperolinon congestum	Marin western flax	Dicots	PDLIN01060	27	5	Threatened	Threatened	G1	S1	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_UCBG-UC Botanical Garden at Berkeley	Chaparral, Ultramafic, Valley & foothill grassland
Heteranthera dubia	water star-grass	Monocots	PMPON03010	9	1	None	None	G5	S2	2B.2	null	Marsh & swamp
Horkelia cuneata var. sericea	Kellogg's horkelia	Dicots	PDROS0W043	58	4	None	None	G4T1?	S1?	1B.1	SB_UCSC-UC Santa Cruz, USFS_S-Sensitive	Chaparral, Closed-cone coniferous forest, Coastal dunes, Coastal scrub
Horkelia marinensis	Point Reyes horkelia	Dicots	PDROS0W0B0	36	2	None	None	G2	S2	1B.2	null	Coastal dunes, Coastal prairie, Coastal scrub
Hydrochara rickseckeri	Ricksecker's water scavenger beetle	Insects	IICOL5V010	13	1	None	None	G2?	S2?	null	null	Aquatic, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters
Hydroporus leechi	Leech's skyline diving beetle	Insects	IICOL55040	13	1	None	None	G1?	S1?	null	null	Aquatic
Hypogymnia schizidiata	island tube lichen	Lichens	NLT0032640	10	3	None	None	G2G3	S2	1B.3	null	Chaparral, Closed-cone coniferous forest
Ischnura gemina	San Francisco forktail damselfly	Insects	IIODO72010	7	4	None	None	G2	S2	null	IUCN_VU-Vulnerable	null
Lasiurus cinereus	hoary bat	Mammals	AMACC05030	238	6	None	None	G5	S4	null	IUCN_LC-Least Concern, WBWG_M-Medium Priority	Broadleaved upland forest, Cismontane woodland, Lower montane coniferous forest, North coast coniferous forest
Lasthenia californica ssp. macrantha	perennial goldfields	Dicots	PDAST5L0C5	59	2	None	None	G3T2	S2	1B.2	BLM_S-Sensitive	Coastal bluff scrub, Coastal dunes, Coastal scrub
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	2	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Layia carnosa	beach layia	Dicots	PDAST5N010	25	1	Endangered	Endangered	G2	S2	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Coastal dunes, Coastal scrub
Leptosiphon croceus	coast yellow leptosiphon	Dicots	PDPLM09170	1	1	None	Endangered	G1	S1	1B.1	SB_UCBG-UC Botanical Garden at Berkeley	Coastal bluff scrub, Coastal prairie
Leptosiphon rosaceus	rose leptosiphon	Dicots	PDPLM09180	31	4	None	None	G1	S1	1B.1	null	Coastal bluff scrub
Lessingia arachnoidea	Crystal Springs lessingia	Dicots	PDAST5S0C0	11	6	None	None	G2	S2	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden	Cismontane woodland, Coastal scrub, Ultramafic, Valley & foothill grassland
Lessingia germanorum	San Francisco lessingia	Dicots	PDAST5S010	5	2	Endangered	Endangered	G1	S1	1B.1	null	Coastal scrub
Lichnanthe ursina	bumblebee scarab beetle	Insects	IICOL67020	8	2	None	None	G2	S2	null	null	Coastal dunes
Limnanthes douglasii ssp. ornduffii	Ornduff's meadowfoam	Dicots	PDLIM02039	2	2	None	None	G4T1	S1	1B.1	SB_UCSC-UC Santa Cruz	Meadow & seep
Malacothamnus arcuatus	arcuate bush-mallow	Dicots	PDMAL0Q0E0	30	6	None	None	G2Q	S2	1B.2	SB_CalBG/RSABG-California/Rancho	Chaparral, Cismontane

											Santa Ana Botanic Garden	woodland
Melospiza melodia pusillula	Alameda song sparrow	Birds	ABPBXA301S	38	5	None	None	G5T2?	S2S3	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Salt marsh
Monardella sinuata ssp. nigrescens	northern curly-leaved monardella	Dicots	PDLAM18162	25	1	None	None	G3T2	S2	1B.2	SB_SBBG-Santa Barbara Botanic Garden	Chaparral, Coastal dunes, Coastal scrub, Lower montane coniferous forest
Monolopia gracilens	woodland woollythreads	Dicots	PDAST6G010	68	2	None	None	G3	S3	1B.2	null	Broadleaved upland forest, Chaparral, Cismontane woodland, North coast coniferous forest, Ultramafic, Valley & foothill grassland
Mylopharodon conocephalus	hardhead	Fish	AFCJB25010	33	1	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Klamath/North coast flowing waters, Sacramento/San Joaquin flowing waters
Myotis thysanodes	fringed myotis	Mammals	AMACC01090	86	1	None	None	G4	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	null
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	Mammals	AMAFF08082	42	5	None	None	G5T2T3	S2S3	null	CDFW_SSC-Species of Special Concern	Chaparral, Redwood
Northern Coastal Salt Marsh	Northern Coastal Salt Marsh	Marsh	CTT52110CA	53	3	None	None	G3	S3.2	null	null	Marsh & swamp, Wetland
Northern Maritime Chaparral	Northern Maritime Chaparral	Scrub	CTT37C10CA	17	2	None	None	G1	S1.2	null	null	Chaparral
Nyctinomops macrotis	big free-tailed bat	Mammals	AMACD04020	32	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_MH-Medium-High Priority	null
Oncorhynchus mykiss irideus pop. 8	steelhead - central California coast DPS	Fish	AFCHA0209G	44	3	Threatened	None	G5T2T3Q	S2S3	null	AFS_TH-Threatened	Aquatic, Sacramento/San Joaquin flowing waters
Pentachaeta bellidiflora	white-rayed pentachaeta	Dicots	PDAST6X030	14	3	Endangered	Endangered	G1	S1	1B.1	SB_UCBG-UC Botanical Garden at Berkeley	Ultramafic, Valley & foothill grassland
Phalacrocorax auritus	double-crested cormorant	Birds	ABNFD01020	39	3	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Plagiobothrys chorisianus var. chorisianus	Choris' popcornflower	Dicots	PDBOR0V061	42	5	None	None	G3T1Q	S1	1B.2	BLM_S-Sensitive, SB_UCSC-UC Santa Cruz	Chaparral, Coastal prairie, Coastal scrub
Plebejus icarioides missionensis	Mission blue butterfly	Insects	IILEPG801A	14	13	Endangered	None	G5T1	S1	null	null	Coastal prairie
Polemonium carneum	Oregon polemonium	Dicots	PDPLM0E050	16	1	None	None	G3G4	S2	2B.2	null	Coastal prairie, Coastal scrub, Lower montane coniferous forest
Polygonum marinense	Marin knotweed	Dicots	PDPGN0L1C0	32	1	None	None	G2Q	S2	3.1	null	Brackish marsh, Marsh & swamp, Salt marsh, Wetland
Potentilla hickmanii	Hickman's cinquefoil	Dicots	PDROS1B0U0	4	2	Endangered	Endangered	G1	S1	1B.1	null	Closed-cone coniferous forest, Coastal bluff scrub, Freshwater marsh, Marsh & swamp, Meadow & seep, Wetland
Rallus obsoletus	California	Birds	ABNME05011	99	8	Endangered	Endangered	G5T1	S1	null	CDFW_FP-Fully	Brackish marsh,

obsoletus	Ridgway's rail										Protected, NABCI_RWL-Red Watch List	Marsh & swamp, Salt marsh, Wetland
Rana boylii	foothill yellow-legged frog	Amphibians	AAABH01050	2468	1	None	Endangered	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened, USFS_S-Sensitive	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow & seep, Riparian forest, Riparian woodland, Sacramento/San Joaquin flowing waters
Rana draytonii	California red-legged frog	Amphibians	AAABH01022	1572	42	Threatened	None	G2G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable	Aquatic, Artificial flowing waters, Artificial standing waters, Freshwater marsh, Marsh & swamp, Riparian forest, Riparian scrub, Riparian woodland, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Reithrodontomys raviventris	salt-marsh harvest mouse	Mammals	AMAFF02040	144	1	Endangered	Endangered	G1G2	S1S2	null	CDFW_FP-Fully Protected, IUCN_EN-Endangered	Marsh & swamp, Wetland
Riparia riparia	bank swallow	Birds	ABPAU08010	298	3	None	Threatened	G5	S2	null	BLM_S-Sensitive, IUCN_LC-Least Concern	Riparian scrub, Riparian woodland
Sanicula maritima	adobe sanicle	Dicots	PDAPI1Z0D0	17	1	None	Rare	G2	S2	1B.1	SB_SBBG-Santa Barbara Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal prairie, Meadow & seep, Ultramafic, Valley & foothill grassland
Senecio aphanactis	chaparral ragwort	Dicots	PDAST8H060	98	2	None	None	G3	S2	2B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_CRES-San Diego Zoo CRES Native Gene Seed Bank	Chaparral, Cismontane woodland, Coastal scrub
Serpentine Bunchgrass	Serpentine Bunchgrass	Herbaceous	CTT42130CA	22	3	None	None	G2	S2.2	null	null	Valley & foothill grassland
Silene scouleri ssp. scouleri	Scouler's catchfly	Dicots	PDCAR0U1MC	23	11	None	None	G5T4T5	S2S3	2B.2	null	Coastal bluff scrub, Coastal prairie, Valley & foothill grassland
Silene verecunda ssp. verecunda	San Francisco campion	Dicots	PDCAR0U213	20	7	None	None	G5T1	S1	1B.2	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_UCSC-UC Santa Cruz	Chaparral, Coastal bluff scrub, Coastal prairie, Coastal scrub, Ultramafic, Valley & foothill grassland
Speyeria callippe callippe	callippe silverspot butterfly	Insects	IILEPJ6091	12	6	Endangered	None	G5T1	S1	null	null	Coastal scrub
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	Insects	IILEPJ608C	17	2	Endangered	None	G5T1	S1	null	null	Coastal dunes
Spirinchus thaleichthys	longfin smelt	Fish	AFCHB03010	46	2	Candidate	Threatened	G5	S1	null	null	Aquatic, Estuary
Suaeda californica	California seablite	Dicots	PDCHE0P020	18	3	Endangered	None	G1	S1	1B.1	null	Freshwater marsh, Marsh & swamp, Wetland
Taxidea taxus	American badger	Mammals	AMAJF04010	594	1	None	None	G5	S3	null	CDFW_SSC-Species of Special	Alkali marsh, Alkali playa,

											Concern, IUCN_LC-Least Concern	Alpine, Alpine dwarf scrub, Bog & fen, Brackish marsh, Broadleaved upland forest, Chaparral, Chenopod scrub, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub, Desert dunes, Desert wash, Freshwater marsh, Great Basin grassland, Great Basin scrub, Interior dunes, Ione formation, Joshua tree woodland, Limestone, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Mojavean desert scrub, Montane dwarf scrub, North coast coniferous forest, Oldgrowth, Pavement plain, Redwood, Riparian forest, Riparian scrub, Riparian woodland, Salt marsh, Sonoran desert scrub, Sonoran thorn woodland, Ultramafic, Upper montane coniferous forest, Upper Sonoran scrub, Valley & foothill grassland
Thamnophis sirtalis tetrataenia	San Francisco gartersnake	Reptiles	ARADB3613B	66	22	Endangered	Endangered	G5T2Q	S2	null	CDFW_FP-Fully Protected	Artificial standing waters, Marsh & swamp, Sacramento/San Joaquin standing waters, Wetland
Trachusa gummifera	San Francisco Bay Area leaf-cutter bee	Insects	IIHYM80010	3	1	None	None	G1	S1	null	null	null
Trifolium amoenum	two-fork clover	Dicots	PDFAB40040	26	1	Endangered	None	G1	S1	1B.1	SB_CalBG/RSABG-California/Rancho Santa Ana Botanic Garden, SB_UCBG-UC Botanical Garden at Berkeley, SB_USDA-US Dept of Agriculture	Coastal bluff scrub, Ultramafic, Valley & foothill grassland
Trifolium hydrophilum	saline clover	Dicots	PDFAB400R5	56	1	None	None	G2	S2	1B.2	null	Marsh & swamp, Valley & foothill grassland, Vernal pool, Wetland
Triphysaria floribunda	San Francisco owl's-clover	Dicots	PDSCR2T010	50	14	None	None	G2?	S2?	1B.2	null	Coastal prairie, Coastal scrub, Ultramafic, Valley & foothill grassland
Triquetrella californica	coastal triquetrella	Bryophytes	NBMUS7S010	13	3	None	None	G2	S2	1B.2	USFS_S-Sensitive	Coastal bluff scrub, Coastal

												scrub
Tryonia imitator	mimic tryonia (=California brackishwater snail)	Mollusks	IMGASJ7040	39	1	None	None	G2	S2	null	IUCN_DD-Data Deficient	Aquatic, Brackish marsh, Estuary, Lagoon, Marsh & swamp, Salt marsh, Wetland
Valley Needlegrass Grassland	Valley Needlegrass Grassland	Herbaceous	CTT42110CA	45	1	None	None	G3	S3.1	null	null	Valley & foothill grassland

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

74 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3712264, 3712263 3712254 and 3712253;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Acanthomintha duttonii	San Mateo thorn-mint	Lamiaceae	annual herb	Apr-Jun	1B.1	S1	G1
Agrostis blasdalei	Blasdale's bent grass	Poaceae	perennial rhizomatous herb	May-Jul	1B.2	S2	G2
Allium peninsulare var. franciscanum	Franciscan onion	Alliaceae	perennial bulbiferous herb	(Apr)May-Jun	1B.2	S2	G5T2
Amsinckia lunaris	bent-flowered fiddleneck	Boraginaceae	annual herb	Mar-Jun	1B.2	S3	G3
Arabis blepharophylla	coast rockcress	Brassicaceae	perennial herb	Feb-May	4.3	S4	G4
Arctostaphylos franciscana	Franciscan manzanita	Ericaceae	perennial evergreen shrub	Feb-Apr	1B.1	S1	G1
Arctostaphylos imbricata	San Bruno Mountain manzanita	Ericaceae	perennial evergreen shrub	Feb-May	1B.1	S1	G1
Arctostaphylos montana ssp. ravenii	Presidio manzanita	Ericaceae	perennial evergreen shrub	Feb-Mar	1B.1	S1	G3T1
Arctostaphylos montaraensis	Montara manzanita	Ericaceae	perennial evergreen shrub	Jan-Mar	1B.2	S1	G1
Arctostaphylos pacifica	Pacific manzanita	Ericaceae	evergreen shrub	Feb-Apr	1B.1	S1	G1
Arctostaphylos regismontana	Kings Mountain manzanita	Ericaceae	perennial evergreen shrub	Dec-Apr	1B.2	S2	G2
Astragalus nuttallii var. nuttallii	ocean bluff milk-vetch	Fabaceae	perennial herb	Jan-Nov	4.2	S4	G4T4
Astragalus pycnostachyus var. pycnostachyus	coastal marsh milk-vetch	Fabaceae	perennial herb	(Apr)Jun-Oct	1B.2	S2	G2T2
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	Mar-Jun	1B.2	S1	G2T1

Calochortus umbellatus	Oakland star-tulip	Liliaceae	perennial bulbiferous herb	Mar-May	4.2	S3?	G3?
Castilleja ambigua var. ambigua	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	Mar-Aug	4.2	S3S4	G4T4
Centromadia parryi ssp. parryi	pappose tarplant	Asteraceae	annual herb	May-Nov	1B.2	S2	G3T2
Chloropyron maritimum ssp. palustre	Point Reyes bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jun-Oct	1B.2	S2	G4?T2
Chorizanthe cuspidata var. cuspidata	San Francisco Bay spineflower	Polygonaceae	annual herb	Apr-Jul(Aug)	1B.2	S1	G2T1
Chorizanthe robusta var. robusta	robust spineflower	Polygonaceae	annual herb	Apr-Sep	1B.1	S1	G2T1
Cirsium andrewsii	Franciscan thistle	Asteraceae	perennial herb	Mar-Jul	1B.2	S3	G3
Cirsium fontinale var. fontinale	Crystal Springs fountain thistle	Asteraceae	perennial herb	(Apr)May-Oct	1B.1	S1	G2T1
Cirsium occidentale var. compactum	compact cobwebby thistle	Asteraceae	perennial herb	Apr-Jun	1B.2	S2	G3G4T2
Collinsia corymbosa	round-headed Chinese-houses	Plantaginaceae	annual herb	Apr-Jun	1B.2	S1	G1
Collinsia multicolor	San Francisco collinsia	Plantaginaceae	annual herb	(Feb)Mar-May	1B.2	S2	G2
Cypripedium fasciculatum	clustered lady's-slipper	Orchidaceae	perennial rhizomatous herb	Mar-Aug	4.2	S4	G4
Dirca occidentalis	western leatherwood	Thymelaeaceae	perennial deciduous shrub	Jan-Mar(Apr)	1B.2	S2	G2
Elymus californicus	California bottle-brush grass	Poaceae	perennial herb	May-Aug(Nov)	4.3	S4	G4
Equisetum palustre	marsh horsetail	Equisetaceae	perennial rhizomatous herb	unk	3	S1S3	G5
Eriophyllum latilobum	San Mateo woolly sunflower	Asteraceae	perennial herb	May-Jun	1B.1	S1	G1
Erysimum franciscanum	San Francisco wallflower	Brassicaceae	perennial herb	Mar-Jun	4.2	S3	G3
Fritillaria biflora var. ineziana	Hillsborough chocolate lily	Liliaceae	perennial bulbiferous herb	Mar-Apr	1B.1	S1	G3G4T1
Fritillaria lanceolata var. tristulis	Marin checker lily	Liliaceae	perennial bulbiferous herb	Feb-May	1B.1	S2	G5T2
Fritillaria liliacea	fragrant fritillary	Liliaceae	perennial bulbiferous herb	Feb-Apr	1B.2	S2	G2
Gilia capitata ssp. chamissonis	blue coast gilia	Polemoniaceae	annual herb	Apr-Jul	1B.1	S2	G5T2
Gilia millefoliata	dark-eyed gilia	Polemoniaceae	annual herb	Apr-Jul	1B.2	S2	G2
Grindelia hirsutula var. maritima	San Francisco gumplant	Asteraceae	perennial herb	Jun-Sep	3.2	S1	G5T1Q
Helianthella castanea	Diablo helianthella	Asteraceae	perennial herb	Mar-Jun	1B.2	S2	G2
	congested-headed	Asteraceae	annual herb	Apr-Nov	1B.2	S2	G5T2

Hemizonia congesta ssp. congesta	hayfield tarplant						
Hesperevax sparsiflora var. brevifolia	short-leaved evax	Asteraceae	annual herb	Mar-Jun	1B.2	S2	G4T3
Hesperolinon congestum	Marin western flax	Linaceae	annual herb	Apr-Jul	1B.1	S1	G1
Heteranthera dubia	water star-grass	Pontederiaceae	perennial herb (aquatic)	Jul-Oct	2B.2	S2	G5
Horkelia cuneata var. sericea	Kellogg's horkelia	Rosaceae	perennial herb	Apr-Sep	1B.1	S1?	G4T1?
Horkelia marinensis	Point Reyes horkelia	Rosaceae	perennial herb	May-Sep	1B.2	S2	G2
Hypogymnia schizidiata	island rock lichen	Parmeliaceae	foliose lichen (null)		1B.3	S1	G2
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	Mar-May	4.2	S3	G3
Lasthenia californica ssp. macrantha	perennial goldfields	Asteraceae	perennial herb	Jan-Nov	1B.2	S2	G3T2
Leptosiphon croceus	coast yellow leptosiphon	Polemoniaceae	annual herb	Apr-Jun	1B.1	S1	G1
Leptosiphon rosaceus	rose leptosiphon	Polemoniaceae	annual herb	Apr-Jul	1B.1	S1	G1
Lessingia arachnoidea	Crystal Springs lessingia	Asteraceae	annual herb	Jul-Oct	1B.2	S2	G2
Lessingia germanorum	San Francisco lessingia	Asteraceae	annual herb	(Jun)Jul-Nov	1B.1	S1	G1
Lessingia hololeuca	woolly-headed lessingia	Asteraceae	annual herb	Jun-Oct	3	S2S3	G3?
Lilium maritimum	coast lily	Liliaceae	perennial bulbiferous herb	May-Aug	1B.1	S2	G2
Limnanthes douglasii ssp. ornduffii	Ornduff's meadowfoam	Limnanthaceae	annual herb	Nov-May	1B.1	S1	G4T1
Lupinus arboreus var. eximius	San Mateo tree lupine	Fabaceae	perennial evergreen shrub	Apr-Jul	3.2	S2	G2Q
Malacothamnus aboriginum	Indian Valley bush-mallow	Malvaceae	perennial deciduous shrub	Apr-Oct	1B.2	S3	G3
Malacothamnus arcuatus	arcuate bush-mallow	Malvaceae	perennial evergreen shrub	Apr-Sep	1B.2	S2	G2Q
Malacothamnus davidsonii	Davidson's bush-mallow	Malvaceae	perennial deciduous shrub	Jun-Jan	1B.2	S2	G2
Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial evergreen shrub	(Apr)May-Sep(Oct)	1B.2	S2	G2
Monardella sinuata ssp. nigrescens	northern curly-leaved monardella	Lamiaceae	annual herb	(Apr)May-Jul(Aug-Sep)	1B.2	S2	G3T2
Monolopia gracilens	woodland woolythreads	Asteraceae	annual herb	(Feb)Mar-Jul	1B.2	S3	G3
Pentachaeta bellidiflora	white-rayed pentachaeta	Asteraceae	annual herb	Mar-May	1B.1	S1	G1
	Choris' popcornflower	Boraginaceae	annual herb	Mar-Jun	1B.2	S1	G3T1Q

Plagiobothrys chorisianus var. chorisianus							
Polemonium carneum	Oregon polemonium	Polemoniaceae	perennial herb	Apr-Sep	2B.2	S2	G3G4
Potentilla hickmanii	Hickman's cinquefoil	Rosaceae	perennial herb	Apr-Aug	1B.1	S1	G1
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb (aquatic)	Feb-May	4.2	S3	G4
Senecio aphanactis	chaparral ragwort	Asteraceae	annual herb	Jan-Apr(May)	2B.2	S2	G3
Silene scouleri ssp. scouleri	Scouler's catchfly	Caryophyllaceae	perennial herb	(Mar-May)Jun-Aug(Sep)	2B.2	S2S3	G5T4T5
Silene verecunda ssp. verecunda	San Francisco campion	Caryophyllaceae	perennial herb	(Feb)Mar-Jun(Aug)	1B.2	S1	G5T1
Suaeda californica	California seablite	Chenopodiaceae	perennial evergreen shrub	Jul-Oct	1B.1	S1	G1
Trifolium amoenum	two-fork clover	Fabaceae	annual herb	Apr-Jun	1B.1	S1	G1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	Apr-Jun	1B.2	S2	G2
Triphysaria floribunda	San Francisco owl's-clover	Orobanchaceae	annual herb	Apr-Jun	1B.2	S2?	G2?
Triquetrella californica	coastal triquetrella	Pottiaceae	moss		1B.2	S2	G2

Suggested Citation

California Native Plant Society, Rare Plant Program. 2020. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 12 August 2020].

Search the Inventory
Simple Search
Advanced Search
Glossary

Information
About the Inventory
About the Rare Plant Program
CNPS Home Page
About CNPS
Join CNPS

Contributors
The Calflora Database
The California Lichen Society
California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Questions and Comments
rareplants@cnps.org

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
Phone: (916) 930-5603 Fax: (916) 930-5654
http://kim_squires@fws.gov

In Reply Refer To: September 29, 2020
Consultation Code: 08FBDT00-2020-SLI-0270
Event Code: 08FBDT00-2020-E-00655
Project Name: SFO Shoreline Protection Program

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08FBDT00-2020-SLI-0270

Event Code: 08FBDT00-2020-E-00655

Project Name: SFO Shoreline Protection Program

Project Type: SHORELINE / BEACH PROTECTION / RENOURISHMENT

Project Description: San Francisco International Airport (the Airport or SFO) has initiated a Shoreline Protection Program (SPP). The objective of the SPP is to plan, design and install new shoreline protection infrastructure that would comply with current Federal Emergency Management Agency (FEMA) requirements for flood protection and incorporate protection for future sea level rise (SLR).

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/37.62205510066178N122.38394598461036W

Counties: San Mateo, CA

Endangered Species Act Species

There is a total of 21 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse *Reithrodontomys raviventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/613	Endangered
Southern Sea Otter *Enhydra lutris nereis* No critical habitat has been designated for this species. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/8560	Threatened

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8104	Endangered
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
San Francisco Garter Snake *Thamnophis sirtalis tetrataenia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Bay Checkerspot Butterfly *Euphydryas editha bayensis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2320	Threatened
Callippe Silverspot Butterfly *Speyeria callippe callippe* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3779	Endangered
Mission Blue Butterfly *Icaricia icarioides missionensis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6928	Endangered
Myrtle's Silverspot Butterfly *Speyeria zerene myrtleae* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6929	Endangered
San Bruno Elfin Butterfly *Callophrys mossii bayensis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3394	Endangered

Flowering Plants

NAME	STATUS
California Seablite *Suaeda californica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle *Cirsium fontinale var. fontinale* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7939	Endangered
Franciscan Manzanita *Arctostaphylos franciscana* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5350	Endangered
Hickman's Potentilla *Potentilla hickmanii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6343	Endangered
Presidio Manzanita *Arctostaphylos hookeri var. ravenii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7216	Endangered
Robust Spineflower *Chorizanthe robusta var. robusta* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9287	Endangered
San Francisco Lessingia *Lessingia germanorum (=L.g. var. germanorum)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8174	Endangered
Sonoma Sunshine *Blennosperma bakeri* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1260	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Appendix E
Special-Status Species Potential to Occur within the Study Area

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Plants			
San Mateo thorn-mint *Acanthomintha duttonii*	FE/SE/1B.1	Chaparral, valley and foothill grassland. Elevation ranges from 160 to 985 feet (50 to 300 meters). Blooms Apr–Jun.	**No potential.** Study area is outside the elevation range.
Blasdale's bent grass *Agrostis blasdalei*	—/—/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie. Elevation ranges from 0 to 490 feet (0 to 150 meters). Blooms May–Jul.	**Low.** Nearest occurrence is approximately 9 miles away and relatively geographically isolated by the Santa Cruz Mountains. Marginal suitable habitat present in study area.
Franciscan onion *Allium peninsulare* var. *franciscanum*	—/—/1B.2	Cismontane woodland, valley and foothill grassland on dry hillsides. Elevation ranges from 170 to 1,000 feet (52 to 305 meters). Blooms (Apr)May–Jun.	**No potential.** Species occurs at higher elevations then occur within the study area.
Bent-flowered fiddleneck *Amsinckia lunaris*	—/—/1B.2	Coastal bluff scrub, cismontane woodland, valley and foothill grassland. Elevation ranges from 5 to 1,640 feet (3 to 500 meters). Blooms Mar–Jun.	**No potential.** Study area is outside the elevation range.
Coast rockcress *Arabis blepharophylla*	—/—/4.3	Broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 5 to 3,610 feet (3 to 1,100 meters). Blooms Feb–May.	**No potential.** Study area is outside the elevation range.
marsh sandwort *Arenaria paludicola*	FE/SE/1B.1	Sandy openings in marshes. Elevation ranges from 3 to 170 meters. Blooms May–August.	**Low.** Study area contains suitable habitat. However, there are no nearby recent occurrences.
Franciscan manzanita *Arctostaphylos franciscana*	FE/—/1B.1	Coastal scrub (serpentine). Elevation ranges from 195 to 985 feet (60 to 300 meters). Blooms Feb–Apr.	**No potential.** Study area is outside the elevation range.
San Bruno Mountain manzanita *Arctostaphylos imbricata*	—/SE/1B.1	Chaparral, coastal scrub. Elevation ranges from 900 to 1,215 feet (275 to 370 meters). Blooms Feb–May.	**No potential.** Study area is outside the elevation range.
Presidio manzanita *Arctostaphylos montana* subsp. *ravenii*	FE/SE/1B.1	Chaparral, coastal prairie, coastal scrub. Elevation ranges from 145 to 705 feet (45 to 215 meters). Blooms Feb–Mar.	**No potential.** Study area is outside the elevation range.
Montara manzanita *Arctostaphylos montaraensis*	—/—/1B.2	Chaparral (maritime), coastal scrub. Elevation ranges from 260 to 1,640 feet (80 to 500 meters). Blooms Jan–Mar.	**No potential.** Study area is outside the elevation range.
Pacific manzanita *Arctostaphylos pacifica*	—/SE/1B.1	Chaparral, coastal scrub. Elevation ranges from 1,080 to 1,085 feet (330 to 330 meters). Blooms Feb–Apr.	**No potential.** Study area is outside the elevation range.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Kings Mountain manzanita *Arctostaphylos regismontana*	—/—/1B.2	Broadleafed upland forest, chaparral, north coast coniferous forest. Elevation ranges from 1,000 to 2,395 feet (305 to 730 meters). Blooms Dec–Apr.	**No potential.** Study area is outside the elevation range.
Ocean bluff milk-vetch *Astragalus nuttallii* var. *nuttallii*	—/—/4.2	Coastal bluff scrub, coastal dunes. Elevation ranges from 5 to 395 feet (3 to 120 meters). Blooms Jan–Nov.	**No potential.** Study area is outside the elevation range.
coastal marsh milk-vetch *Astragalus pycnostachyus* var. *pycnostachyus*	—/—/1B.2	Coastal dunes (mesic), coastal scrub, marshes and swamps (coastal salt, streamsides). Elevation ranges from 0 to 100 feet (0 to 30 meters). Blooms (Apr)Jun–Oct.	**Low.** This species may occur within the study area within marsh habitat. No nearby recent occurrences.
alkali milk-vetch *Astragalus tener* var. *tener*	—/—/1B.2	Alkaline flats and vernally moist meadows. Elevation ranges from 0 to 195 feet (1 to 60 meters). Blooms Mar–Jun.	**Low.** Although alkaline habitat (salt panne) is present in the study area, it was observed to be devoid of vegetation during ESA's field survey despite the presence of pooled water.
Oakland star-tulip *Calochortus umbellatus*	—/—/4.2	Broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland. Elevation ranges from 325 to 2,295 feet (100 to 700 meters). Blooms Mar–May.	**No potential.** Study area is outside the elevation range.
Johnny-nip *Castilleja ambigua* var. *insalutata*	—/—/4.2	Coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps, valley and foothill grassland, vernal pools margins. Elevation ranges from 0 to 1,425 feet (0 to 435 meters). Blooms Mar–Aug.	**No potential.** Species range is restricted to Monterey County.
Congdon's tarplant *Centromadia parryi* subsp. *congdonii*	—/—/1B.1	Terraces, swales, floodplains, grassland and disturbed sites. Elevation ranges from 0 to 900 feet (0 to 300 meters). Blooms Jun–Oct.	**Low.** Suitable habitat present, but no documented occurrences within San Mateo or San Francisco Counties.
Pappose tarplant *Centromadia parryi* subsp. *parryi*	—/—/1B.2	Chaparral, coastal prairie, meadows and seeps, marshes and swamps (coastal salt), valley and foothill grassland (vernally mesic). Elevation ranges from 0 to 1,380 feet (0 to 420 meters). Blooms May–Nov.	**Low.** Grassland within the study area provides suitable habitat, but all nearby occurrences are presumed extirpated.
Point Reyes bird's-beak *Chloropyron maritimum* subsp. *palustre*	—/—/1B.2	Marshes and swamps (coastal salt). Elevation ranges from 0 to 35 feet (0 to 10 meters). Blooms Jun–Oct.	**Low.** This species may occur within the study area within marsh habitat. No nearby recent occurrences.
San Francisco Bay spineflower *Chorizanthe cuspidata* var. *cuspidata*	—/—/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub. Elevation ranges from 5 to 705 feet (3 to 215 meters). Blooms Apr–Jul(Aug).	**Low.** While this species may occur within the study area on disturbed sites within sandy soils, all extant populations occur along the open ocean, not within the bay.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	Status	General Habitat Requirements	Potential for Species Occurrence
Robust spineflower *Chorizanthe robusta* var. *robusta*	FE/—/1B.1	Chaparral (maritime), cismontane woodland (openings), coastal dunes, coastal scrub. Elevation ranges from 5 to 985 feet (3 to 300 meters). Blooms Apr–Sep.	**Low.** This species may occur within the study area in openings in sandy soils; however, the species was last observed in San Mateo County in 1905, so is unlikely to be present.
Franciscan thistle *Cirsium andrewsii*	—/—/1B.2	Broadleafed upland forest, coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 0 to 490 feet (0 to 150 meters). Blooms Mar–Jul.	**No potential.** Study area is outside the elevation range.
Crystal Springs fountain thistle *Cirsium fontinale* var. *fontinale*	FE/SE/1B.1	Chaparral (openings), cismontane woodland, meadows and seeps, valley and foothill grassland. Elevation ranges from 145 to 575 feet (45 to 175 meters). Blooms (Apr)May–Oct.	**No potential.** Study area is outside the elevation range.
Compact cobwebby thistle *Cirsium occidentale* var. *compactum*	—/—/1B.2	Chaparral, coastal dunes, coastal prairie, coastal scrub. Elevation ranges from 15 to 490 feet (5 to 150 meters). Blooms Apr–Jun.	**No potential.** Study area is outside the elevation range.
Round-headed Chinese-houses *Collinsia corymbosa*	—/—/1B.2	Coastal dunes. Elevation ranges from 0 to 65 feet (0 to 20 meters). Blooms Apr–Jun.	**Low.** Not observed in San Mateo since 1905. Sandy soils present in the study area only provide marginal suitable habitat.
San Francisco Collinsia *Collinsia multicolor*	—/—/1B.2	Closed-cone coniferous forest, coastal scrub. Elevation ranges from 95 to 820 feet (30 to 250 meters). Blooms (Feb)Mar–May.	**No potential.** Study area is outside the elevation range.
Clustered lady's-slipper *Cypripedium fasciculatum*	—/—/4.2	Lower montane coniferous forest, north coast coniferous forest. Elevation ranges from 325 to 7,990 feet (100 to 2,435 meters). Blooms Mar–Aug.	**Low.** This species may occur in the study area along waterways. The most suitable habitat occurs behind the wastewater treatment plant. However, because the species has not been observed since 1923 in San Mateo County, it is unlikely to occur.
Western leatherwood *Dirca occidentalis*	—/—/1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, north coast coniferous forest, riparian forest, riparian woodland. Elevation ranges from 80 to 1,395 feet (25 to 425 meters). Blooms Jan–Mar(Apr).	**No potential.** Study area is outside the elevation range.
California bottle-brush *Elymus californicus*	—/—/4.3	Broadleafed upland forest, cismontane woodland, north coast coniferous forest, riparian woodland. Elevation ranges from 45 to 1,540 feet (15 to 470 meters). Blooms May–Aug(Nov).	**Low.** The species may occur within the study area along forested habitat behind the wastewater treatment plant. Study area is not within elevation range.
Marsh horsetail *Equisetum palustre*	—/—/3	Marshes and swamps. Elevation ranges from 145 to 3,280 feet (45 to 1,000 meters).	**No potential.** Study area is outside the elevation range.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	Status	General Habitat Requirements	Potential for Species Occurrence
San Mateo woolly sunflower *Eriophyllum latilobum*	FE/SE/1B.1	Cismontane woodland (often serpentine, on roadcuts), coastal scrub, lower montane coniferous forest. Elevation ranges from 145 to 1,085 feet (45 to 330 meters). Blooms May–Jun.	**No potential.** Study area is outside the elevation range.
San Francisco wallflower *Erysimum franciscanum*	—/—/4.2	Serpentine outcrops, coastal scrub or sand dunes and granitic hillsides. Elevation ranges from 0 to 1,805 feet (0 to 550 meters). Blooms Mar–Jun.	**Low.** Sandy areas within study area only provide marginal suitable habitat.
Hillsborough chocolate lily *Fritillaria biflora* var. *ineziana*	—/—/1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 490 to 490 feet (150 to 150 meters). Blooms Mar–Apr.	**No potential.** Study area is outside the elevation range.
Marin checker lily *Fritillaria lanceolata* var. *tristulis*	—/—/1B.1	Coastal bluff scrub, coastal prairie, coastal scrub. Elevation ranges from 45 to 490 feet (15 to 150 meters). Blooms Feb–May.	**No potential.** Study area is outside the elevation range.
Fragrant fritillary *Fritillaria liliacea*	—/—/1B.2	Heavy soils on open hills near the coast, often sepentinite, within woodland, scrub and grassland. Elevation ranges from 5 to 1,345 feet (3 to 410 meters). Blooms Feb–Apr.	**Low.** Upland grasslands only provide marginal suitable habitat.
Blue coast gilia *Gilia capitata* subsp. *chamissonis*	—/—/1B.1	Coastal sand hills. Elevation ranges from 5 to 655 feet (2 to 200 meters). Blooms Apr–Jul.	**Low.** Sandy soils present in the study area only provide marginal suitable habitat. Only one documented occurrence within San Mateo County.
Dark-eyed gilia *Gilia millefoliata*	—/—/1B.2	Coastal dunes. Elevation ranges from 5 to 100 feet (2 to 30 meters). Blooms Apr–Jul.	**Low.** Sandy soils present in the study area only provide marginal suitable habitat. Has not been observed in San Mateo County since 1902.
San Francisco gumplant *Grindelia hirsutula* var. *maritima*	—/—/3.2	Coastal bluff scrub, coastal scrub, valley and foothill grassland. Elevation ranges from 45 to 1,310 feet (15 to 400 meters). Blooms Jun–Sep.	**Low.** The species may occur within the study area within marsh habitat; other species of Grindelia were observed throughout the study area during the August 2020 survey. Species occurs at slightly higher elevations then occur within the study area.
Diablo helianthella *Helianthella castanea*	—/—/1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Elevation ranges from 195 to 4,265 feet (60 to 1,300 meters). Blooms Mar–Jun.	**No potential.** Study area is outside the elevation range.
Congested-headed hayfield tarplant *Hemizonia congesta* subsp. *congesta*	—/—/1B.2	Valley and foothill grassland. Elevation ranges from 65 to 1,835 feet (20 to 560 meters). Blooms Apr–Nov.	**Low.** All populations that previously occurred in San Mateo County have been extirpated.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Short-leaved evax *Hesperevax sparsiflora* var. *brevifolia*	—/—/1B.2	Coastal bluff scrub (sandy), coastal dunes, coastal prairie. Elevation ranges from 0 to 705 feet (0 to 215 meters). Blooms Mar–Jun.	**Low.** There are only two records of this species occurring within San Francisco and San Mateo Counties, both of which are believed to be extirpated.
Marin western flax *Hesperolinon congestum*	FT/ST/1B.1	Chaparral, valley and foothill grassland on serpentine soils. Elevation ranges from 15 to 1,215 feet (5 to 370 meters). Blooms Apr–Jul.	**No potential.** No suitable habitat present within the study area.
Water star-grass *Heteranthera dubia*	—/—/2B.2	Marshes and swamps (alkaline, still or slow-moving water). Elevation ranges from 95 to 4,905 feet (30 to 1,495 meters). Blooms Jul–Oct.	**Low.** The species may occur in slow-moving or still water throughout the study area; however, the species may be extirpated from San Mateo County as there are no occurrences listed in California Consortium of Herbaria (2020).
Kellogg's horkelia *Horkelia cuneata* var. *sericea*	—/—/1B.1	Closed-cone coniferous forest, chaparral (maritime), coastal dunes, coastal scrub. Elevation ranges from 30 to 655 feet (10 to 200 meters). Blooms Apr–Sep.	**No potential.** Study area is outside the elevation range.
Point Reyes Horkelia *Horkelia marinensis*	—/—/1B.2	Coastal dunes, coastal prairie, coastal scrub. Elevation ranges from 15 to 2,475 feet (5 to 755 meters). Blooms May–Sep.	**Low.** Some marginal suitable habitat present within the study area, but there are no nearby recent occurrences.
Island rock lichen *Hypogymnia schizidiata*	—/—/1B.3	Closed-cone coniferous forest, chaparral. Elevation ranges from 1,180 to 1,330 feet (360 to 405 meters).	**No potential.** Study area is outside the elevation range.
Coast iris *Iris longipetala*	—/—/4.2	Freshwater meadows and seeps. Elevation ranges from 0 to 1,970 feet (0 to 600 meters). Blooms Mar–May.	**Low.** Grasslands present within the study area only provide marginal suitable habitat. There are several nearby occurrences in the San Bruno Mountain State & County Park, none of which occur within alkaline wetlands.
Perennial goldfields *Lasthenia californica* subsp. *macrantha*	—/—/1B.2	Coastal bluff scrub, coastal dunes, coastal scrub. Elevation ranges from 15 to 1,705 feet (5 to 520 meters). Blooms Jan–Nov.	**No potential.** Study area is slightly outside the elevation range. All extant populations occur along the open ocean, not within the bay.
Coast yellow Leptosiphon *Leptosiphon croceus*	—/SE/1B.1	Coastal bluff scrub, coastal prairie. Elevation ranges from 30 to 490 feet (10 to 150 meters). Blooms Apr–Jun.	**No potential.** Study area is outside the elevation range.
Rose leptosiphon *Leptosiphon rosaceus*	—/—/1B.1	Open, grassy slopes and coastal bluffs. Elevation ranges from 0 to 330 feet (0 to 100 meters). Blooms Apr–Jul.	**Low.** Sandy areas present within the study provide suitable habitat. However, there are no nearby recent occurrences.
Crystal Springs lessingia *Lessingia arachnoidea*	—/—/1B.2	Cismontane woodland, coastal scrub, valley and foothill grassland. Elevation ranges from 195 to 655 feet (60 to 200 meters). Blooms Jul–Oct.	**No potential.** Study area is outside the elevation range.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
San Francisco lessingia *Lessingia germanorum*	FE/SE/1B.1	Coastal scrub (remnant dunes). Elevation ranges from 80 to 360 feet (25 to 110 meters). Blooms (Jun)Jul–Nov.	**No potential.** Study area is outside the elevation range.
Woolly headed Lessingia *Lessingia hololeuca*	—/—/3	Broadleafed upland forest, coastal scrub, lower montane coniferous forest, valley and foothill grassland in serpentine soils. Elevation ranges from 45 to 1,000 feet (15 to 305 meters). Blooms Jun–Oct.	**No potential.** Study area is outside the elevation range.
Coast lily *Lilium maritimum*	—/—/1B.1	Broadleafed upland forest, closed-cone coniferous forest, coastal prairie, coastal scrub, marshes and swamps (freshwater), north coast coniferous forest. Elevation ranges from 15 to 1,560 feet (5 to 475 meters). Blooms May–Aug.	**Low.** The species may occur in coastal scrub habitat within the study area, although the species has not been observed recently in San Mateo County so its presence is unlikely.
Ornduff's meadowfoam *Limnanthes douglasii* subsp. *ornduffii*	—/—/1B.1	Meadows and seeps. Elevation ranges from 30 to 65 feet (10 to 20 meters). Blooms Nov–May.	**Low.** There is currently only one known population of the species near Half Moon Bay.
San Mateo tree lupine *Lupinus arboreus* var. *eximius*	—/—/3.2	Chaparral, coastal scrub. Elevation ranges from 295 to 1,805 feet (90 to 550 meters). Blooms Apr–Jul.	**No potential.** Study area is outside the elevation range.
Indian Valley bush-mallow *Malacothamnus aboriginum*	—/—/1B.2	Chaparral, cismontane woodland. Elevation ranges from 490 to 5,575 feet (150 to 1,700 meters). Blooms Apr–Oct.	**No potential.** Study area is outside the elevation range.
Arcuate bush-mallow *Malacothamnus arcuatus*	—/—/1B.2	Chaparral, cismontane woodland. Elevation ranges from 45 to 1,165 feet (15 to 355 meters). Blooms Apr–Sep.	**No potential.** Study area is outside the elevation range.
Davidson's bush-mallow *Malacothamnus davidsonii*	—/—/1B.2	Chaparral, cismontane woodland, coastal scrub, riparian woodland. Elevation ranges from 605 to 3,740 feet (185 to 1,140 meters). Blooms Jun–Jan.	**No potential.** Study area is outside the elevation range.
Hall's bush-mallow *Malacothamnus hallii*	—/—/1B.2	Chaparral, coastal scrub. Elevation ranges from 30 to 2,495 feet (10 to 760 meters). Blooms (Apr)May–Sep(Oct).	**No potential.** Study area is outside the elevation range.
Northern curly leaved Monardella *Monardella sinuata* subsp. *nigrescens*	—/—/1B.2	Chaparral, coastal dunes, coastal scrub, lower montane coniferous forest, and woodland. Elevation ranges from 0 to 985 feet (0 to 300 meters). Blooms (Apr)May–Jul(Aug–Sep).	**No potential.** No recent occurrences in San Mateo County.

Common Name *Scientific Name*	Status	General Habitat Requirements	Potential for Species Occurrence
Woodland woolythreads *Monolopia gracilens*	—/—/1B.2	Broadleafed upland forest (openings), chaparral (openings), cismontane woodland, north coast coniferous forest (openings), valley and foothill grassland. Elevation ranges from 325 to 3,935 feet (100 to 1,200 meters). Blooms (Feb)Mar–Jul.	**No potential.** Study area is outside the elevation range.
White-rayed pentachaeta *Pentachaeta bellidiflora*	FE/SE/1B.1	Cismontane woodland, valley and foothill grassland (often serpentine). Elevation ranges from 110 to 2,035 feet (35 to 620 meters). Blooms Mar–May.	**No potential.** Study area is outside the elevation range.
Choris' popcornflower *Plagiobothrys chorisianus* var. *chorisianus*	—/—/1B.2	Chaparral, coastal prairie, coastal scrub. Elevation ranges from 5 to 525 feet (3 to 160 meters). Blooms Mar–Jun.	**Low.** Species may occur near marsh edges along the coast. Has not been seen in San Mateo County along the coast since 1965 near Point San Bruno and since 1932 along the shoreline in Burlingame.
Oregon Polemonium *Polemonium carneum*	—/—/2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest. Elevation ranges from 0 to 6,005 feet (0 to 1,830 meters). Blooms Apr–Sep.	**No potential.** Species only known from Pilarcitos Canyon/Reservoir area and Santa Cruz Mountains locally.
Hickman's cinquefoil *Potentilla hickmanii*	FE/SE/1B.1	Coastal bluff scrub, closed-cone coniferous forest, meadows and seeps (vernally mesic), marshes and swamps (freshwater). Elevation ranges from 30 to 490 feet (10 to 149 meters). Blooms Apr–Aug.	**No potential.** Study area is outside the elevation range.
Lobb's aquatic buttercup *Ranunculus lobbii*	—/—/4.2	Cismontane woodland, north coast coniferous forest, valley and foothill grassland, vernal pools. Elevation ranges from 45 to 1,540 feet (15 to 470 meters). Blooms Feb–May.	**No potential.** Study area is outside the elevation range.
Chaparral ragwort *Senecio aphanactis*	—/—/2B.2	Chaparral, cismontane woodland, coastal scrub. Elevation ranges from 45 to 2,625 feet (15 to 800 meters). Blooms Jan–Apr (May).	**No potential.** Study area is outside the elevation range.
Scouler's catchfly *Silene scouleri* subsp. *scouleri*	—/—/2B.2	Coastal bluff scrub, coastal prairie, valley and foothill grassland. Elevation ranges from 0 to 1,970 feet (0 to 600 meters). Blooms (Mar–May)Jun–Aug(Sep).	**Low**. Species recorded along the coast north in the Bayview Hills in 1956, but has not been observed since.
San Francisco campion *Silene verecunda* subsp. *verecunda*	—/—/1B.2	Coastal bluff scrub, chaparral, coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 95 to 2,115 feet (30 to 645 meters). Blooms (Feb)Mar–Jun(Aug).	**No potential.** Study area is outside the elevation range.
California seablite *Suaeda californica*	FE/—/1B.1	Marshes and swamps (coastal salt). Elevation ranges from 0 to 50 feet (0 to 15 meters). Blooms Jul–Oct.	**Moderate.** Marsh within study area provides suitable habitat. Nearest recent occurrence is approximately 6 miles away from study area.
Two-fork clover *Trifolium amoenum*	FE/—/1B.1	Coastal bluff scrub, valley and foothill grassland (sometimes serpentine). Elevation ranges from 15 to 1,360 feet (5 to 415 meters). Blooms Apr–Jun.	**Low.** Nearby populations have been extirpated.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Saline clover *Trifolium hydrophilum*	—/—/1B.2	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools. Elevation ranges from 0 to 985 feet (0 to 300 meters). Blooms Apr–Jun.	**Low.** Marsh within study area provides suitable habitat. However, there are no nearby recent occurrences.
San Francisco owl's-clover *Triphysaria floribunda*	—/—/1B.2	Coastal grassland and serpentine slopes. Elevation ranges from 0 to 600 feet (0 to 200 meters). Blooms Apr–Jun.	**Low.** Grassland present within the study area only provides marginal suitable habitat. Many of the occurrences within the area have been extirpated.
Coastal triquetrella *Triquetrella californica*	—/—/1B.2	Coastal bluff scrub, coastal scrub. Elevation ranges from 30 to 330 feet (10 to 100 meters).	**No potential.** Study area is outside the elevation range.
Invertebrates			
Opler's longhorn moth *Adela oplerella*	—/*/—	From Marin County and the Oakland area on the inner coast ranges south to Santa Clara County. One record from Santa Cruz County. All but Santa Cruz site is on serpentine grassland. Larvae feed on *Platystemon californicus*.	**Low.** Host plants for this species were not observed during reconnaissance survey. The nearest CNDDB occurrence record for this species is approximately 7 miles northwest of the Project and was recorded in 1909 (Occurrence No. 12).
Incredible harvestman *Banksula incredula*	—/*/—	Known only from the type locality, San Bruno Mountain, San Mateo County.	**No potential.** Suitable habitat not present within study area.
Obscure bumble bee *Bombus caliginosus*	—/SC/—	Coastal areas from Santa Barabara county to north to Washington state. Food plant genera include Baccharis, Cirsium, Lupinus, Lotus, Grindelia and Phacelia.	**Low.** Food plants present in study area but in limited quantities. The nearest CNDDB occurrence record for this species is approximately 2 miles south of the Project and was recorded in 1926 (Occurrence No. 124).
Western bumble bee *Bombus occidentalis*	—/SC/—	Once common & widespread, species has declined precipitously from central CA to southern B.C., perhaps from disease.	**Low.** Food plants present in study area but in limited quantities. The nearest CNDDB occurrence record for this species is approximately 3.25 miles east of the Project and was recorded in 1996 (Occurrence No. 244).
San Bruno elfin butterfly *Callophrys mossii bayensis*	FE/—/—	Serpentine grasslands with larval host plants dwarf plantain (*Plantago erectis*) and purple owl's clover (*Castilleja exserta subsp. exerta*).	**No potential.** Host plants for this species were not observed during reconnaissance survey and site conditions are not conducive to supporting host plants; therefore this species is not expected on site.
Monarch butterfly – California overwintering population *Danaus plexippus*	—/*/—	Eucalyptus groves (wintering sites).	**Low.** Eucalyptus trees within SFO (e.g., near Coast Guard station) provide potentially suitable overwintering habitat. However, no impacts to these areas resulting from the Project are anticipated.
Stage's dufourine bee *Dufourea stagei*	—/*/—	Coastal scrub; ground-nesting bee.	**Low.** Suitable habitat present within study area in limited quantities. The nearest CNDDB occurrence record for this species is at least 2.0 miles north of the Project on Montara Mountain and was recorded in 1962 (Occurrence No. 1).

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT/—/—	Serpentine grasslands with larval host plants dwarf plantain (*Plantago erectis*) and purple owl's clover (*Castilleja exserta subsp. exerta*).	**No potential.** Host plants for this species were not observed during reconnaissance survey and site conditions are not conducive to supporting host plants; therefore this species is not expected on site.
San Francisco forktail damselfly *Ischnura gemina*	—/*/—	Endemic to the San Francisco Bay area. Small, marshy ponds and ditches with emergent and floating aquatic vegetation.	**Low.** Nearest CNDDB occurrence record from 1996 within flood control channel vegetated with *Typha,* west of SFO and U.S. 101 on SFO's West-of-Bayshore property (Occurrence No. 7). Marginally suitable habitat may be present within the study area in the San Bruno Channel.
Mission blue butterfly *Plebejus icarioides missionensis*	FE/—/—	Grassland with *Lupinus albifrons*, *L. formosa*, and *L. varicolor*.	**No potential.** Host plants for this species were not observed during reconnaissance survey and site conditions are not conducive to supporting host plants; therefore this species is not expected on site.
Callippe silverspot butterfly *Speyeria callippe callippe*	FE/—/—	Found in native grasslands with *Viola pedunculata* as larval food plant.	**No potential.** Site conditions are not conducive to supporting host plants; therefore this species is not expected on site.
Myrtle's silverspot butterfly *Speyeria zerene myrtleae*	FE/—/—	Host plants include *Grindelia hirsutula, Abronia latifolia, Mondardella, Cirsium vulgare, and Erigeron glaucus* where found on the San Francisco and Marin peninsulas.	**No potential.** The only vegetated portion of the project site is dominated by sweet fennel and coyote bush. Host plants for this species were not observed during reconnaissance survey and site conditions are not conducive to supporting host plants; therefore this species is not expected on site.
Fish and Marine Mammals			
Green Sturgeon (Southern DPS) *Acipenser medirostris*	FT/SSC/—	Marine and estuarine environments and Sacramento River; All of San Francisco Bay-Delta.	**Moderate.** This species migrates from the Pacific Ocean to spawning habitat in the Sacramento River watershed but may forage in or near the project area.
Pacific herring (*Clupea pallasii*)	CDFW-managed species under the MLMA	Spawns in estuaries and bays, including along Oakland and San Francisco waterfronts, where it attaches egg masses to eelgrass, seaweed, pilings, breakwater rubble, and other hard surfaces. Juveniles congregate in San Francisco Bay during summer before moving into deeper waters in fall.	**Moderate.** Species spawning is documented to occur within 8 miles of the study area and suitable habitat is present in the study area for juveniles.
Tidewater goby *Eucyclogobius newberryi*	FE/SSC/—	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	**No potential.** Tidewater goby is no longer believed to occur in San Francisco Bay.[1]
Delta smelt *Hypomesus transpacificus*	FT/SE/—	Sacramento–San Joaquin Delta. Seasonally in Suisun Bay, Carquinez Strait & San Pablo Bay.	**No potential.** Study area outside of known range.

[1] U.S. Fish and Wildlife Service. 2005. Recovery Plan for the Tidewater Goby (Eucyclogobius newberryi). U.S. Fish and Wildlife Service, Portland, Oregon. vi + 199 pp.

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Hardhead *Mylopharodon conocephalus*	—/SSC/—	Low to mid-elevation freshwater streams in the Sacramento–San Joaquin drainage. Also present in the Russian River. Clear, deep pools with sand-gravel-boulder bottoms and slow water velocity. Not found where exotic centrarchids predominate.	**No potential.** No suitable habitat within study area.
Central California coast DPS steelhead *Oncorhynchus mykiss*	FT/SSC/—	Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds.	**Moderate.** No foraging or spawning habitat for this species is present. No streams supporting spawning runs are present within or in the vicinity of the marine study area. There is a moderate potential for incidental occurrence of this species if individuals are lost or swept into the area by currents.
Central Valley spring-run ESU Chinook salmon *O. tshawytscha*	FT/ST/—	Ocean waters, Sacramento and San Joaquin Rivers; Migrates from ocean through San Francisco Bay-Delta to freshwater spawning grounds	**Low.** No foraging of spawning habitat for this species is present. No streams supporting spawning runs are present within or in the vicinity of the project site. There is a low potential for incidental occurrence of this species if individuals stray from migration routes.
Sacramento River winter-run ESU Chinook salmon *O. tshawytscha*	FE/SE/—	Ocean waters, Sacramento and San Joaquin Rivers; Migrates from ocean through San Francisco Bay-Delta to freshwater spawning grounds.	**Low.** No foraging of spawning habitat for this species is present. No streams supporting spawning runs are present within or in the vicinity of the project site. There is a low potential for incidental occurrence of this species if individuals stray from migration routes.
Pacific harbor seal *Phoca vitulina richardii*	Protected by MMPA	Estuaries and nearshore waters with rocky or soft-bottomed substrates. Frequently hauls out on intertidal rocks, tidal mudflats and sandy beaches.	**Moderate.** Harbor seals have been observed somewhat regularly in the study area throughout the year between 2015 and 2020.
Harbor porpoise *Phocoena phocoena*	Protected by MMPA	Nearshore waters, particularly bays, estuaries, harbors, and fjords less than 600 feet (200 m) deep. Range in the Pacific extends from as far north as the Bering Sea, Alaska, as far south as Point Conception, California.	**Low.** Harbor porpoise sightings In San Francisco Bay are concentrated around the Golden Gate Bridge and Richardson Bay.
Longfin smelt *Spirinchus thaleichthys*	FC/ST/—	Throughout the nearshore coastal waters and open waters of San Francisco Bay-Delta including the river channels and sloughs of the Delta.	**High.** This species is documented to inhabit the deep channels of Central Bay for most of the year, including the waters adjacent to the project site.
California sea lion *Zalophus californianus*	Protected by MMPS	Inhabits estuaries and nearshore waters. Hauls out on islands, natural; mainland areas, and man-made structures. Pier 39 of San Francisco is the only haul-out site in San Francisco Bay. Primary breeding sites in California are Año Nuevo State Park and the Channel Islands. No breeding sites exist in San Francisco Bay.	**Moderate.** California sea lion may enter the study area to forage. A California sea lion has been found on the SFO airfield at least twice, most recently in 2020.[2]

2 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, editorial comment to draft document, February 22, 2021.

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Reptiles			
Western pond turtle *Actinemys marmorata*	—/SSC/—	Ponds, marshes, rivers, streams, and irrigation ditches with aquatic vegetation. Requires basking sites and suitable upland habitat for egg-laying. Nest sites most often characterized as having gentle slopes (<15%) with little vegetation or sandy banks.	**Moderate.** The nearest occurrence was recorded in 2006, approximately 3.1 miles southwest of the study area in a creek linking San Andreas Lake and Crystal Springs Reservoir (Occurrence No. 350). Optimal habitat is not present within the study area. The Millbrae Canal and San Bruno Channel are located within the study area and provide marginally suitable habitat for western pond turtle. Both channels provide low-quality habitat because of the lack of basking sites (e.g., steep levee banks, concrete-lined channel in the Millbrae Canal) and upland areas for breeding.
Green sea turtle *Chelonia mydas*	FT/—/—	Range in the eastern North Pacific Ocean from Baja California to Alaska, most commonly from San Diego South. When in nearshore foraging grounds, turtles feed on seagrasses and algae.	**Low.** Unlikely to occur in San Francisco Bay along the project site.
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	FE/SE,FP/—	Densely vegetated ponds near open hillsides with abundant small mammal burrows.	**Low.** Optimal habitat is not present within the study area, but wetlands west of SFO and U.S. 101 on SFO's West-of-Bayshore property support a known breeding population. The Millbrae Channel, which flows directly south of this area, is a concrete-lined channel that provides poor-quality habitat for SFGS. Because of significant physical barriers to dispersal (such as U.S. 101) and a lack of suitable upland and aquatic habitat within the study area, the potential for SFGS to occur within the study area is low.
Amphibians			
California giant salamander *Dicamptodon ensatus*	—/SSC/—	Wet coastal forests in or near cold, permanent and semi-permanent streams and seepages.	**No potential.** Suitable habitat is not present within the study area.
Foothill yellow-legged frog *Rana boylii*	—/SC/—	Partly shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Needs at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis.	**No potential.** No suitable habitat within the study area.
California red-legged frog *Rana draytonii*	FT/SSC/—	Freshwater ponds and slow streams with emergent vegetation for egg attachment. Requires 11–20 weeks of permanent water for larval development. Must have access to estivation habitat.	**Low.** Known CRLF breeding population occurs in wetlands west of SFO and U.S. 101 on SFO's West-of-Bayshore property this area (Occurrence No. 33). The Millbrae Channel, which flows directly south of this area, is a concrete-lined channel that provides poor-quality habitat for CRLF. Because of significant physical barriers to dispersal (such as U.S. 101) and a lack of suitable upland and aquatic habitats within the study area, the potential for CRLF to occur within the study area is low.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	Status	General Habitat Requirements	Potential for Species Occurrence
Birds			
Burrowing owl *Athene cunicularia*	—/SSC/—	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	**Present (Low nesting and overwintering potential).** Study area has limited to no burrows or burrow surrogates for nesting or overwintering burrowing owls (ground squirrels are not present). However, burrowing owl has been observed in the study area for short periods of time (< 2 weeks) in October 2015, December 2016 and December 2017 in 3 separate locations: near the end of runway 19L, at the intersection of taxiways C and L, between the 28 runways by taxiways C and P.[3]
Marbled Murrelet *Brachyramphus marmoratus*	FT/SE/—	Feeds near-shore; nests inland along coast from Eureka to Oregon border and from Half Moon Bay to Santa Cruz. Nests in old-growth redwood-dominated forests, up to six miles inland, often in Douglas-fir.	**Low (No nesting potential)**. No suitable nesting habitat within the study area. Unlikely to occur in San Francisco Bay.
Western snowy plover *Charadrius alexandrinus nivosus*	FT/SSC/—	Sandy beaches, salt pond levels and shores of alkali lakes. Needs sandy, gravelly or friable soils for nesting.	**High (No nesting potential).** Suitable nesting habitat is not present within the study area. Overwintering individuals have been observed foraging within the study area on a spit located at the corner of Reach 12 and Reach 13.
Merlin *Falco columbarius*	—/WL/—	Bay marshes, open woodlands, savannahs, edges of grasslands, deserts, farmlands, and cities. Preys primarily on birds of open habitats, using trees and snags as a hunting post.	**Present (No nesting potential).** Merlin has been documented at SFO in 2015 and 2019.[4] May overwinter and forage within the study area; however, study area is outside of breeding range.
American peregrine falcon *Falco peregrines anatum*	FDL/SDL, FP/—	Woodlands, coastal habitats, riparian areas, coastal and inland waters, human made structures that may be used as nest or temporary perch sites.	**Present.** A breeding pair of American peregrine falcons successfully nested within the SFO United MOC maintenance hangar, located near Reach 1, in 2020[5] and have been nesting in this location since at least 2011.[6]
Salt marsh common yellowthroat *Geothlypis trichas sinuosa*	—/SSC/—	Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting.	**Moderate.** Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for saltmarsh common yellowthroat. The nearest record of this species occurred in 2001 approximately 3 miles west of the study area around San Andreas Lake (Occurrence No. 79).

3 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, pers. comm.
4 Ibid.
5 Ibid.
6 Zeka Glucs Director, Predatory Bird Research Group, University of California, Santa Cruz, pers. comm.

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
California black rail *Laterallus jamaicensis coturniculus*	—/ST, FP/—	Salt and brackish marshes; also in freshwater marshes at low elevations.	**Moderate.** Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for California black rail. Marsh bird surveys conducted for the San Francisco Estuary Invasive Spartina Project in 2017, 2018, and 2019 did not detect any California black rails within marshes in the Reach 14 area.7 The nearest record of this species occurred in 1972 approximately 7 miles southeast of the study area (Occurrence No. 12).
White-tailed kite *Elanus leucurus*	—/FP/—	Inhabit savannas, open woodlands, marshes, desert grasslands, partially cleared lands, and cultivated fields. Nests in trees that typically range from 10 to 160 feet tall.	**Present (Limited nesting potential).** Known to occur within study area. Trees in study area provide potential roosting and nesting habitat. Marshes in study area provide foraging habitat.
Alameda song sparrow *Melospiza melodia pusillula*	—/SSC/—	Salt marshes of eastern and south San Francisco Bay. Inhabits Salicornia marshes; nests low in Grindelia bushes (high enough to escape high tides) and in Salicornia.	**Moderate.** Tidal and brackish marshes in the study area, including those in Reaches 1 (San Bruno Channel), 2, and 14, provide suitable habitat for Alameda song sparrow. The nearest record of this species occurred in 1947 in the vicinity of the study area (San Bruno) (Occurrence No. 32).
Brown pelican *Pelecanus occidentalis californicus* (nesting colony and communal roosts)	FDL/CDL, FP/—	Pelagic forager along ocean and bay shorelines whose breeding range extends from the Channel Islands south to Mexico.	**Present (No nesting potential).** Known to occur in study area, resting on sand spit beach at the end of the 28 runways and on the jetty west of the wastewater treatment plant. Forages in the San Francisco Bay. Could loaf on features such as piers in the project study area. San Francisco Bay is located outside of the species' breeding range.
Double-crested cormorant *Phalacrocorax auritus*	—/WL/—	Rookery breeder in coastal areas and inland lakes in fresh, saline, and estuarine waters.	**Present (Limited nesting potential).** Abundant in San Francisco Bay. May forage off-shore of the study area. Trestles and spits offer limited low quality nesting habitat.
Short-tailed albatross *Phoebastria (=Diomedea) albatrus*	FE/SSC/—	A pelagic species that spends most of its time at sea and returns to land only for breeding purposes.	**Low (No nesting potential).** Breeds only at one or two sites off the coast of Japan, occasional visitor to California coast and could appear on a transient basis offshore of the study area.
California Ridgway's rail *Rallus obsoletus obsoletus*	FE/ST, FP/—	Salt marsh wetlands with dense vegetation along the San Francisco Bay.	**Present.** California Ridgway's rails are known to occur in marsh habitat within the Reach 14 area. A small number of individuals were documented during breeding season surveys in this marsh annually from 2007 through 2019,[8] and in 2021.[9]

7 OEI. 2018b, 2019. California Ridgway's Rail Surveys for the San Francisco Estuary Invasive Spartina Project. Reports to California Coastal Conservancy. Prepared by Olofson Environmental, Inc. November 12, 2018, January 13, 2020.

8 OEI. 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2018a, 2018b, 2019. California Ridgway's Rail Surveys for the San Francisco Estuary Invasive Spartina Project. Reports to California Coastal Conservancy. Prepared by Olofson Environmental, Inc. July 6, 2007, June 30, 2009, November 2009, February 2011, December 2011, December 18, 2012, November 23, 2013, October 2014, September 24, 2015, November 30, 2016, January 23, 2018, November 12, 2018, January 13, 2020.

9 Natalie Reeder, Wildlife Biologist, San Francisco International Airport, pers. comm.

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name ***Scientific Name***	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Bank swallow *Riparia riparia (nesting)*	—/ST/—	Vertical banks and cliffs with sandy soil, near water. Nests in holes dug in cliffs and river banks.	**Low (No nesting potential).** No suitable nesting habitat in the study area. Species may occur on a transient basis while foraging.
California least tern *Sternula antillarum browni*	FE/SE, FP/—	Nests along the coast from San Francisco Bay south to northern Baja California. Colonial breeder on bare or sparsely vegetated, flat substrates: sand beaches, alkali flats, landfills, or paved areas.	**Low (Limited nesting potential).** Forages near the Bay shoreline. The Project site shoreline is nearly completely armored with riprap. Salt panne and other unvegetated areas along the shoreline provide limited low quality nesting habitat. Closest nesting site is located on Alameda NAS.
Mammals			
Pallid bat *Antrozous pallidus*	—/—/WBWG: High	Prefers caves, crevices, hollow trees, or buildings in areas adjacent to open space for foraging. Associated with lower elevations in California.	**Moderate.** The nearest record for this species is adjacent to the project site (Millbrae) and was recorded in 1947 (Occurrence No. 294).
Townsend's big-eared bat *Corynorhinus townsendii*	—/CSC/WBWG: High	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings of rocky areas with caves or tunnels. Roosting sites limited. Extremely sensitive to human disturbance.	**Low.** Limited roosting habitat for this species is available within buildings of the project site; however high levels of human disturbance in the project vicinity may discourage use.
Santa Cruz kangaroo rat *Dipodomys venustus venustus*	—/*/—	Silverleaf manzanita mixed chaparral in the Zayante Sand Hills ecosystem of the Santa Cruz Mountains. Needs soft, well-drained sand.	**No potential.** Suitable habitat not present within the study area.
Southern Sea Otter *Enhydra lutris nereis*	FT/FP/—	Nearshore environments between Santa Barbara and Half Moon Bay. Although historic inhabitants of San Francisco Bay prior to being hunted to near extinction, occasional sightings of otters within the Bay occur.	**Low.** Species is an infrequent visitor to San Francisco Bay and historically have limited their visitations to the waters between the Golden Gate and Alcatraz Island, including Richardson Bay.
North American porcupine *Erethizon dorsatum*	—/*/—	Forested habitats in the Sierra Nevada, Cascade, and Coast ranges, with scattered observations from forested areas in the Transverse Ranges. Wide variety of coniferous and mixed woodland habitat.	**No potential.** Suitable habitat not present within the study area.
Hoary bat *Lasiurus cinereus*	—/—/WBWG: Medium	Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths; requires water. Could forage over San Francisco Bay.	**Moderate.** Trees within the study area provide potential roosting habitat. Study area provides foraging habitat. The nearest record for this species was collected just east of the project site (San Bruno) in 1990 (Occurrence No. 119).
Fringed myotis *Myotis thysanodes*	—/—/WBWG: High	In a wide variety of habitats, optimal habitats are pinyon-juniper, valley foothill hardwood & hardwood-conifer. Uses caves, mines, buildings or crevices for maternity colonies and roosts.	**Moderate.** Trees within the study area provide potential roosting habitat. The nearest record for this species was collected approximately 2.3 miles east of the project site near Crystal Springs Reservoir in 2005 (Occurrence No. 44).

APPENDIX E
SPECIAL-STATUS SPECIES POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name *Scientific Name*	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**
Yuma myotis *Myotis yumanensis*	—/—/WBWG: Low-Medium	Optimal habitats are open forests and woodlands with sources of water over which to feed. Wide variety of habitats below 8,000-foot elevation. Distribution is closely tied to bodies of water. Maternity colonies in caves, mines, buildings or crevices.	**Moderate.** Yuma myotis is also known to forage over salt marshes and estuaries in San Francisco Bay.[10] Aquatic habitats present within the study area provide foraging habitat for this species.
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	—/SSC/—	Forest habitats of moderate canopy & moderate to dense understory. May prefer chaparral & redwood habitats. Constructs nests of shredded grass, leaves & other material. May be limited by availability of nest-building materials.	**No potential.** Suitable habitat not present within the study area.
Big free-tailed bat *Nyctinomops macrotis*	—/SSC/WBWG: Medium-High	Low-lying arid areas in Southern California. Prefer habitats with rugged, rocky terrain up to 8,000 feet elevation. Need high cliffs or rocky outcrops for roosting sites. Feeds principally on large moths.	**Low.** Could migrate through study area. However, preferred habitat not present within study area. Nearest occurrence record is approximately 4.5 miles east of the Project site in Pacifica and was recorded in 1984 (Occurrence No. 20).
Salt marsh harvest mouse *Reithrodontomys raviventris*	FE/SE, FP/—	Only in the saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed is primary habitat, but may occur in other marsh vegetation types and in adjacent upland areas. Does not burrow; builds loosely organized nests. Requires higher areas for flood escape.	**Low.** The nearest record of this species is approximately 7 miles south of the study area and was recorded in 1960 (Occurrence No. 57). Tidal marsh habitat in the Reach 14 area provides only marginally suitable habitat because of its narrow, linear configuration and lack of high-tide refugia, and isolation from known populations in south San Francisco Bay.
American badger *Taxidea taxus*	—/SSC/—	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	**No potential.** Suitable habitat not present within the study area.

10 Johnston, D. 2007. Bats and the San Francisco Bay. *Tideline, San Francisco Bay National Wildlife Refuge Complex* 28.4: 1-4.

Common Name *Scientific Name*	**Status**	**General Habitat Requirements**	**Potential for Species Occurrence**

NOTES:

CNDDB = California Natural Diversity Database

[a] The California Department of Fish and Wildlife (CDFW), the agency responsible for determining California Rare Plant Rank (CRPR) plant rankings, does not recognize a ranking status for the northern California black walnut, as the species is not named on CDFW's October 2019 *Special Vascular Plants, Bryophytes, and Lichens List*; however, the California Native Plant Society (CNPS) recognizes this tree as a Rank 1B.1 (rare, threatened, or endangered in California and elsewhere; seriously threatened in California). There is a current widespread distribution in Northern California and southern Oregon of trees that match *J. hindsii* morphologically, previously thought to be hybrids. Recent findings show that most of these occurrences are genetically pure *J. hindsii*.[11] There are only three or four sites (in Contra Costa, Sacramento, and Napa Counties) where the species is known to have occurred before the extensive settlement of California by Europeans in the mid-19th century, which has served as the exclusive justification for CNPS designating a rare plant rank of 1B.1. This now-known widespread distribution of genetically pure *J. hindsii* suggests that the CNPS rare plant rank of 1B.1 is not appropriate.

KEY:

STATUS: Federal/State/Other (CNPS CRPR, Western Bat Working Group, Xerces Society for Invertebrate Conservation)

Federal (U.S. Fish and Wildlife Service)

FDL = delisted
FE = listed as endangered (in danger of extinction) by the federal government
FT = listed as threatened (likely to become endangered within the foreseeable future) by the federal government
FC = candidate to become a *proposed* species
BGEPA = Bald and Golden Eagle Protection Act
MMPA = Marine Mammal Protection Act

State (CDFW)

SE = listed as endangered by the State of California
ST = listed as threatened by the State of California
SC = state candidate for listing
* = Special Animals List
SSC = California Species of Special Concern
FP = state fully protected
SDL = delisted
SR = state rare (plants)

Other

California Native Plant Society (CNPS) California Rare Plant Rank (CRPR)

1A = Presumed extirpated in California; Rare or extinct in other parts of its range.
1B = Rare, threatened, or endangered throughout range; Most species in this rank are endemic to California.
2A = Extirpated in California, but common in other parts of its range.
2B = Rare, threatened, or endangered in California but common in other parts of its range.

An extension reflecting the level of threat to each species is appended to each rarity category as follows:
.1 = Seriously endangered in California
.2 = Fairly endangered in California

Western Bat Working Group (WBWG)

Low = Stable population
Medium = Need more information about the species, possible threats, and protective actions to implement
High = Imperiled or at high risk of imperilment

Xerces Society for Invertebrate Conservation (XSIC)

CI = Critically imperiled
IM = Imperiled
VU = Vulnerable
DD = Data Deficit

International Union for Conservation of Nature (IUCN) Red List

LC = Least concern
NT = Near threatened
VU = Vulnerable
EN = Endangered
CR = Critically endangered

SOURCE: Data compiled by Environmental Science Associates in 2019 and 2020

11 Potter, D., H. Bartosh, G. Dangl, J. Yang, R. Bittman, et. al. 2018. Clarifying the Conservation Status of Northern California Black Walnut (*Juglans hindsii*) Using Microsatellite Markers. *Madroño*, 65(3):131–140.

Appendix F
Species Observed within the Study Area

1. Plant Species Observed
2. Wildlife Species Observed

1. Plant species observed during the August 14 biological reconnaissance survey

Scientific Name	Common Name	Origin	Form
Acacia baileyana	Cootamundra wattle	non-native	tree, shrub
Acacia longifolia	Golden wattle	non-native	tree
Acacia melanoxylon	Blackwood acacia	non-native (invasive)	tree
Achillea millefolium	Yarrow	native	perennial herb
Aesculus californica	Buckeye	native	tree
Allium triquetrum	White flowered onion	non-native	perennial herb (bulb)
Amaranthus deflexus	Large fruited amaranth	non-native	annual herb
Amaryllis belladonna	Naked lady	non-native	perennial herb
Arctostaphylos sp.	-	-	-
Artemisia californica	Coastal sage brush	native	shrub
Atriplex prostrata	Fat-hen	non-native	annual herb
Atriplex semibaccata	Australian saltbush	non-native (invasive)	perennial herb
Avena barbata	Slim oat	non-native (invasive)	annual, perennial grass
Avena fatua	Wildoats	non-native (invasive)	annual grass
Brassica nigra	Black mustard	non-native (invasive)	annual herb
Bromus catharticus	Rescue grass	non-native	annual, perennial grass
Bromus diandrus	Ripgut brome	non-native (invasive)	annual grass
Bromus hordeaceus	Soft chess	non-native (invasive)	annual grass
Cakile maritima	Sea rocket	non-native (invasive)	annual herb
Calandrinia menziesii	Red maids	native	annual herb
Calycanthus occidentalis	Spicebush	native	shrub
Calystegia sp.	-	-	-
Carduus tenuiflorus	Slender flowered thistle	non-native (invasive)	annual herb
Carpobrotus chilensis	Sea fig	non-native (invasive)	perennial herb
Carpobrotus edulis	Iceplant	non-native (invasive)	perennial herb
Carpobrotus sp.	-	-	-
Ceanothus thyrsiflorus	Blueblossom	native	tree, shrub
Centranthus ruber	Jupiter's beard	non-native	annual, perennial herb
Centromadia sp.	-	-	-
Chasmanthe floribunda	Chasmanthe	non-native	perennial herb
Chenopodium album	Lambs quarters	non-native	annual herb
Convolvulus arvensis	Field bindweed	non-native	perennial herb, vine
Cortaderia jubata	Andean pampas grass	non-native (invasive)	perennial grass
Cuscuta pacifica	Goldenthread	native	annual herb, vine (parasitic)
Cyclospermum sp.	-	-	-
Cyperus eragrostis	Tall cyperus	native	perennial grasslike herb
Delairea odorata	Cape ivy	non-native (invasive)	perennial herb
Diplacus aurantiacus	Sticky monkeyflower	native	shrub
Distichlis spicata	Salt grass	native	perennial grass
Echium candicans	Pride of madeira	non-native (invasive)	shrub

Echium pininana	Pine echium	non-native	shrub
Eleocharis palustris	Common spikerush	native	perennial grasslike herb
Equisetum telmateia ssp. braunii	Giant horsetail	native	fern
Erigeron canadensis	Canada horseweed	native	annual herb
Erigeron glaucus	Seaside daisy	native	perennial herb
Eriogonum fasciculatum	California buckwheat	native	shrub
Erodium botrys	Big heron bill	non-native	annual herb
Eschscholzia californica	California poppy	native	annual, perennial herb
Eucalyptus camaldulensis	Red gum	non-native (invasive)	tree
Euphorbia sp.	-	-	-
Foeniculum vulgare	Fennel	non-native (invasive)	perennial herb
Frankenia salina	Alkali heath	native	perennial herb
Fremontodendron californicum	California fremontia	native	shrub
Genista monspessulana	French broom	non-native (invasive)	shrub
Geranium dissectum	Wild geranium	non-native (invasive)	annual herb
Geranium pusillum	Small flowered geranium	non-native	annual herb
Grindelia hirsutula	Gumweed	native	perennial herb
Grindelia stricta	Gumweed	native	perennial herb
Hedera helix	English ivy	non-native (invasive)	vine, shrub
Helminthotheca echioides	Bristly ox-tongue	non-native (invasive)	annual, perennial herb
Heracleum maximum	Common cowparsnip	native	perennial herb
Hesperocyparis macrocarpa	Monterey cypress	native	tree
Heteromeles arbutifolia	Toyon	native	shrub
Hirschfeldia incana	Short-podded mustard	non-native (invasive)	perennial herb
Hordeum murinum	Foxtail barley	non-native (invasive)	annual grass
Hordeum vulgare	Common barley	non-native	annual grass
Ilex aquifolium	Holly	non-native (invasive)	tree, shrub
Jaumea carnosa	Marsh jaumea	native	perennial herb
Kniphofia sp.	-	-	-
Lactuca serriola	Prickly lettuce	non-native	annual herb
Limonium californicum	Marsh rosemary	native	perennial herb
Limonium perezii	Canarian sea lavender	non-native	perennial herb
Malva parviflora	Cheeseweed	non-native	annual herb
Medicago polymorpha	California burclover	non-native (invasive)	annual herb
Melilotus indicus	Annual yellow sweetclover	non-native	annual herb
Mentha pulegium	Pennyroyal	non-native (invasive)	perennial herb
Myoporum laetum	Ngaio tree	non-native (invasive)	tree, shrub
Olea europaea	Olive	non-native (invasive)	tree, shrub
Opuntia sp.	-	-	-
Oxalis pes-caprae	Bermuda buttercup	non-native (invasive)	perennial herb
Pinus radiata	Monterey pine	native	tree

Pittosporum crassifolium	Thick leaf box	non-native	tree, shrub
Plantago lanceolata	Ribwort	non-native (invasive)	perennial herb
Plantago sp.	-	-	-
Polypogon monspeliensis	Annual beard grass	non-native (invasive)	annual grass
Pyracantha sp.	-	-	-
Quercus agrifolia	Coast live oak	native	tree
Raphanus sativus	Wild radish	non-native (invasive)	annual, biennial herb
Rumex crispus	Curly dock	non-native (invasive)	perennial herb
Salicornia pacifica	Pickleweed	native	perennial herb
Salsola soda	Alkali russian thistle	non-native (invasive)	annual herb
Schoenoplectus californicus	California bulrush	native	perennial grasslike herb
Scirpus sp.	-	-	-
Sisyrinchium bellum	Blue eyed grass	native	perennial herb
Sonchus oleraceus	Common sow thistle	non-native	annual herb
Sparaxis tricolor	Harlequin flower	non-native	perennial herb
Sporobolus sp.	-	-	-
Suaeda calceoliformis	Horned sea blite	native	annual herb
Taraxacum officinale	Red seeded dandelion	non-native	perennial herb
Toxicodendron diversilobum	Poison oak	native	vine, shrub
Tragopogon porrifolius	Salsify	non-native	perennial herb
Typha latifolia	Broadleaf cattail	native	perennial herb (aquatic)
Vicia sativa	Spring vetch	non-native	annual herb, vine
Vinca major	Vinca	non-native (invasive)	perennial herb
Vitis californica	California wild grape	native	vine, shrub
Washingtonia filifera	California fan palm	native	tree

2. Wildlife species observed during the August 14 biological reconnaissance survey

Scientific Name	Common Name	Taxonomic Group
Ardea alba	Great egret	Birds
Ardea herodias	Great blue heron	Birds
Branta canadensis	Canada goose	Birds
Calidris minutilla	Least Sandpiper	Birds
Corvus corax	Common raven	Birds
Egretta thula	Snowy egret	Birds
Eremophila alpestris	Horned lark	Birds
Haematopus bachmani	Black oystercatcher	Birds
Hirundo rustica	Barn swallow	Birds
Hydroprogne caspia	Caspian tern	Birds
Larus occidentalis	Western gull	Birds
Larus delawarensis	Ring-billed gull	Birds
Lemosa fedoa	Marbled godwit	Birds
Limnodromus scolopaceus	Long-billed dowitcher	Birds
Limosa fedoa	Marbled godwit	Birds
Numenius americanus	Long-billed curlew	Birds
Passer domesticus	House sparrow	Birds
Phalacrocorax auritus	Double-crested cormorant	Birds
Pluvialis squatarola	Black-bellied plover	Birds
Recurvirostra americana	American avocet	Birds
Sturnus vulgaris	European starling	Birds
Tringa semipalmata	Willet	Birds
Zenaida macroura	Mourning dove	Birds
Phoca vitulina	Harbor seal	Mammals

APPENDIX G

Coastal Hydraulics Technical Report

Final

SAN FRANCISCO INTERNATIONAL AIRPORT SHORELINE PROTECTION PROGRAM

Coastal Hydraulics Technical Report

Prepared for
San Francisco International Airport

December 2021

ESA

Final

SAN FRANCISCO INTERNATIONAL AIRPORT SHORELINE PROTECTION PROGRAM

Coastal Hydraulics Technical Report

Prepared for
San Francisco International Airport

December 2021

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900
esassoc.com

ESA

Bend	Orlando	San José
Camarillo	Pasadena	Santa Monica
Delray Beach	Petaluma	Sarasota
Destin	Portland	Seattle
Irvine	Sacramento	Tampa
Los Angeles	San Diego	
Oakland	San Francisco	

D201900874.00

CONTENTS

San Francisco International Airport Shoreline Protection Program Coastal Hydraulics Technical Report

Appendix

Figures

Tables

SECTION 1
Introduction

1.1 Project Understanding

In 2010, the City and County of San Francisco (City) amended its floodplain management program and joined the National Flood Insurance Program (NFIP), administered by the Federal Emergency Management Administration (FEMA). Under this program, participating communities agree to implement floodplain management ordinances that limit the risk of future flood damage in flood-prone areas. These ordinances must meet the minimum floodplain management criteria of the federal regulations that govern the NFIP. To inform the NFIP, FEMA publishes Flood Insurance Rate Maps (FIRMs), which show areas currently subject to inundation during floods having a 1 percent chance of exceedance in a given year (also referred to as the base flood or 100-year flood). These floodplains are referred to as Special Flood Hazard Areas (SFHAs).

The FIRMs for San Francisco International Airport (the Airport) show the Airport is within an SFHA and may be inundated by water from San Francisco Bay (the bay) during the 100-year flood (FEMA 2021). Consequently, under the San Francisco floodplain management ordinance, the Airport must implement the City's flood-resistant construction requirements for structures located in SFHAs.

In addition to the current flood hazard shown in the FIRMs, the best-available science predicts that sea level will rise in the coming decades and into the next century (Griggs et al. 2017). This sea-level rise will exacerbate the future flood hazards that the Airport faces by causing the bay's water levels to rise.

For these reasons, the project sponsor, the City and County of San Francisco, acting by and through the San Francisco Airport Commission, proposes to implement the Shoreline Protection Program (proposed project) to address flood protection and future sea-level rise. The proposed project would install a new shoreline protection system that would comply with current FEMA requirements for flood protection and would incorporate protection from future sea-level rise.

The project site consists of the northern, eastern, and southern perimeter of the Airport, which is primarily located in unincorporated San Mateo County, California, approximately 13 miles south of downtown San Francisco. Portions of the Airport lie within the city boundaries of South San Francisco to the north, San Bruno to the west, and Millbrae to the south (**Figure 1**). The Airport's San Francisco Bay shoreline is divided into 15 reaches based on shoreline orientation, existing protection type, existing foreshore conditions, and existing landside conditions. In order to

SOURCE: SFO, 2021

SFO Shoreline Protection Program

FIGURE 1
REACH LOCATIONS

address landside flood protection, Reach 16 may be required to form a continuous, closed flood protection system. However, the landside Reach 16 would only be necessary to construct if the shoreline protection system is unable to connect to neighboring shoreline protection systems in South San Francisco and Millbrae.[1] The proposed project would remove the existing shoreline protection features and would construct a new shoreline protection system for Reaches 1–15 comprised of a combination of reinforced concrete and steel sheet pile walls to eliminate the probability of substantial inundation at the Airport through 2085.

Reach-specific crest elevations for the 15 shoreline reaches are based on the flood barrier accreditation requirements for FEMA (COWI 2021a). In addition to meeting current FEMA accreditation requirements, in accordance with guidance from the California Ocean Protection Council (OPC 2020) and City and County of San Francisco planning department (CCSF 2020), the proposed project would add an additional 3.5 feet of elevation to the shoreline protection system to greatly reduce the probability of substantial inundation, even with the sea-level rise projected through 2085.

Some reaches would also include armor rock revetments and/or add open water fill. Along the newly constructed shoreline, armor rock revetments would be used in tandem with walls, aiding to dissipate wave energy and to prevent sediment from being eroded. Added fill, either in the form of soil or grout, would be employed for some of the reaches to stabilize the shoreline around the flood walls. The proposed design for most of the 15 coastal reaches would not include any new open water fill in the bay (defined as elevations below the mean higher high tide[2] water level) beyond minor placement of armor rock to replenish or replace existing armor rock revetments. Reaches 7 and 8, bordering Runways 19L and 19R (Figure 1), are the primary exception.[3] For these two reaches, the proposed project would extend the shoreline protection system an additional 75 to 200 feet beyond the existing shoreline into the open waters of the bay.

1.2 Coastal Hydraulics Assessment Approach

The purpose of this technical report is to assess the potential coastal hydraulic impacts of the proposed project to inform the California Environmental Quality Act (CEQA) analysis. This technical report considers the extent of these potential effects to support the CEQA analysis for various topics, including but not limited to hydrology and water quality, geology and soils, and biological resources. Coastal hydraulics is interpreted to mean the movement of water within the bay due to astronomic tides, storm surge, wind, and wind waves. This water movement can, if sufficiently strong, erode and then transport the sediment forming the natural bed of the bay.

1 As Reach 16 would be constructed along the eastern side of U.S. 101, construction of the reach would not result in changes within San Francisco Bay. As such, this technical report does not address Reach 16.

2 Average of the highest tide that occurs each day.

3 The proposed project also includes minor amounts of fill along Reaches 2B, 4, 11, 12, 13, and 14. The proposed fill for these reaches would be placed mostly above the bay's high tides and only extend towards the bay by 30 feet or less. This amount of fill is below the resolution of the analysis conducted for this report. Reach 8, which would extend approximately 60 feet into the bay, is analyzed in this report and found to have minimal impact on coastal hydraulics. This finding supports the assumption that bayward fill of 30 feet or less in the other reaches will have negligible effects on the bay's coastal hydraulics.

Because the proposed project would place fill in the open bay, it would alter the coastal hydraulics and may substantially alter the bay floor adjacent to the new shoreline owing to local scour[4] or deposition. Coastal hydraulics would be altered by the proposed project where the extensions of Reach 7 and Reach 8 add open water fill. Sediment transport induced by waves and currents interacting with the new structures could alter the hydraulic forces exerted on the bay floor and shoreline and thereby induce changes in scour and deposition.

For these reasons, modeling of tidal currents and wind waves was conducted in order to assess whether project-induced changes to these processes are sufficient to affect the bay's bed elevations, and the amount of change expected (depth, extent). Standard engineering hydrodynamic and wave models were used to discern changes.

With the occurrence of sea-level rise, higher bay water levels will increase the water depth at all shoreline structures protecting the Airport. Therefore, the modeling considered scenarios with the addition of 3.5 feet of sea-level rise for the potential for these future conditions to alter tidal currents and enable larger wind-waves to reach the shoreline structures.

To account for these potential effects, hydrodynamic modeling was used to simulate existing conditions (as a baseline for comparison), conditions with the proposed project, and future sea-level rise conditions with and without the proposed project. The planned modeling approach addressed combined effects of currents, waves, and sea-level rise on sediment transport, and is described in the subsequent section.

1.3 Summary of Findings

The hydrodynamic model developed for use in this report was calibrated such that it accurately replicates observed water levels and current velocities in South San Francisco Bay (South Bay). For proposed project conditions, the changes in current velocity and bed shear stress[5] are limited in extent to just the portion of the bay immediately adjacent to Reaches 7 and 8.

Another model to predict bay waves was calibrated to a set of wave observations and accurately replicated wave conditions. Over a wide range of hindcast[6] and extreme wind conditions, the mean and maximum changes in bed shear stress predicted by this model were relatively small, and did not substantially alter the balance of wave-induced bed shear stress relative to the critical shear stress[7] for bed erosion. Along some sections of the proposed open water fill, the outboard shoulder of the fill would be designed to include rock armor revetment sufficient to resist erosion from these higher bed shear stresses.

To further resolve the dynamics of waves interacting with the shoreline, another model that accounts for additional wave processes was developed to represent two nearshore cross sections, one for Reach 7 and one for Reach 8. This modeling indicates that the changes in bed shear stress

---

4 *Scour* is the removal of sediment or rock armor due to flowing water or waves.

5 *Bed shear stress* is the force per unit area exerted by moving water on the bed that can erode sediment from the bed and influence the deposition of suspended sediment onto the bed.

6 "Hindcast" refers to use of modeling to estimate probable past conditions.

7 *Critical shear stress* is the value for bed shear stress above which sediment will be eroded from the bed.

due to waves interacting with the proposed open water fill would only occur on top of the rock armor revetment over the fill. Since the purpose of the rock armor revetment is to resist scour by waves, no substantial changes to the bed sediments beyond the extents of the proposed project are anticipated due to waves interacting with the proposed shoreline structures.

1.4 Report Limitations

This technical report is limited to the potential effects of the proposed project on bay currents, tides, and bed sediments adjacent to the Airport. The analysis does not consider extreme bay conditions that may occur due to seiches and tsunamis because they are very rare events. This technical report also does not review the proposed project's effectiveness in its primary design objective of protecting the Airport from coastal flooding. This technical report also does not evaluate unintended migration of the open water fill into the bay either during construction or once construction is complete. Construction methods and long-term stability of the open water fill are assumed to be addressed by the proposed project's construction specifications and engineering design plans.

1.5 Report Organization

The remainder of this technical report is organized as follows:

- Environmental Setting (Section 2) describes the coastal conditions in the bay that affect the Airport's shoreline
- Modeling Methods (Section 3) describes the development and application of hydrodynamic and wave models to characterize the bay and the proposed project
- Modeling Results (Section 4) presents and compares model predictions for existing and with-project conditions to assess the potential impacts of the proposed project on the bay

INTENTIONALLY BLANK

SECTION 2
Environmental Setting

The Airport is bounded to the north, east, and south by the bay. This section describes the environmental setting that determines the bay's coastal hydraulics.

2.1 Tides and Tidal Datums

Water levels in the bay are controlled by water level fluctuations in the Pacific Ocean that travel through the Golden Gate and propagate throughout the bay. Changes in ocean water levels occur daily due to the astronomic tide, which are water level fluctuations caused by forces between the astronomic bodies of the earth, the sun, and the moon. San Francisco Bay experiences semidiurnal tides, with each day having two high and two low tides of unequal heights.

Common tidal datums, which are representative statistics calculated from the continually changing tidal water levels include:

- Mean higher high water (MHHW) – average of each day's highest tide.
- Mean sea level (MSL) – average of all stages of the tide.
- Mean lower low water (MLLW) – average of each day's lowest tide.

The National Oceanic and Atmospheric Administration (NOAA) maintains a network of tide gauges that report observed tides and tidal datums within the bay. For FEMA's regional coastal hazard modeling study, data from these gauges was used to calibrate a hydraulic model of the bay (DHI 2011). Output from this modeling were then used to estimate tidal datums around the bay perimeter (AECOM 2016). The tidal datums at the Airport are listed in **Table 1**. These elevations and all other elevations in this study are referenced to the North American Vertical Datum of 1988 (NAVD88), the same reference for elevation used for the proposed project's design (COWI 2021a).

TABLE 1
SAN FRANCISCO BAY TIDAL DATUMS AT THE AIRPORT

Tidal Datum	Water Level (feet NAVD88)
Mean Higher High Water (MHHW)	6.8
Mean Sea Level (MSL)	3.3
Mean Lower Low Water (MLLW)	-0.7

SOURCE: AECOM (2016)

The astronomic tide range varies by a few feet on about a two-week cycle, with larger tide ranges called "spring" tides and smaller tide ranges called "neap" tides. The largest tides of the year are approximately 1 to 1.5 feet higher than MHHW and usually occur in December or January due to a combination of spring tide, watershed inflow, and/or storm surge (defined below).

2.2 Storm Surge

In addition to astronomic tides, winter storm events that originate in the Pacific Ocean cause higher water levels in the bay, often called "storm surge." Storm surge can result in flooding, by raising typical astronomic tides via atmospheric and oceanic processes. Atmospheric processes that cause storm surge are lower atmospheric pressure and wind setup. In addition, changes in large-scale oceanic circulation, particularly during winters with El Niño conditions,[8] can cause higher-than-normal water levels for several months at a time. Depending on the intensity of each of these processes, as well as their timing relative to astronomic tides, storm surge can result in bay water levels up to about 3 feet higher than astronomic tides alone. Winter storm winds can also generate waves that may pose an additional flood hazard, particularly when the waves ride on a storm surge-elevated water surface.

The estimated 1-year (99 percent annual exceedance probability[9] [AEP]), 10-year (10 percent AEP), and 100-year (1 percent AEP) still water levels are listed in **Table 2**. These flood stage statistical water levels are based on the coastal hydraulic analysis (DHI 2011) used for FEMA's revised coastal flood mapping (FEMA 2021), and as the basis of design for the proposed project's floodwall crest elevations (COWI 2021a). As still water levels, they do not include the additional flood hazards due to waves.

TABLE 2
EXTREME STILL WATER LEVELS AT THE AIRPORT

Return interval	Extreme Tide Elevation (feet NAVD88)
1-year (99% AEP)	8.1
10-year (10% AEP)	9.1
100-year (1% AEP)	10.3

SOURCE: AECOM 2016

2.3 Salinity

In the bay, salinity has the greatest influence on vertical variability in water density (e.g., Conomos 1979, Burchard & Baumert 1998). Due to the region's Mediterranean climate, the effects of freshwater inflow on water density and circulation in the estuary are seasonally varying. Due to the spatially varying characteristics, the northern and southern reaches of the estuary are

8 *El Niño conditions* refers to a pattern of warm water that develops in the central and eastern-central Pacific Ocean and causes a series of oceanic and meteorological responses, including higher water levels along the West Coast.

9 *Annual exceedance probability* refers to the probability of an event being equaled or exceeded each year. An alternate naming convention is based on the return interval concept, where the return interval is the reciprocal of the annual exceedance probability. For example, the 99 percent annual exceedance probability may also be called the 1-year event and the 1 percent annual exceedance probability may also be called the 100-year event.

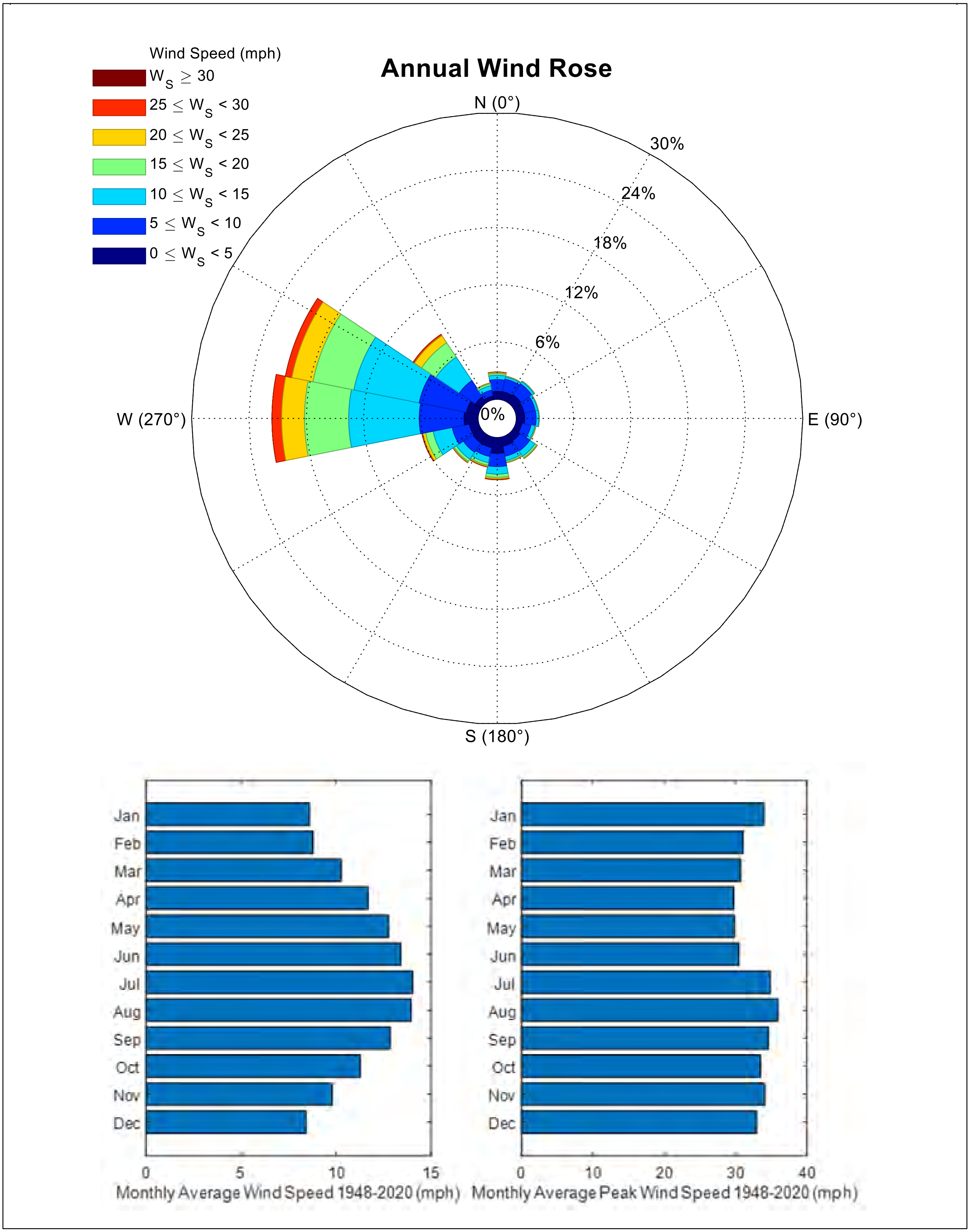
hydrologically distinct. The northern reach receives freshwater inflow from 40 percent of California's land area and is considered a partially mixed estuary, while the southern reach (South Bay, which borders the project site) is surrounded by smaller, mountainous watersheds with far less freshwater inflow and is considered a tidal lagoon (Conomos 1979). Because of little freshwater inflow, active wind mixing during summer months, and a broad, shallow bathymetry, South Bay waters are generally well mixed throughout the year, except for brief periods during wet winters.

During the period 1991–2017, the maximum difference in near-bed versus near-surface annual median salinity at a water-quality monitoring station at the San Mateo Bridge was 1 practical salinity unit (psu) (Livsey & Downing-Kunz 2020), or about one part per thousand, by mass. An example of infrequent stratified conditions occurred due to the large freshwater inflow to the estuary during the wetter-than-average winter of 2017. Across seven boat-based water-quality monitoring cruises between January 11, 2017, and April 27, 2017 (Schraga et al. 2018), the difference in near-bed versus near-surface in the main channel near the Airport started at 0.6 psu, increased to a peak of 9.6 psu, and returned to 0.1 psu by the end of the period. Only for a two-month period in the middle of this period was this winter's heavy precipitation and freshwater inflow large enough to support a vertical salinity (and density) difference of 3 psu, sufficient for mild to moderate stratification. These data indicate that, in the region near the Airport, vertical density differences are generally minor and, even during the rainiest winters, are fairly short lived. Given this, the modeling used in this report consider only well-mixed (i.e., no vertical variations in density) and depth-averaged conditions.

2.4 Wind

Wind speeds and directions were obtained from the Automated Surface Observing System (ASOS) meteorology station at the Airport from 1948 to 2020 (National Climatic Data Center Station ID #23234). The wind data were collected once an hour, at the standard 2-minute averaging duration and elevation of 33 feet. **Figure 2** summarizes wind conditions at the Airport over this 72-year record as a wind rose (top panel) to show annual frequency by direction, and as monthly averages (bottom panels) to show seasonality.

At the Airport, the predominant winds are from the west and west-northwest (Figure 2). These winds occur because of the pressure differential that develops between cool air over the ocean and warmer air heated over land. The San Bruno Gap, located between San Bruno Mountain and the Santa Cruz Mountains, funnels these winds into the west to west-northwest direction range experienced. This wind pattern occurs most frequently in the spring and summer when overland air temperatures are higher. These winds, commonly referred to as "sea breezes" usually follow a daily pattern, peaking in the late afternoon with speeds typically between 20 to 25 mph. Since the Airport is located on the western shore of the bay, the winds from the west to west-northwest generate waves that grow in size as they travel away from the Airport's shoreline.



SOURCE: SFO ASOS, National Climatic Data Center Station ID #23234

SFO Shoreline Protection Program

FIGURE 2

WIND SPEED AND DIRECTION AT THE AIRPORT 1948-2020

Although July and August have the highest wind speeds when averaged over an entire month, peak wind speeds at the Airport, such as the 10-year (10 percent AEP) or the 100-year (1 percent AEP) wind speeds, occur in the winter and tend to blow from south of the Airport. These peak winds are caused by winter storm events tracking across the bay, so typically last for less than a day. **Table 3** presents extreme wind speeds at the airport over the 72-year record for 2-minute averaging durations and 30-minute averaging durations. The 2-minute wind speeds were converted to lower wind speeds that correspond to the 30-minute averaging duration using the methods described in the Coastal Engineering Manual (USACE 2002).

TABLE 3
EXTREME WIND SPEEDS AT THE AIRPORT

	Wind Speed (mph)	
Return interval	**2-minute avg.**	**30-minute avg.**
1-year (99% AEP)	28.8	24.9
10-year (10% AEP)	52.2	45.2
100-year (1% AEP)	65.2	56.5

SOURCE: NCDC Station ID #23234

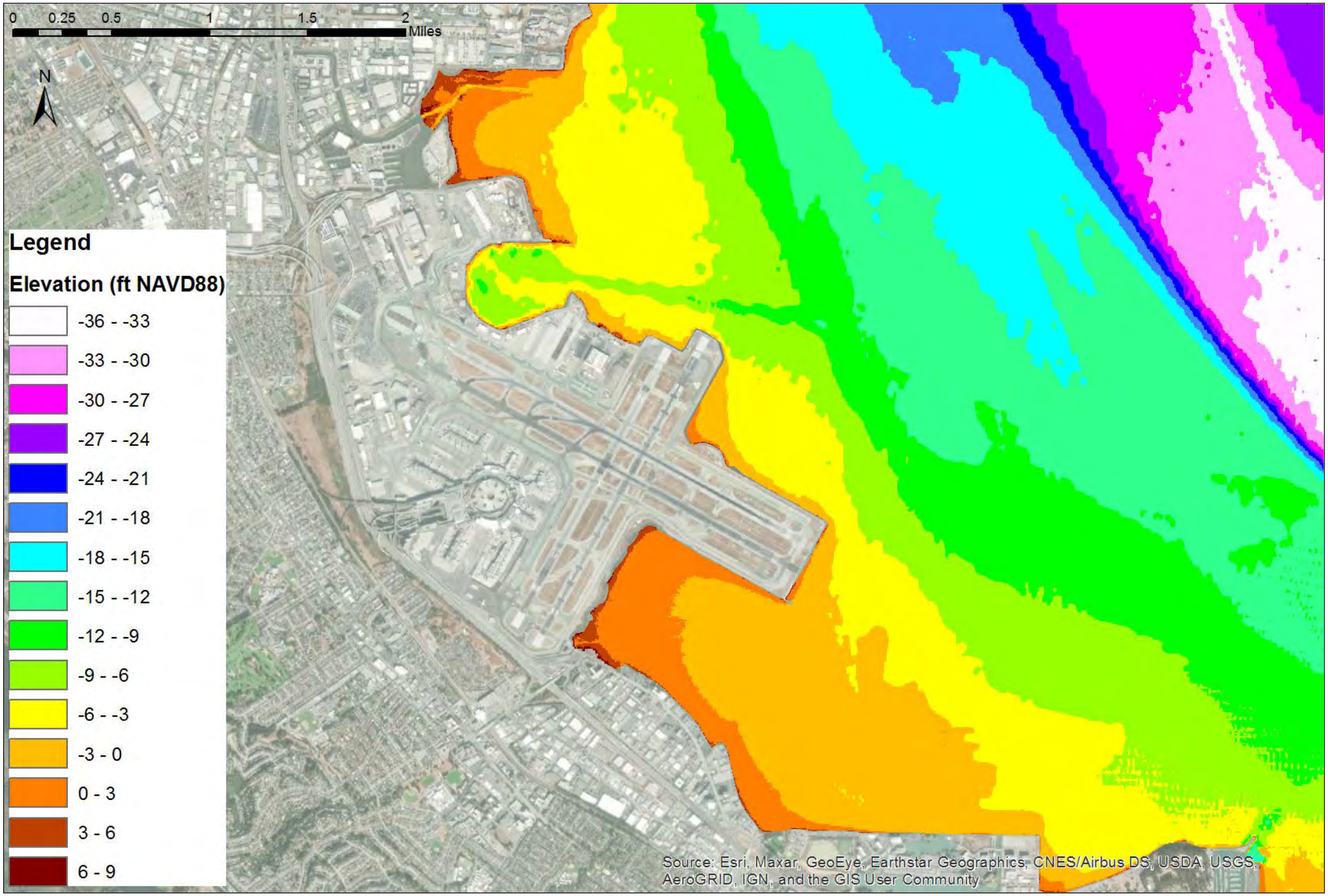
2.5 Bathymetry

To support the modeling for this technical report, bathymetry datasets and decadal-scale bathymetric change in and around the project site were analyzed. Bathymetric data have been collected at various times and extents in South Bay (e.g., Jaffe & Foxgrover 2006) and used to develop digital elevation models (DEMs) (e.g., Carignan et al. 2011). In this work, bathymetric data were sought at two spatial scales – *local* (within approximately 0.5 miles of the Airport's shoreline) and *regional* (within approximately 8 miles of the Airport's shoreline). Upon review of available data, the highest-quality datasets for bathymetry and bathymetric-change analysis at these two scales were identified and are summarized in **Table 4**. Where possible, existing DEMs were obtained; for two datasets (Fugro 2014; OPC 2014, Table 4), DEMs were developed through interpolation of bathymetry survey data using ArcGIS software. A composite map of best-available local- and regional-scale bathymetry is presented in **Figure 3**. Along most of the Airport's shoreline, the bed elevation is below 0 feet NAVD88, so that water line is at or close to the shoreline for all tidal water levels. However, along the southern portion of the Airport's shoreline adjacent to Reach 14, a substantial swath of the bed elevation is between 0 feet NAVD88 and 3 feet NAVD88. In this higher area, the water line will pull back from the Airport's shoreline by up to 0.25 miles at low tide, leaving an expanse of exposed mudflats along this portion of the shoreline.

TABLE 4
SUMMARY OF BATHYMETRIC DATASETS

Dataset Name	Year(s) Collected	Data Access	Vertical Uncertainty (feet)	Notes
Local Scale				
USGS San Francisco Bay Lidar	2010–2011	—[a]	0.4	Existing DEM joined with Fugro (2014) data for composite of previous bathymetry
Fugro Bathymetry	2014	n/a	n/a	DEM developed and joined with USGS (2010) data for composite of previous bathymetry
Meridian Shoreline Survey	2013	n/a	n/a	Elevation at discrete points used for quality assurance
eTrac Survey	2020	n/a	0.6	Existing DEM used as subsequent bathymetry
Regional Scale				
NOAA San Francisco Bay 1/3 arc-second DEM	1979–1983	—[b]	0.3	Existing DEM used as previous bathymetry; DEM generated in 2010 based on 1979–1983 bathymetry surveys
OPC Area A Bathymetry	2014	—[c]	2.0	DEM developed for use as subsequent bathymetry; footprint is limited in spatial extent

NOTES:
[a] Accessible online at https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=1406
[b] Accessible online at https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:741/html#
[c] Accessible online at https://coast.noaa.gov/digitalcoast/data/



SOURCE: NOAA/NOS, 1983 and eTrac, 2020

SFO Shoreline Protection Program

FIGURE 3
SAN FRANCISCO BAY BATHYMETRY AT THE AIRPORT

2.6 Suspended Sediment and Geomorphology

2.6.1 Suspended Sediment Dynamics

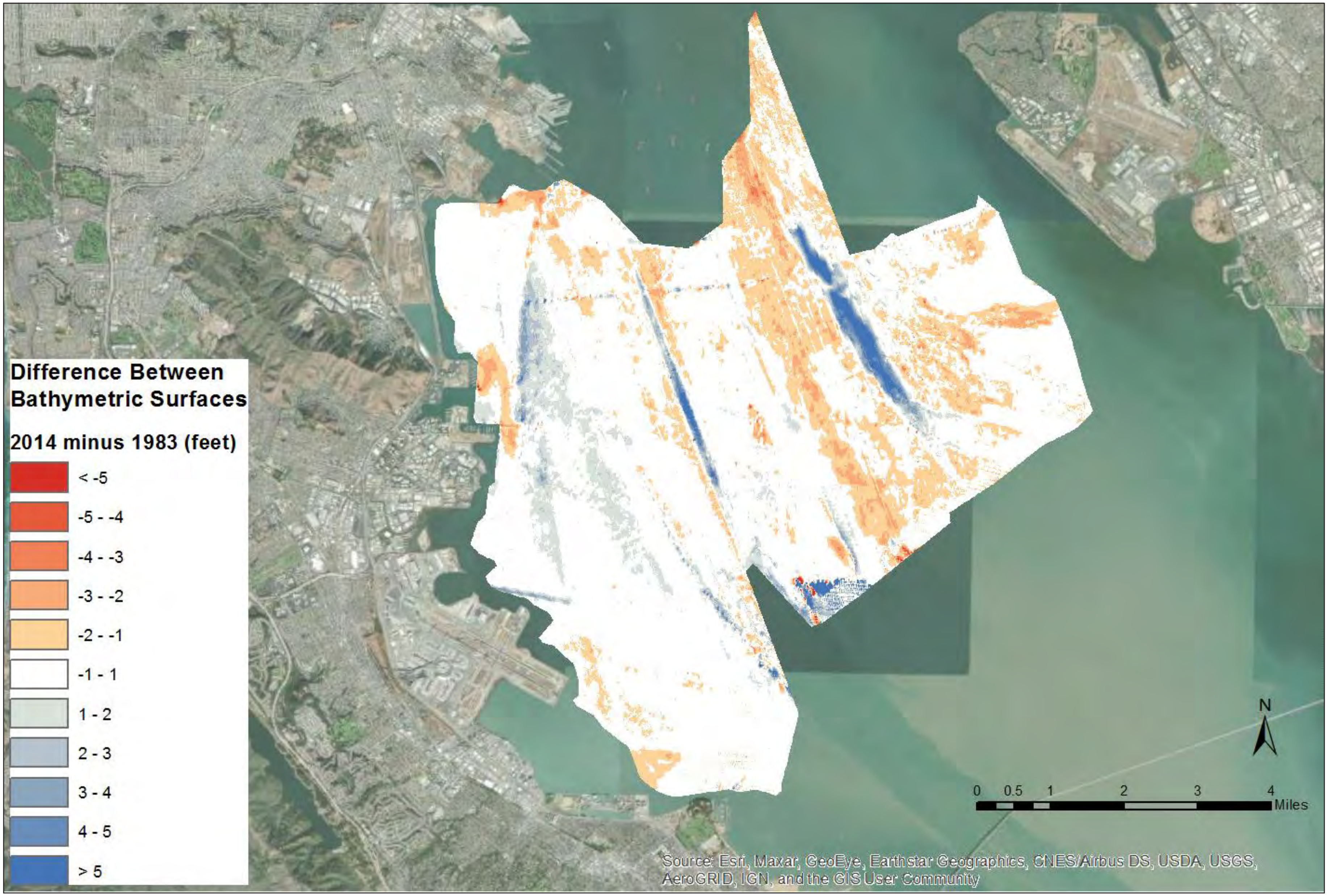
In this report, South Bay is considered the portion of San Francisco Bay extending south from the San Francisco–Oakland Bay Bridge. South Bay has a shoal-channel geometry with broad shoals (depth 6–12 feet) and a narrow, deep channel (depth 40–45 feet; Brand et al. 2010). South bay features mud-dominated bottom sediments (i.e., mean grain diameter less than 0.0025 inches; Barnard et al. 2013). The mean grain size of bed sediments on the shoal adjacent approximately 1 mile from the Airport is spatially uniform with a value less than 0.00063 inches (Barnard et al. 2013). Wind-forced surface waves, most often generated during summer afternoons and winter storms, induce sediment resuspension by increasing bottom shear stress. On the shallow shoals of the bay, wind waves have been shown to be the dominant process in bed sediment resuspension (Chou et al. 2018). At a location southeast of the Airport, Brand et al. (2010) found that sediment flux (or transport) was highest during periods of wind waves interacting with tidal currents, and greatest resuspension was observed on flood tides following wave events during low water. However, given that the dominant wind direction in South Bay is from the northwest (Figure 2, p. 10), wind-induced sediment resuspension is expected to be limited at the Airport, since winds from the northwest have limited fetch.[10]

2.6.2 Regional Bathymetric Changes

Recent decadal-scale bathymetric change provides geomorphic context for the region of the bay adjoining the Airport. Calculating bathymetric change requires at least two bathymetry datasets or DEMs having similar spatial extents and resolution. Bathymetric change between 1956 and 1983 was computed by Jaffe and Foxgrover (2006) in the bay adjoining the Airport. Even over almost three decades, bed elevation changes were minimal. Jaffe and Foxgrover (2006) also computed bathymetric change between 1983 to 2005 for the area between Coyote Point (3 miles south of the Airport) and the San Mateo–Hayward Bridge (Jaffe and Foxgrover 2006), and the trend of minimal change on the bed around the Airport continued. At the time of the Jaffe and Foxgrover (2006) publication, data were not available for this period in the immediate vicinity of the Airport.

For this technical report, regional bathymetric change using an existing DEM based on 1983 data (NOAA 2021, Table 4) and a DEM generated based on 2014 data (OPC 2014, Table 4) was assessed. The resulting difference map (2014 data minus 1983 data) shows relatively small changes in regional bathymetry over the period (**Figure 4**). This geomorphic equilibrium is expected as it is a continuation of the lack of bathymetric change for this region for the previous intervals, 1956 to 1983 and 1983 to 2005 (Jaffe and Foxgrover 2006). The largest bathymetric change near the Airport in Figure 4 is a linear depositional feature that runs from east of the Airport towards Seaplane Harbor (Figure 1, p. 2). This deposition occurred in the channel, which connects the harbor to deeper waters (Figure 3, p. 13). This channel was dredged to artificially deepen it when seaplanes and flying boats used the harbor but has not been dredged in recent decades.

[10] *Fetch* is the distance over water that wind blows and generates waves.



SOURCE: NOAA/NOS, 1983 and OPC, 2014

SFO Shoreline Protection Program

FIGURE 4
REGIONAL-SCALE BATHYMETRIC CHANGE 1983 to 2014

Additional research of bathymetric changes at the seasonal scale (van der Wegen et al. 2019) demonstrates morphological response to short-term variations in tidal currents and waves is restricted to the main channel-shoal edge. Considering the siting of the Airport on the upwind side of the predominant wind direction, away from the main channel-shoal edge, and the stable morphology of the near-shore shoals in this region of the bay, existing research suggests limited wind-wave resuspension and that the region around the Airport has remained in geomorphic equilibrium for almost six decades.

2.6.3 Local Bathymetric Changes

At the local scale of within a half-mile of the Airport, high-resolution data sufficient for analysis of bathymetric change are limited. For this study, the baseline bathymetry was determined from a composite DEM based on two discrete surveys (USGS 2010; Fugro 2014, Table 4) to augment data gaps in the Fugro (2014) survey and provide greater spatial extent. To compute bathymetric change, the overlapping region from a recent survey (eTrac 2020, Table 4) was differenced (2020 minus 2010 and 2014 data). The results of this calculation are shown in **Figure 5**. For most of the bay immediately adjacent to the Airport, bathymetric change is limited to less than 0.5 feet. The one area with consistent bathymetric change is the deposition of 0.5 feet to 1 foot within Seaplane Harbor (Figure 1, p. 2). As noted for the channel leading to Seaplane Harbor, apparent in the regional bathymetric change (Figure 4, p. 15), this deposition is likely because these areas had previously been artificial deepened by dredging and are gradually filling in towards a return to their original elevations. In Figure 5, the thin strip of larger bathymetric change (e.g., 2 feet or more) along the existing shoreline is probably due to slight offsets in horizontal mapping along the relatively steep shoreline shoulder, and is likely not indicative of actual erosion since the existing shoreline is protected with rock armor revetment. Slightly further offshore from Reach 7 and Reach 8, there are patches of bathymetric change between a half foot to one foot. An explanation for these differences in bathymetry is not known at this time. These patches are typically under one foot and could be within the combined uncertainty of the two data sets used to calculate the difference (Table 4, p. 12).

SOURCE: USGS, 2010; Furgo, 2014; eTrac, 2020

SFO Shoreline Protection Program

FIGURE 5

LOCAL-SCALE BATHYMETRIC CHANGE 2010/2014 to 2020

2.7 Sea-Level Rise

The proposed project is designed to provide flood protection for the Airport, factoring in the potential for sea-level rise to exacerbate flood hazards. In the conceptual design phase, the sea-level design criteria of FEMA accreditation plus 36 inches (three feet) of sea-level rise were selected based on the best-available climate change science, guidance, timeframe, flood hazard reduction, and cost (AECOM and Telamon Engineering Consultants 2018). These design criteria, which are based on the latest science, were reviewed by the design team that is advancing the proposed project from conceptual design to the project description (COWI 2021a) used for this technical report.

The best-available science for sea-level rise projections and guidance for how to design for these projections came from a suite of California, regional, and City documents (OPC 2018; OPC 2020; BCDC et al. 2020; CCSF 2020). In response to the latest state strategy (OPC 2020), the amount of sea-level rise used for the design was increased by 6 inches to 3.5 feet. Construction of the proposed project would begin in 2025, and the assumed functional lifespan is 60 years, so the proposed project's performance was assessed to 2085.

Considering all these factors, the selected flood barrier crest elevation is set to the current FEMA accreditation requirements for the 100-year flood hazard with an additional 3.5 feet to prepare for sea-level rise. Therefore, the coastal hydraulic conditions assessed in this technical report considers existing flood hazards as well as 3.5 feet of sea-level rise. According to OPC (2018), there is a small chance (between about 5 percent and 0.5 percent probability) of exceeding 3.5 feet of sea-level rise by 2085. However, since the modeling indicated that the effect of 3.5 feet of sea-level rise was relatively minor as compared to existing conditions, if a slightly higher amount of sea-level rise does occur by 2085, the impacts would not be substantially different than what is predicted by the modeling for 3.5 feet of sea-level rise.

SECTION 3
Modeling Methods

3.1 Methodology for Assessing Erosion

The environmental conditions described above are used to develop and apply computer models for assessing coastal hydraulics. Coastal hydraulics, the movement of water in the bay, occur due to multiple types of environmental forces and include both flowing currents and wind-generated waves. These different types of forcing and hydraulic responses require different types of models:

- Hydrodynamic modeling
- Bay wave modeling
- Coupled hydrodynamic and bay wave modeling
- Shoreline wave modeling

In addition to quantifying the potential changes to the currents and waves themselves, these models are also used to assess the potential for currents and waves to alter the sediment bed of the bay. This assessment relies on using the hydrodynamic and wave models to predict the bed shear stress resulting from currents and waves. Bed shear stress is the force per unit area exerted by moving water on the bed that can erode sediment from the bed and influence the deposition of suspended sediment onto the bed.

3.2 Hydrodynamic Modeling

3.2.1 Model Selection

The hydrodynamic model developed for this assessment leverages the SF Bay-Delta Community Model (Community Model) developed by the US Geological Survey (USGS), IHE Delft Institute for Water Education, and Deltares. A publicly available version of a Delft3D Bay-Delta model's input files (termed the "SF Bay Community Model") was developed as part of the CASCADE II program (Deltares NL 2019). Versions of this model have been used for peer-reviewed studies of tidal hydrodynamics and sediment transport studies in the bay (Achete et al. 2015). The model is also related to the Delft3D model used by the USGS to assess sea-level rise vulnerabilities in the bay (Coastal Storm Modeling System or CoSMoS v. 2.1). The model developed by this team of researchers uses the Delft3D FM modeling suite, developed by Deltares. This suite can simulate storm surges, detailed tidal and fluvial flows and resulting water levels, wind-driven currents and setup, waves, and the interactions between these processes.

Both two-dimensional (Achete et al. 2015) and three-dimensional (Martyr et al. 2017) applications of the model were developed for the bay. This study builds on the two-dimensional (2D), depth-averaged model. Depth-averaged conditions provide a sufficient representation of hydrodynamics in the vicinity of the project site since the water depths are fairly shallow (Section 2.5, p. 11) and salinity stratification is infrequent (Section 2.3, p. 8).

3.2.2 Domain Extent and Grid

The hydrodynamic model covers the same extent as the Community Model. In addition to the bay, the model includes coastal waters immediately to the west of the Golden Gate, the major tributary channels of San Pablo Bay, and a portion of the San Francisco-San Joaquin Delta. The model does not include areas landward of the developed shoreline. During flood events, particularly those that include sea-level rise, many stretches of the bay shoreline would be overtopped and experience landward inundation. However, shoreline overtopping is not a focus of this model, which is intended to assess changes of the proposed project on in-bay hydraulics and sediment transport.

The grid for the hydrodynamic model used in this study is based on that of the Community Model, but includes significant refinements in the South Bay, particularly in the vicinity of the Airport. The Community Model grid cell size ranges from about 6,000 feet by 6,000 feet at the Pacific Ocean boundary to about 500 feet by 500 feet for much of the bay. The current model employs a grid that gradually steps down from 500 feet by 500 feet near Alameda, to about 32-foot by 32-foot cells adjacent to the Airport (**Figure 6**). In addition to increasing the resolution, the shoreline alignment was also adjusted to match features within the study area, including Seaplane Harbor, the Airport shoreline, and much of the City of Burlingame's shoreline. To represent the proposed project, the grid was refined to reflect the proposed shoreline alignment, as described in the proposed project's design drawings (COWI 2021a).

3.2.3 Bathymetry

The model bathymetry was developed from a combination of publicly available datasets, and recent surveys of the Airport's shoreline and the shallow waters in its immediate vicinity. Section 2.5 describes the datasets applied to develop the existing bathymetry. At the shoreline of the project site, the bathymetry incorporates the transition from subtidal waters to the shoreline levee above high tide levels. Areas not available from recent surveys (such as the mouth of Colma Creek) were estimated based on nearby bathymetry and FEMA (2019).

For proposed project conditions, the existing conditions bathymetry was revised to reflect the in-bay extension of the shoreline shown in the project's design drawings (COWI 2021a). The differences between the existing and with-project bathymetries are shown in **Figure 7**. The project's proposed flood barriers extending out into the bay along Reach 7 and Reach 8 were represented in the model as weirs along the proposed barrier alignment. Along all other reaches, no changes to the model were made because the proposed project along these reaches consists only of flood barriers that are landward of the bay.

SOURCE: ESA Delft3D FM Model

SFO Shoreline Protection Program

FIGURE 6
HYDRODYNAMIC MODEL GRID

SOURCE: ESA Delft3D and SWAN modeling (2021)

SFO Shoreline Protection Program

FIGURE 7
BATHYMETRY CHANGE, WITH-PROJECT CONDITIONS MINUS EXISTING CONDITIONS

3.2.4 In-Water Structures

Lighting trestles at the end of the runways were represented in the model as pillar structures. The alignment of the trestles was based on aerial photographs. The diameter and spacing of the pillars for existing conditions was based on information provided by the design team (COWI 2020). The existing trestles consists of single 16-inch wood piles spaced about every 17 feet along the main axis, and single or double piles spaced about every 10 to 16 feet to support the minor transverse trestles that occur every 100 feet. With-project conditions for the lighting trestles at the end of Runway 19L are based on the proposed design for the replacement trestles (COWI 2021b). The proposed Runway 19L lighting trestle is designed with single 16-inch concrete piles every 100 feet along the main axis, and single or double piles spaced about every 12 to 16 feet to support the minor transverse trestles that occur every 100 feet. The lighting trestles at the end of Runway 28L and 28R do not have substantial modifications proposed for their in-water portions, so no change was made in the model for these trestles.

3.2.5 Bed Roughness

Bed roughness was represented using a Manning's roughness coefficient that varied through the bay. The same roughness values developed for the San Francisco Bay Community model were used for this study. For the majority of the South Bay (including the project site), a value of 0.025 was applied. The model includes higher roughness values for parts of the Central Bay and North Bay, and in tidal channels within the Delta.

3.2.6 Boundary Conditions

Boundary conditions are used to specify the physical processes that act upon the model domain and cause movement of water within the domain. Given the limited freshwater discharge to the South Bay in relation to its size, tidal water level fluctuations in the Pacific Ocean are expected to be the predominant cause of the currents in areas affected by the proposed project. Thus, freshwater contributions were not included in the modeling. Wind stress on the water surface were included, as these forces can cause currents and changes in water levels.

Additional details about the boundary conditions used to represent the scenarios described in Section 3.4, p. 40, are provided in the sections below.

3.2.6.1 Water Levels

For the 2018 typical summer conditions and the January 2005 10-year flood event, the observed water levels at Point Reyes were used as time-varying boundary conditions at the model's western edge (**Table 5**).

TABLE 5
BOUNDARY CONDITION DATA

Scenario	Water Levels	Wind
Baseline	**Tidal:** NOAA Summer 2018 **Storm:** NOAA January 2005 **100-year Flood:** NOAA January 1983 scaled to FEMA – 100-year Flood level	NCDC Station ID #23234 monitoring data
Project	**Tidal:** NOAA Summer 2018 **Storm:** NOAA January 2005 **100-year Flood:** NOAA January 1983 scaled to FEMA – 100-year Flood level	NCDC Station ID #23234 monitoring data

For the 100-year event, observed January 25–30, 1983, water levels at the Golden Gate (NOAA Station 9414290) were adjusted to match recent FEMA extreme value analysis to estimate the 100-year event. This time period was selected because it contains four of the top six highest water levels observed at the Golden Gate over the last century (NOAA 2021). The observed water levels were raised by 0.7 feet so the highest water level on January 27, 1983, matches the 100-year water level calculated by FEMA for this location (BakerAECOM 2012).

3.2.6.2 Wind

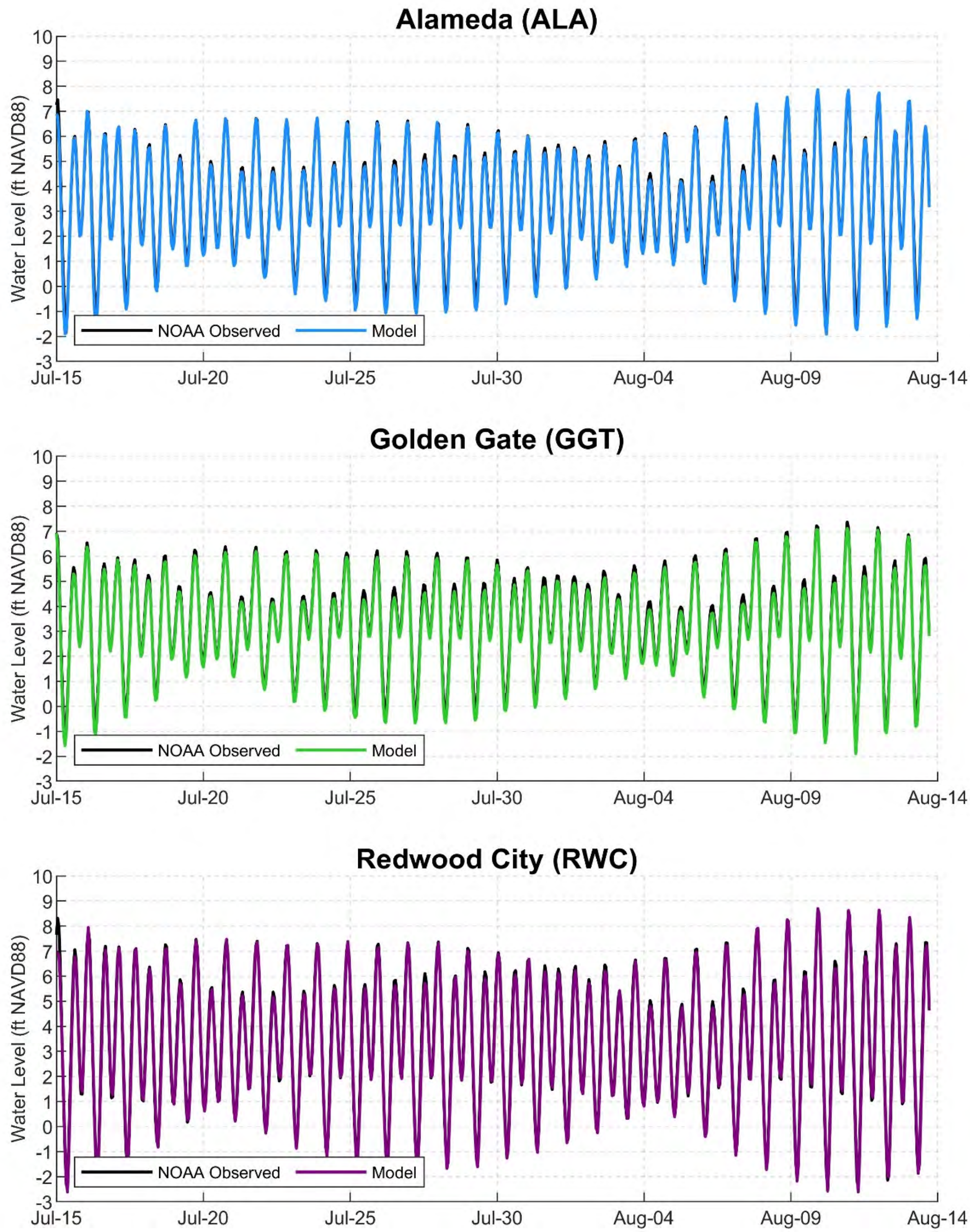
In the hydrodynamic model, surface winds were included to account for their contribution to local current velocities, and to a lesser extent, changes in the water surface elevation from wind-driven setup. Wind data were obtained from the ASOS meteorology station at the Airport, as described in Section 2.4, p. 9. Wind speed and direction time series at the Airport were applied uniformly across the grid.

3.2.7 Calibration

To assess the hydrodynamic model’s capacity to replicate observed water levels and currents, several modeling runs that predicted historic conditions were compared with observed water levels and current velocities.

3.2.7.1 Comparison with Observed Water Levels

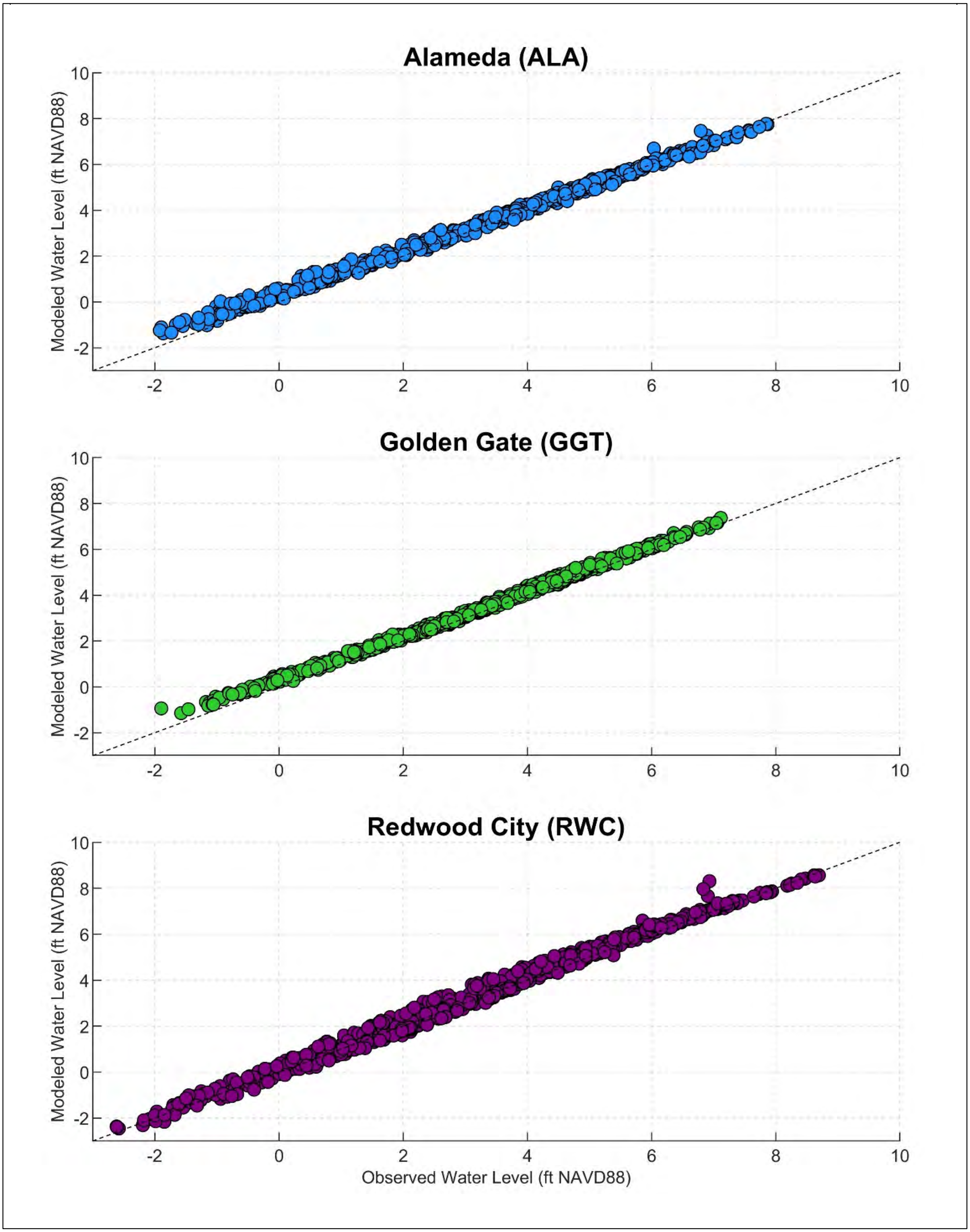
Modeled water levels were compared to concurrent tide levels observed by NOAA within the bay. The model’s predictive skill is assessed as the magnitude of difference between observed and predicted values, and also using statistical measures such as the coefficient of determination (a measure of how strongly the model predicts the variance in the data). The number of tide stations used for comparison varies by simulation, because the period when NOAA data is available varies by station. Tidal harmonics were also compared between the model and observations. Harmonics are individual components of the tides that, when overlapped, generate the bay’s observed water levels. Model comparisons are shown in **Figure 8** through **Figure 14** and **Table 6**, p. 32.



SOURCE: ESA Delft3d FM Model, NOAA Alameda, Presidio, Redwood City tide gauges

FIGURE 8

TIME SERIES COMPARISON OF MODELED AND OBSERVED TIDES FROM SUMMER 2018 SIMULATION

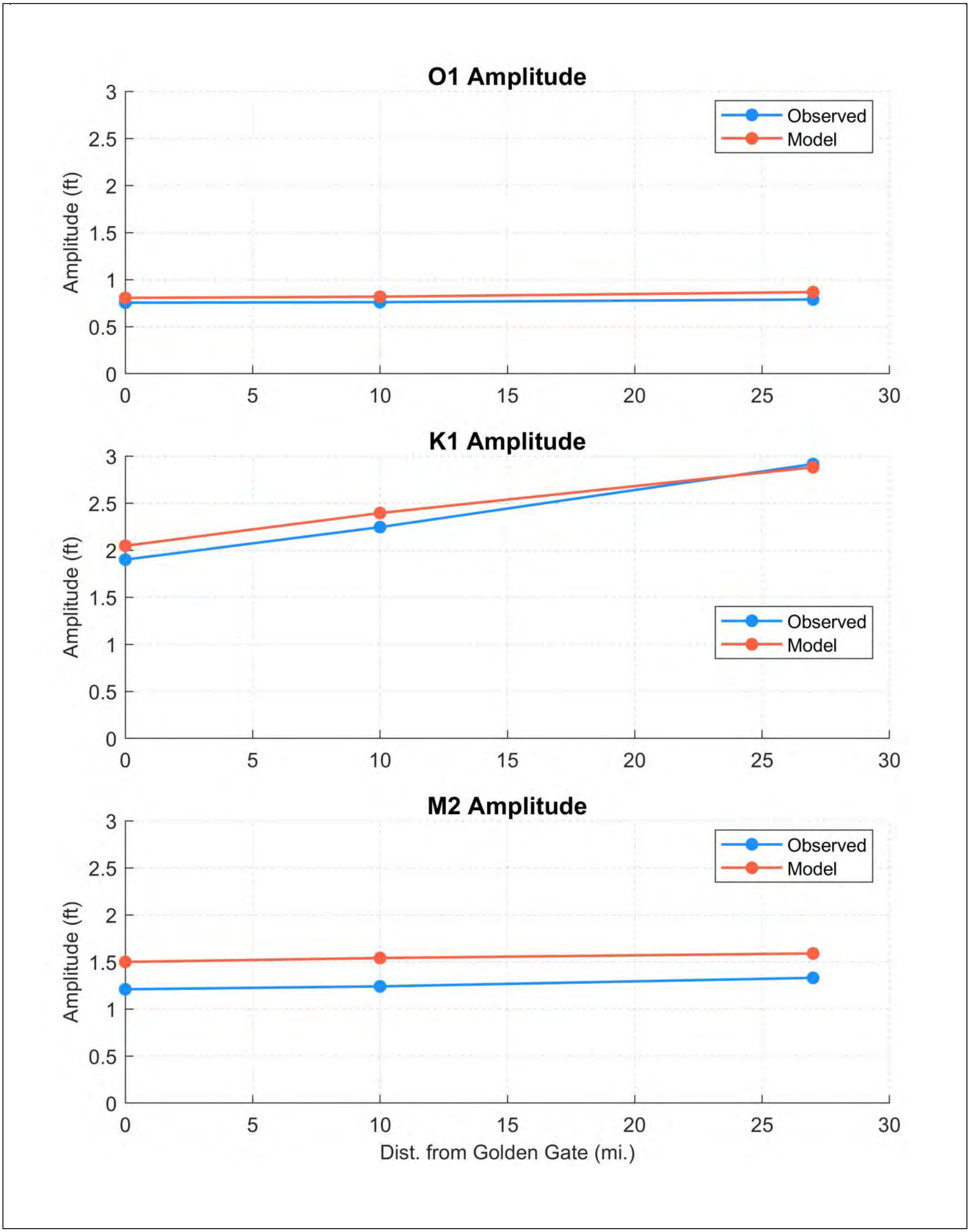


SOURCE: ESA Delft3d FM Model, NOAA Alameda, Presidio, Redwood City tide gauges

SFO Shoreline Protection Program

FIGURE 9

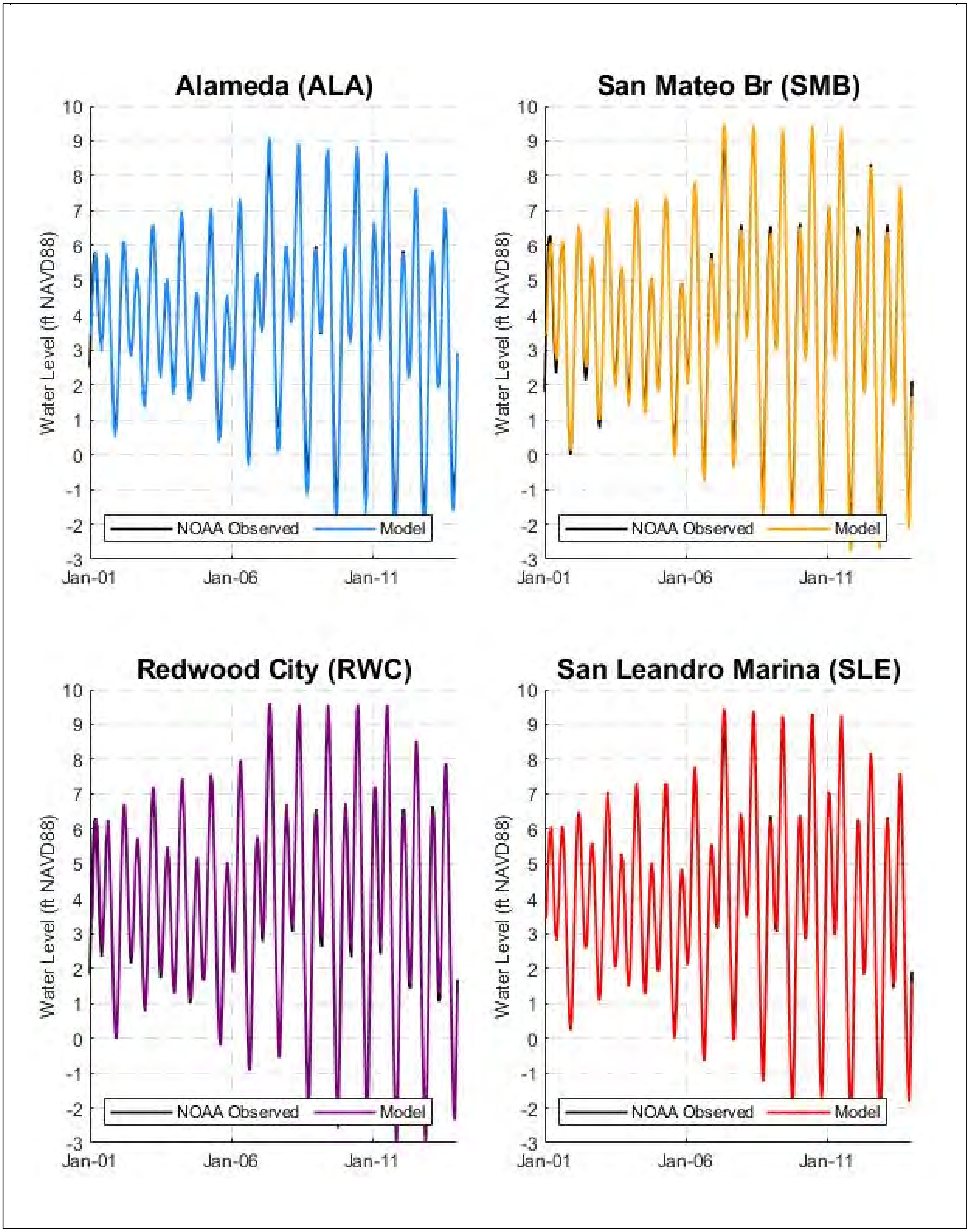
COMPARISON OF MODELED AND OBSERVED TIDE LEVELS FROM SUMMER 2018 SIMULATION



SOURCE: ESA Delft3D FM Model, NOAA tide stations at Presidio, Alameda and Redwood City

SFO Shoreline Protection Program

FIGURE 10
COMPARISON OF OBSERVED AND MODELED TIDE CONSTITUENTS FOR JULY 15 TO AUGUST 15, 2018

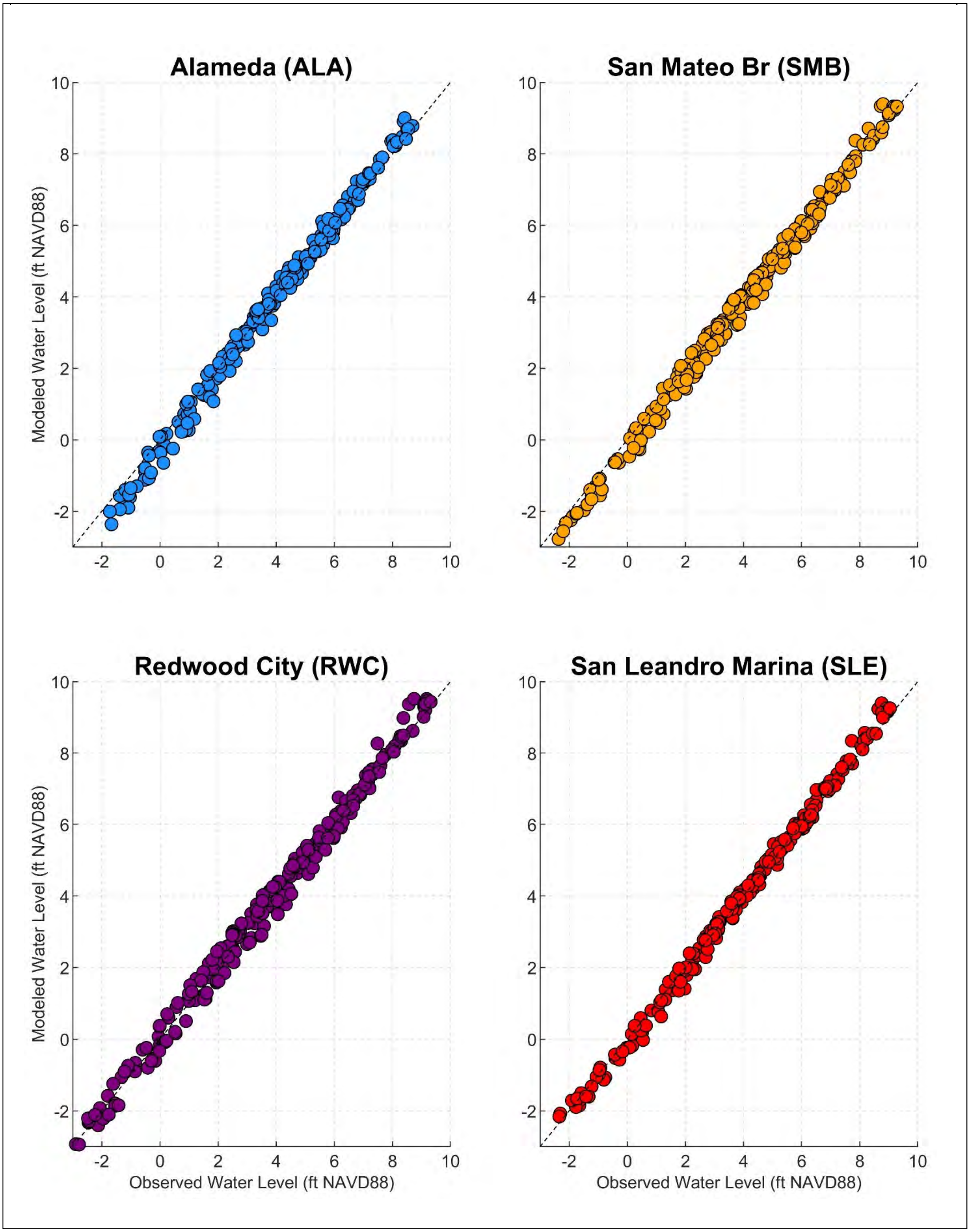


SOURCE: ESA Delft3d FM Model, NOAA Alameda, San Mateo, Redwood City, San Leandro tide gauges

SFO Shoreline Protection Program

FIGURE 11

TIME SERIES COMPARISON OF MODELED AND OBSERVED TIDES FROM JANUARY 2005 SIMULATION

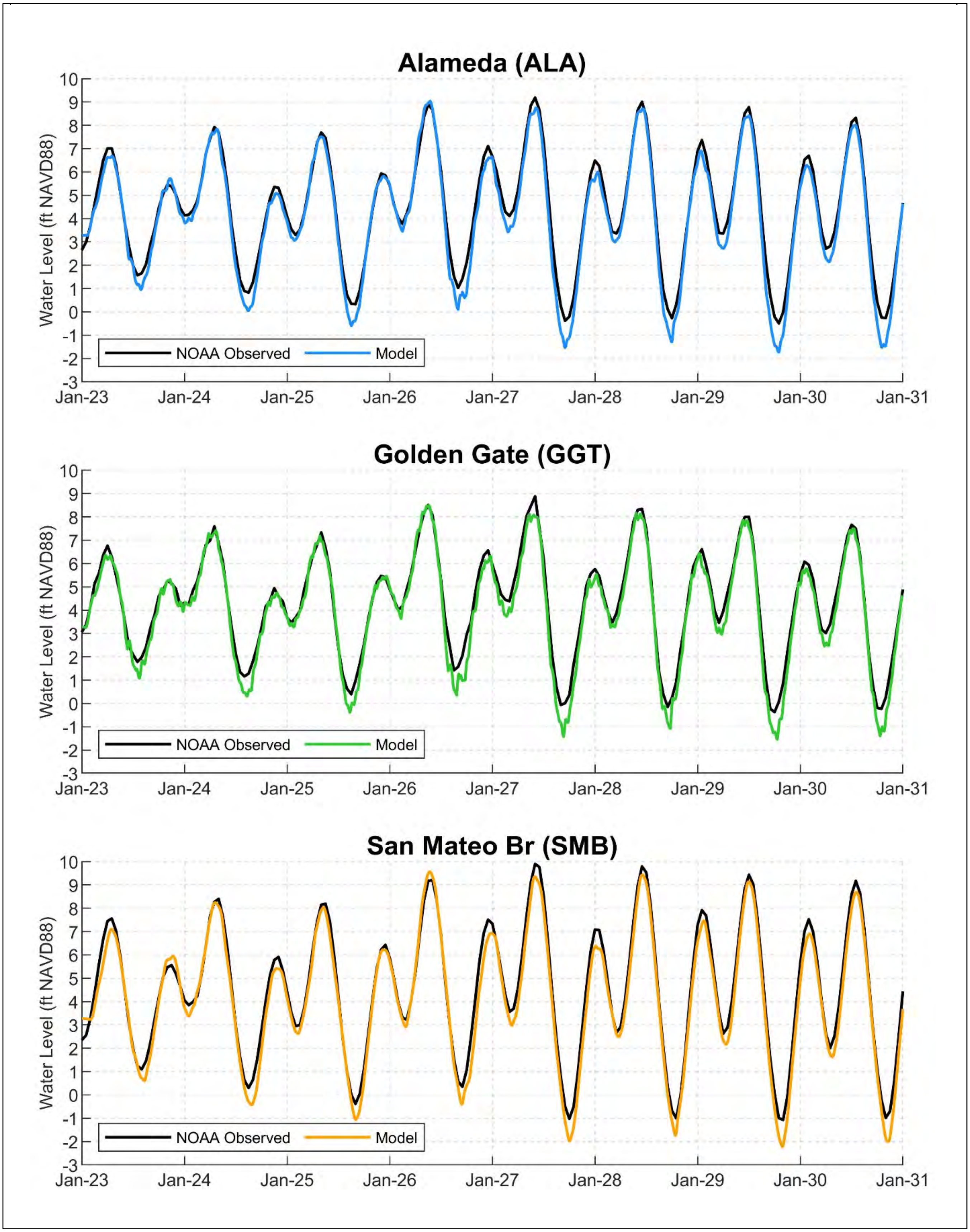


SOURCE: ESA Delft3d FM Model, NOAA Alameda, San Mateo, Redwood City, San Leandro tide gauges

SFO Shoreline Protection Program

FIGURE 12

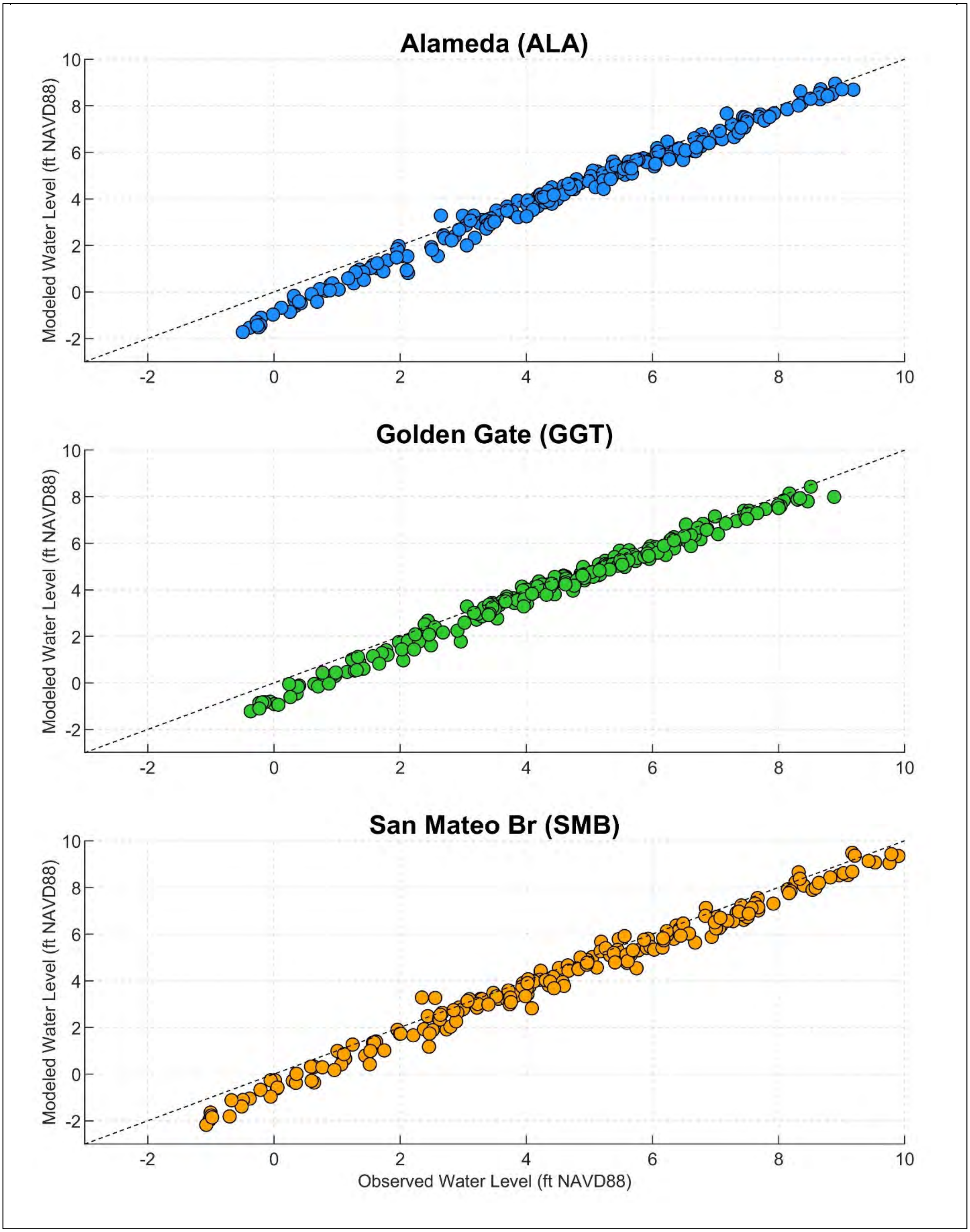
COMPARISON OF MODELED AND OBSERVED TIDE LEVELS FROM JANUARY 2005 SIMULATION



SOURCE: ESA Delft3d FM Model, NOAA Alameda, San Mateo, Redwood City, San Leandro tide gauges

FIGURE 13

TIME SERIES COMPARISON OF MODELED AND OBSERVED TIDES FROM JANUARY 1983 SIMULATION



SOURCE: ESA Delft3d FM Model, NOAA Alameda, Presidio, San Mateo tide gauges

FIGURE 14
COMPARISON OF MODELED AND OBSERVED TIDE LEVELS FROM JANUARY 1983 SIMULATION

TABLE 6
MODEL ACCURACY

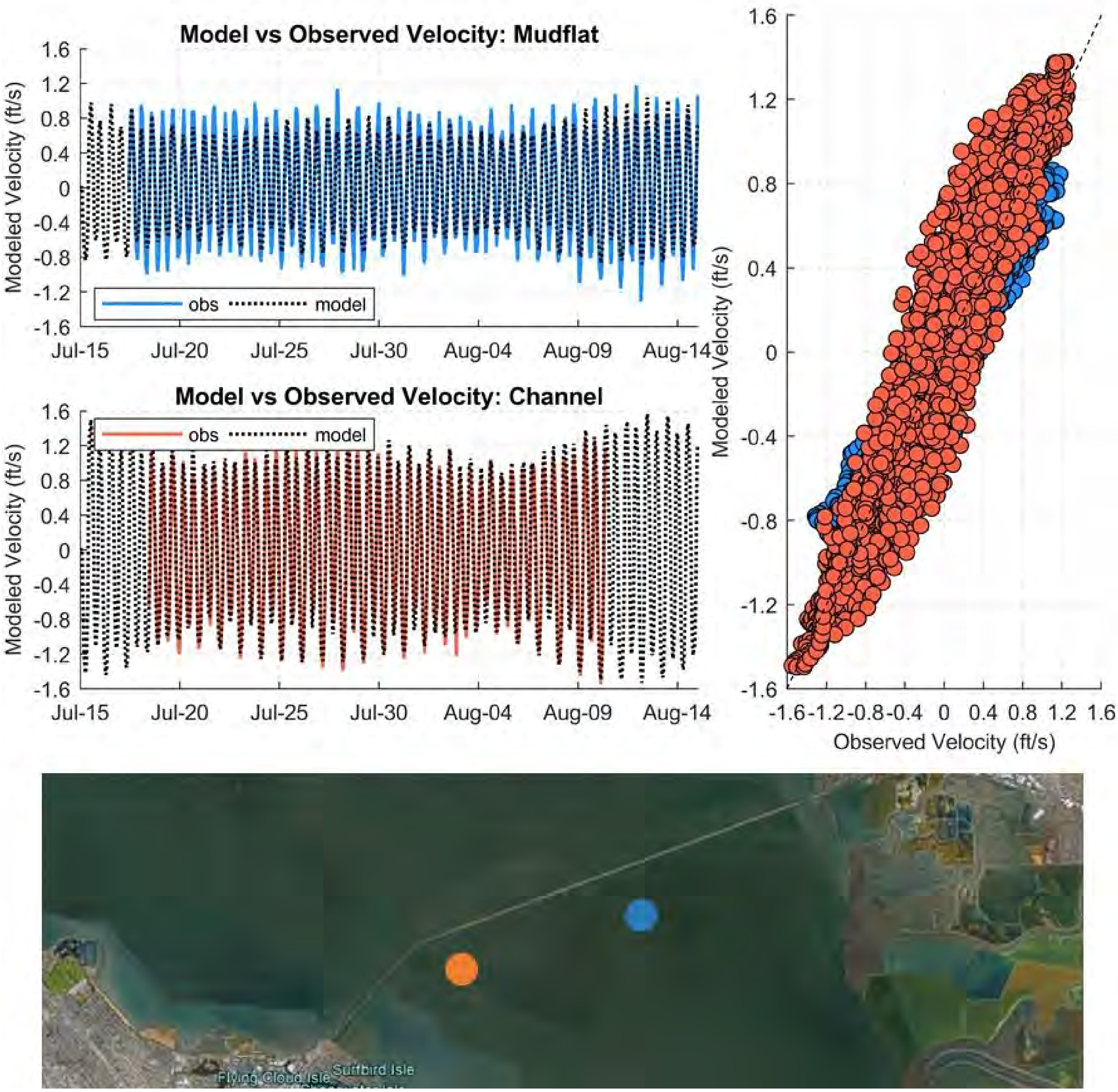
Type of Event	Location	Coef. of Determination (R^2)
Summer Tides (July 15–August 15, 2018)	Presidio	0.986
	Alameda	0.985
	Redwood City	0.988
10-Year Flood (January 1–14, 2005)	Alameda	0.990
	San Leandro Marina	0.996
	San Mateo Br.	0.992
	Redwood City	0.991
100-Year Flood (January 23–30, 1983, unadjusted)	Presidio	0.963
	Alameda	0.961
	San Mateo Br.	0.966

For typical summer tidal conditions, the model replicates observed water levels at several locations in the bay; Figure 8 compares modeled and observed time series of water levels during the summer 2018 period. The model had a close fit with observations in the Central Bay (Presidio and Alameda stations), and also in the South Bay at Redwood City, where the natural amplification of tides becomes apparent. Figure 9 shows a direct comparison of the hourly water levels. Errors were within 0.5 feet at each of the stations (**Table A-1**), and the coefficient of determination was above 0.98 for all three sites. The model also reproduced the expected amplitudes of the three tidal constituents (Figure 10).

The model was also assessed against water level data for flood conditions in January 2005 and January 1983, when tides were influenced by strong winds and storm surge. Figure 11 through Figure 14 show the time series and direct comparison of hourly water levels. The model fit was slightly weaker compared to the summer 2018 simulation, but hourly errors were typically less than 0.5 feet at all sites (Table A-1), and the coefficient of determination values were above 0.96. For the adjusted January 1983, the highest water levels predicted by the model at the Airport are 10.3 feet NAVD88, which is consistent with the 100-year water level at the Airport, as determined by FEMA (Table 2).

3.2.7.2 Comparison with Observed Current Velocities

The model predictions for velocity also compare well against velocity observations in the South Bay. In July–August 2018, a data collection effort led by Stanford University researchers (Egan et al. 2019) included several current velocity stations south of the San Mateo Bridge. These data stations include both deep channel and shallower shoals, so they span the range of water depths that also occur near the Airport. **Figure 15** compares modeled and observed velocities. Errors were generally less than 0.3 feet per second, and the coefficient of determination was above 0.8 for all stations.



SOURCE: ESA Delft3D FM Model, Stanford velocity data

SFO Shoreline Protection Program

FIGURE 15

COMPARISON OF MODELED AND OBSERVED VELOCITIES DURING THE SUMMER 2018 SIMULATION

3.3 Bay Wave Modeling

3.3.1 Model Selection

To evaluate potential erosive forces due to wind waves, a 2-D wind wave generation model for the South Bay was developed using the Simulating WAves Nearshore (SWAN) model ("wave model"). SWAN is a third-generation phase-averaged wave action model developed at Delft University of Technology, with support of the U.S. Office of Naval Research. The SWAN model was developed using Delft3D-WAVE (Version 4.95) (Deltares 2021) to prepare inputs and execute the SWAN model. SWAN accounts for wave generation, propagation, and dissipation. SWAN is "[a]llowed for use" by the USACE's Hydrology, Hydraulics and Coastal Community of Practice and also approved for FEMA flood studies.

3.3.2 Domain Extent and Grid

A series of three structured grids were nested together to represent the wave-generating fetches off the Airport's shoreline. By nesting grids within one another, the full extent of wave fetches could be covered efficiently while also providing high resolution in the immediate vicinity of the Airport. Wave predictions are initially made for the largest grid, which has coarser grid cell sizing. The predictions are then passed to the next smaller grid, which has more refined grid cells. By stepping down through the three nested grids, higher resolution for wave predictions is achieved adjacent to the Airport without having to calculate at this same high resolution throughout the bay.

Figure 16 shows the extents of the large (white), medium (gray), and small (navy) grids. The large grid covers the Central Bay and South Bay, approximately 13 miles east to west and approximately 43 miles north to south. This grid includes approximately 75,000 rectangular grid cells that are each approximately 330 feet by 330 feet. The medium grid is nested inside the large grid and covers approximately 2.5 miles east to west and approximately 6 miles north to south. This grid includes approximately 50,000 rectangular grid cells that range in size approximately from 80 feet by 300 feet to 80 feet by 80 feet. The medium grid provides adequate transition in grid cell size from the large grid to the small grid. The small grid covers approximately 2 miles east to west and approximately 4.5 miles north to south. The small grid includes approximately 120,000 grid cells that are identical to those from the hydrodynamic model (Section 3.2.2, p. 20), except for along the grid's eastern boundary where the SWAN grid was trimmed to not require the use of transitional triangular cells, which are available in the unstructured hydrodynamic model but not for the structured wave model.

SOURCE: Google Earth, 2021; ESA SWAN model, 2021

SFO Shoreline Protection Program

FIGURE 16
BAY WAVE MODEL NESTED GRID EXTENTS AND CELL SIZE

3.3.3 Bathymetry

Existing conditions bathymetry used in the wave model is the same as that applied in the hydrodynamic model. Details on the bathymetry sources for both models are described in Section 2.5, p. 11. For the with-project condition, bed elevations were increased to represent the proposed flood walls and open water fill along Reach 7 and Reach 8. No changes were applied to bathymetry seaward of the flood walls and fill.

3.3.4 In-Water Structures

The existing lighting trestles at the ends of Runways 19L, 28L, and 28R were represented in the wave model using SWAN's obstacles formulation (Deltares 2021). Obstacles are specified with an alignment and transmission coefficient based on their geometry. The SWAN obstacle formulation accounts for the degree of wave energy transmission for waves that pass through model grid cells containing the obstacles. Transmission coefficients can range from 0.0 to 1.0, where a transmission coefficient of 0.0 represents complete blockage of waves and a coefficient of 1.0 represents no blockage of waves.

To account for the piles supporting the lighting trestles, the alignment of each section of trestle is represented as a line the length of each section. Each section is assigned a transmission coefficient based on the approximate number and diameter of piles in the section, using the method outlined in Hartmann (1969). The piles' diameter (16 inches) and spacing (10 to 16 feet) for existing conditions were taken from COWI (2020). With-project conditions for the lighting trestles at the end of Runway 19L are based on the proposed design for the replacement trestles (COWI 2021b), as described in Section 3.2.4, p. 23. Calculated transmission coefficients following Hartmann (1969) ranged from 0.991 (existing conditions) to 0.999 (with-project conditions). This indicates that the both the existing and proposed trestles have a minimal impact on wave heights and negligible difference between them.

3.3.5 Wind Boundary Conditions

Wind speed and direction, based on the Airport's ASOS meteorological station (as described in Section 2.4, p. 9), were applied uniformly across the model domain to generate wind waves. This assumption of uniform winds across the wave model domain is reasonable, given the close proximity of the meteorological station to the modeled portion of the bay. The 2-minute averaging duration is the standard for reported ASOS wind data. However, this duration is not appropriate for wave prediction because the time scale for waves to adjust to the wind and to propagate is longer.

Because waves take time to accumulate energy from the wind, the wind speed averaging duration selected for modeling should be appropriate to the wind speed and fetch (USACE 2002). Too short of an averaging interval will yield a higher wind speed, but one whose short duration would not last long enough for waves to develop in equilibrium with this wind speed. For the Airport, fetch lengths are approximately 10 to 15 miles. This fetch range corresponds to a duration-limited interval of up to two hours. To select conservatively high wind speeds, a 30-minute averaging duration was selected for this study.

3.3.6 Parameters

Model parameters were selected based on guidance from Deltares (2021). Bed friction was calculated according to the JONSWAP model with a bottom bed coefficient of 0.067 square meters per cubic second, consistent with the bay's relatively shallow depths. The wave frequency and wave direction resolution were increased to account for the relatively short-period waves that occur in the South Bay. The Komen white-capping coefficient was reduced by 35 percent from default values to better represent white-capping in nearshore areas (Seibt et al. 2013). All other model parameters were set to default values and were verified during the calibration process, as described below.

3.3.7 Model Implementation

To capture the range of expected conditions in the project area, the SWAN model was applied for a range of combined water level and wind conditions.

Modeled wind waves were used for three purposes: 1) to couple wave and hydrodynamic modeling (Section 3.4, p. 40) that evaluates potential changes in velocity and wave- and current-induced bed shear stresses as a result of the proposed project; 2) to predict potential changes in extreme wave heights and wave-induced bed shear stress as a result of the proposed project; and 3) to select wave boundary conditions for the shoreline wave modeling (Section 3.5, p. 41).

For all wave model runs, the waves are considered to be stationary. This means that the waves are assumed to always have reached equilibrium with the specified wind speed and direction. This assumption is reasonable given the bay's fetch-limited conditions, in which wave travel times are relatively small compared to the observed rate at which wind speed and direction change.

The wave model was run using a constant water level across all of the model's extent, with the specified water level set for conditions at the Airport. While actual bay water levels will have slight spatial gradients due to the propagations of the tides, these gradients are assumed to not significantly affect wave conditions at the Airport.

For the extreme wind and wave conditions, the water levels were set to the Airport's tidal datums for MLLW, MSL, and MHHW (Table 1, p. 7), in combination with the 100-year wind speed (Table 3, p. 11), converted to 30-minute averaging duration (Section 3.3.5, p. 36). For the 100-year water level, the 10-year wind speed was used to simulate extreme conditions, since coincident 100-year wind speed and 100-year water levels are likely to occur with substantially less than a 1 percent annual exceedance probability. These 100-year events yield similar coastal flood conditions to the response-based approach used by the design team (COWI 2021) and provide a conservative upper bound to model wave effects at the shoreline of the Airport.

Three principal wind directions were modeled: northeast (45 degrees from north); southeast (135 degrees); and north-northwest (335 degrees). The rationale for selecting these three wind directions is based on preliminary modeling runs in which wind-wave heights were evaluated from all wind directions for wind speeds of 40 miles per hour. The largest wave heights offshore of Reach 7 (the region where the greatest amount of fill is proposed) were observed for these three wind directions. Note that north-northwest and southeast roughly correspond to the primary fetch axes of San Francisco Bay offshore of the Airport and the northeast corresponds to the minor fetch axes of the bay.

3.3.8 Calibration

The wave model was assessed for its calibration by using field data collected in July and August 2018 as part of a study of south bay sediment dynamics (Egan et al. 2019). This deployment included pressure gauges to measure water levels just south of the San Mateo-Hayward Bridge. Water levels were recorded at high frequency, to capture the variations due to wind waves, and then the water level records were processed to determine significant wave height, peak wave period, and spectral peak wave period. Wave direction could not be determined from the water level records.

To assess the SWAN wave model, the predicted wave heights and periods were extracted from the coupled wave and hydrodynamic model (described in Section 3.4) results at two stations where wave observations were made during the Egan et al. 2018 summer deployment. Then, these model predictions for significant wave height and peak wave period are compared to the observed values, as shown in **Figure 17**.

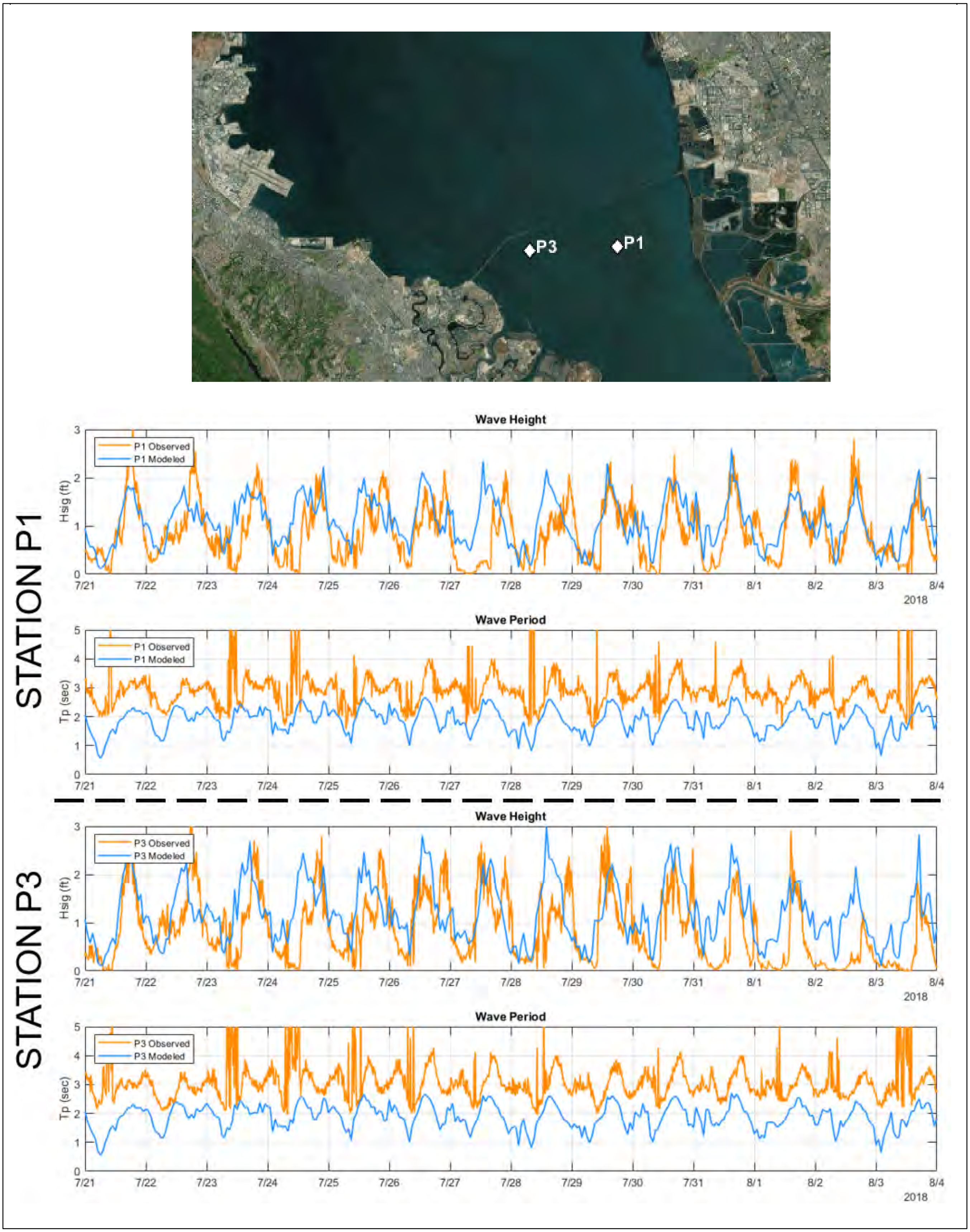
During this period, “sea breeze” winds reached 20 to 25 mph each afternoon, with wind directions usually from 280 to 300 degrees north. Maximum observed wave heights during the deployment were between 2 and 3 feet. Peak wave periods were typically between 3 and 4 seconds, with occasional clusters of longer period waves that may have been caused by passing vessels. The P1 station was located in shallower water and experienced slightly smaller wave heights than the P3 station.

The modeled wave predictions generally replicate the timing and magnitude of the observed daily ranges in significant wave height and wave period. The model slightly underpredicts wave periods, particularly when wave heights are less than one foot. Wave heights and periods were not predicted by the modeling for periods when wind direction or wind speed is missing from the observed record.

Several factors contribute to the relatively minor differences between modeled and observed conditions at stations P1 and P3:

- Stations P1 and P3 are located within the large grid (300 feet by 300 feet) on the shallow bay flats. This grid cell resolution may not fully represent some of the local bathymetric transitions and corresponding changes in wave heights that can occur at the channel-to-shoal transition near these stations.
- The model does not include the effects of the San Mateo Bridge, which may have a minor influence on wave heights at station P3.

Overall, this calibration demonstrated the model’s capacity to reproduce observed bay wave conditions with good accuracy. The factors discussed above that may contribute to differences between predicted and observed waves largely do not apply to the Airport. Hence, the wave model is considered to be sufficiently accurate to predict the potential changes in wave conditions that may occur as a result of implementation of the proposed project.



SOURCE: ESA, 2021, Egan et al 2019

SFO Shoreline Protection Program

FIGURE 17
WIND WAVE CALIBRATION AT POINTS P1 AND P3

3.4 Coupled Hydrodynamic and Wave Modeling

In order to combine effects of hydrodynamics and waves on the bay and bed adjacent to the Airport, coupled hydrodynamic-wave modeling was implemented using Delft3D FM Suite. The hydrodynamic model described in Section 3.2, p. 19, and the bay wave model described in Section 3.3, p. 34, were coupled using the Deltares Integrated Modeler Runner (DIMR) with SWAN receiving wind, water level, and current information from D-Flow every hour, and passing back radiation stress information for wave setup calculation. The hydrodynamic model runs for an hour, then passes its water level and current information to the SWAN module. Along with the wind field, SWAN uses this information to predict the wave field. This wave field is assumed to persist for the subsequent hour of the hydrodynamic model's execution, with the bed shear stresses due to waves added to the bed shear stresses due to currents to predict the total bed shear stress.

The coupled modeling was applied to simulate representative tidal conditions and storm surge conditions, as well as an event consistent with the FEMA 100-year coastal flood. These three time periods were based on recorded events in the bay. The representative tidal period spans from July 15 to August 15, 2018. The representative storm surge case is based on the period from January 1 to 14, 2005, which was an event with water levels similar to a 10-year flood event. Lastly, the 100-year coastal flood case is modeled by simulating the period from January 25 to 30, 1983, and by shifting the tide levels during this event to match the 100-year event documented by AECOM (2016). This 100-year event yields similar coastal flood conditions to the response-based approach used by the design team (COWI 2021).

For each of these three model time periods, the following cases were applied:

- Existing conditions without the project
- Existing conditions with the project
- Existing conditions + 3.5 feet of sea-level rise without the project
- Existing conditions + 3.5 feet of sea-level rise with the project[11]

This results in 12 total coupled model simulations (**Table 7**). Model outputs of velocity and bed shear stress are assessed for the potential to change sediment scour and deposition as a result of the proposed project (Section 4).

[11] Analysis of sea-level rise conditions are pending confirmation of the revised alignment for Reach 7.

TABLE 7
COUPLED MODEL SCENARIOS

Project Condition	Type of Event
Existing Sea-Level	
No Project	Summer Tides (July 15–August 15, 2018)
No Project	10-year Flood (January 1–14, 2005)
No Project	100-year Flood (January 25–30, 1983, adjusted)
Project	Summer Tides (July 15–August 15, 2018)
Project	10-year Flood (January 1–14, 2005)
Project	100-year Flood (January 25–30, 1983, adjusted)
Conditions with 3.5 Feet of Sea-Level Rise	
No Project	Summer Tides (July 15–August 15, 2018) + 3.5 feet SLR
No Project	10-year Flood (January 1–14, 2005) + 3.5 feet SLR
No Project	100-year Flood (January 25–30, 1983, adjusted) + 3.5 feet SLR
Project	Summer Tides (July 15–August 15, 2018) + 3.5 feet SLR
Project	10-year Flood (January 1–14, 2005) + 3.5 feet SLR
Project	100-year Flood (January 25–30, 1983, adjusted) + 3.5 feet SLR

3.5 Shoreline Wave Modeling

3.5.1 Model Selection

Modeled offshore wind-wave heights (from SWAN modeling) were translated to the shoreline using the XBeach model (Roelvink et al. 2009). XBeach predicts wave conditions with fewer simplifying assumptions than SWAN, thereby allowing for predictions of wave hydrodynamics as waves approach and break at the shoreline. This model captures the relevant swash zone processes including wave interactions with steep slopes, dynamic setup, and complex bathymetry. The use of XBeach allows a quantitative estimate of the bed shear stresses for these more complex wave dynamics. Waves are modeled non-hydrostatically to resolve wave-by-wave flow and surface elevation variations as waves interact with the shoreline.

The model was applied for a representative cross section at both Reach 7 and Reach 8, the two shoreline reaches with substantial open water fill (COWI 2021a). The XBeach model is used to compare mean and maximum bed shear stress for these two reaches for two shoreline configurations —existing and with-project. For each case, four water levels were modeled, for a total of 16 model simulations.

3.5.2 Grid

The Reach 7 and Reach 8 cross sections were developed using the most recent topography and bathymetry data available (Meridian 2015 and eTrac 2020). The cross sections were selected to correspond approximately with the centerlines of the reaches as shown in the proposed project's design drawings (COWI 2021a). The bed elevation profile for Reach 7 was derived from a transect perpendicular to the existing shoreline, just northwest of the lighting pier at the bayward end of Runway 19L, extending 945 feet into the bay. At Reach 7, the maximum (crest) elevations of the modeled shoreline for the existing and with-project cases were 12.7 and 20.2 feet NAVD88, respectively. The bed elevation profile for Reach 8 was derived from a transect perpendicular to the existing shoreline at the centerline of the reach and extending 1,650 feet into the bay. At Reach 8, the maximum elevations of the modeled shoreline for the existing and with-project cases were 12.6 and 19.6 feet NAVD88, respectively.

3.5.3 Model Setup

The model was developed with spectral wave boundary conditions based on SWAN output from extreme wind and wave conditions (Section 3.3.7, p. 37) at the offshore edge of the XBeach grid. Four water levels were modeled in both SWAN and XBeach—MLLW, MSL, MHHW, and the 100-year still water level (SWL); see Sections 2.1 and 2.2, pp. 7 and 8, for a description and Table 1, p. 7, and Table 2, p. 8, for values. In the SWAN model, the 100-year wind speed was used to simulate extreme conditions for the MLLW, MSL, and MHHW water levels. The 10-year wind speed was used to simulate extreme conditions for the 100-year water level, since coincident 100-year wind speed and water level are likely to occur with substantially less than a 1 percent annual exceedance probability. Of the three principal wind directions modeled, the largest resulting wave height at the offshore edge of the XBeach grid for each reach (**Table A-2** and **Table A-3**) was used as input for the XBeach model. Bed roughness was parameterized using Manning's *n* values as follows: concrete – 0.02 (inboard of the floodwall crest); riprap – 0.044 (from the floodwall crest to toe of fill); and bay mud – 0.025 (from toe of fill to offshore model boundary). Wave breaking was simulated using the Roelvink (1993) formula. The model simulations were one hour in duration with a 1-second time step to provide a suitable duration for averaging wave statistics.

SECTION 4
Modeling Results

Results of each type of modeling to predict changes in coastal hydraulics are presented in the following sections. This set of modeling results demonstrates that overall, the potential extent and magnitude of change to the bay's coastal hydraulics are limited.

In addition to minor changes in currents and waves themselves, changes to these hydraulic conditions can also cause changes to the bay's bed elevation. Changes to the bed elevation occur when the bed shear stress, the force exerted by currents or waves on the bed's sediments, changes substantially. A benchmark for characterizing bed shear stress changes is the critical shear stress of the bed sediments. Critical shear stress is the threshold above which water movements from currents or waves erode sediment from the bed, into suspension in the water column.

Previous modeling of the bay has found that the portions of the bay like the bed near the Airport have a two-layer response to bed shear stress. The top layer of bed sediments, which are estimated to be a few inches thick (Chou et al. 2018), are relatively unconsolidated mud particles. Because they are unconsolidated, they have less resistance to erosion, and are regularly eroded by tidal currents and waves action. This regular movement of the top layer helps sustain this layer, since the movement means these particles do not have time to consolidate and therefore have smaller critical shear stress for erosion. Below this unconsolidated layer, a thicker layer of consolidated mud resides. While composed of similar mud particles, this consolidated layer has not been recently eroded, and so has had time to expel water from in between particles. This consolidation increases the particles' resistance to erosion, which is reflected as larger critical shear stress. The consolidated layer is usually at least several feet deep.

A summary of the critical bed shear stress for erosion that is used in prior sediment transport modeling are provided in **Table 8**. In each of the following sections, model results are provided in terms of bed shear stress, which can then be compared to the critical bed shear stress for erosion to assess potential for the proposed project to cause substantive changes to the bed elevation in the bay.

TABLE 8
CRITICAL BED SHEAR STRESS FOR EROSION, SOUTH BAY SHOALS

Source	Unconsolidated (psf)	Consolidated (psf)
Gostic (2018)	0.0031	0.019
Chou et al. (2018)	0.0021	0.0084
Brand et al. (2010)	0.0010	n/a

NOTE: psf=pounds per square foot

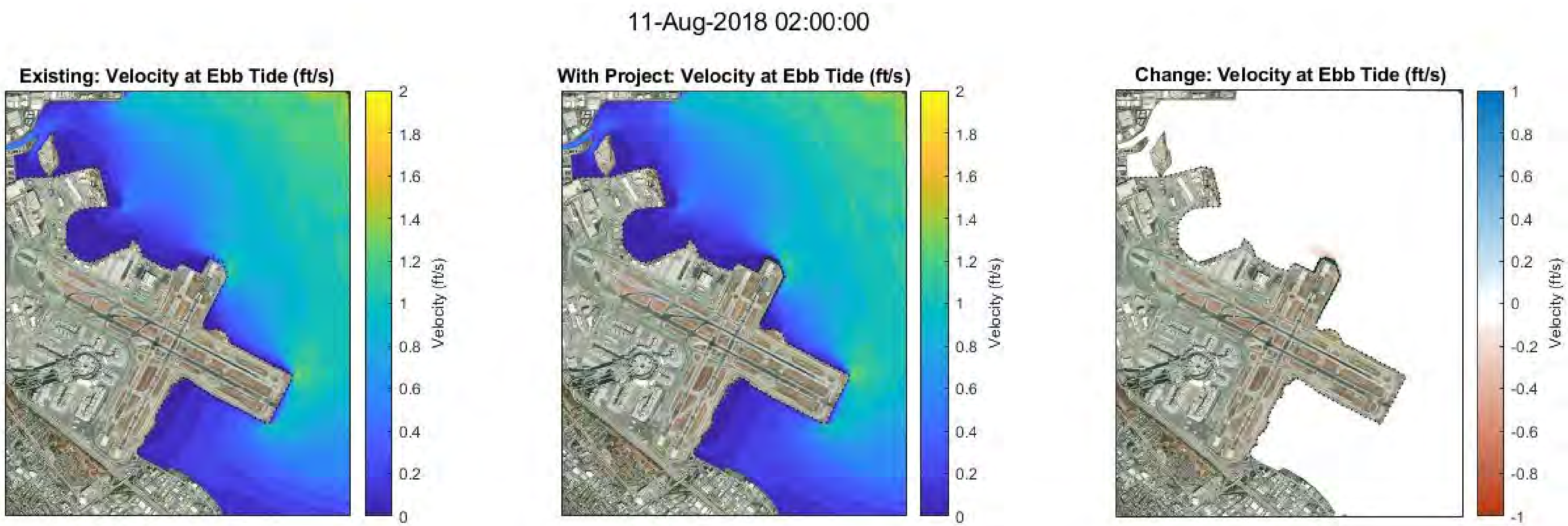
4.1 Coupled Hydrodynamic and Wave Modeling

Overall, the coupled hydrodynamic and wave model results indicate that project effects due to changes in tidal, storm surge, and wind-induced waves are likely to be small and localized. The potential for project effects was evaluated by mapping current velocity and bed shear stress and comparing these velocities and combined (current-induced and wave-induced) bed shear stresses between existing and with-project conditions.

Points throughout the tidal cycle were modeled and reviewed. However, results shown are during ebb tides after MHHW because this is when peak current velocity occurs during the tidal cycle. The areas where velocity and bed shear stress change substantially are limited to just in the vicinity of Reach 7 and the northern portion of Reach 8, as shown in **Figure 18** and **Figure 19** during a summer 2018 ebb tide. Along other reaches of the proposed project and within the adjoining bay, the changes in velocity and bed shear stress due to the proposed project are negligible.

Conditions around Reach 7 and Reach 8, where with-project changes are most pronounced, are shown in more detail for velocity in **Figure 20** and bed shear stress in **Figure 21**. Even for existing conditions, the protrusion of Reach 7 into the bay appears to somewhat constrict the northward ebb flow and thereby cause both flow deceleration and acceleration (Figure 20, left panel). While predicted flows accelerate offshore of Reach 7, the velocity immediately adjacent to the tip of Reach 7 are slower, as the local effects of the shallower depths and drag of the shoreline are more prevalent. With-project conditions, which extend the shoreline into the bay, also extend the slower moving nearshore water into the bay. This results in the decrease in velocity immediately adjacent to the proposed project’s shoreline, as compared to existing conditions (Figure 20, right panel). This region of slower velocity stretches out in the downstream (northwest) direction. Both the existing Runway 19L lighting trestle and proposed Runway 19L lighting trestle extend across this zone of slower velocity. Since the proposed trestle decreases pile spacing as compared to the existing trestle (Section 3.2.4, p. 23), the proposed trestle would exert less drag on the flow than the existing trestle and allow tidal currents to increase. However, since the velocity is predicted to decrease along the trestle alignment, the effect of the proposed trestle is negligible in comparison to the proposed open water fill. Further offshore, a slight increase in velocity occurs. These changes in velocity are echoed in the changes in bed shear stress. The quantitative change in velocity and bed shear stress at ten locations near Reach 7 and Reach 8 are tabulated in **Table A-4**.

To assess the relative importance of these changes in combined bed shear stress, the percentage of the time that the bed shear stresses exceeded the critical bed shear stresses for erosion were calculated over the duration of the model scenarios. Both the critical bed shear stress for the upper layer of unconsolidated sediment and the lower layer of consolidated sediment were considered. The intermediate values of critical bed shear stress from Chou et al (2018) were used from among the range of critical bed shear stresses summarized in Table 8, p. 43. By comparing the percent time exceeded between existing and with-project conditions, the potential effects of the proposed project on the bed can be evaluated.

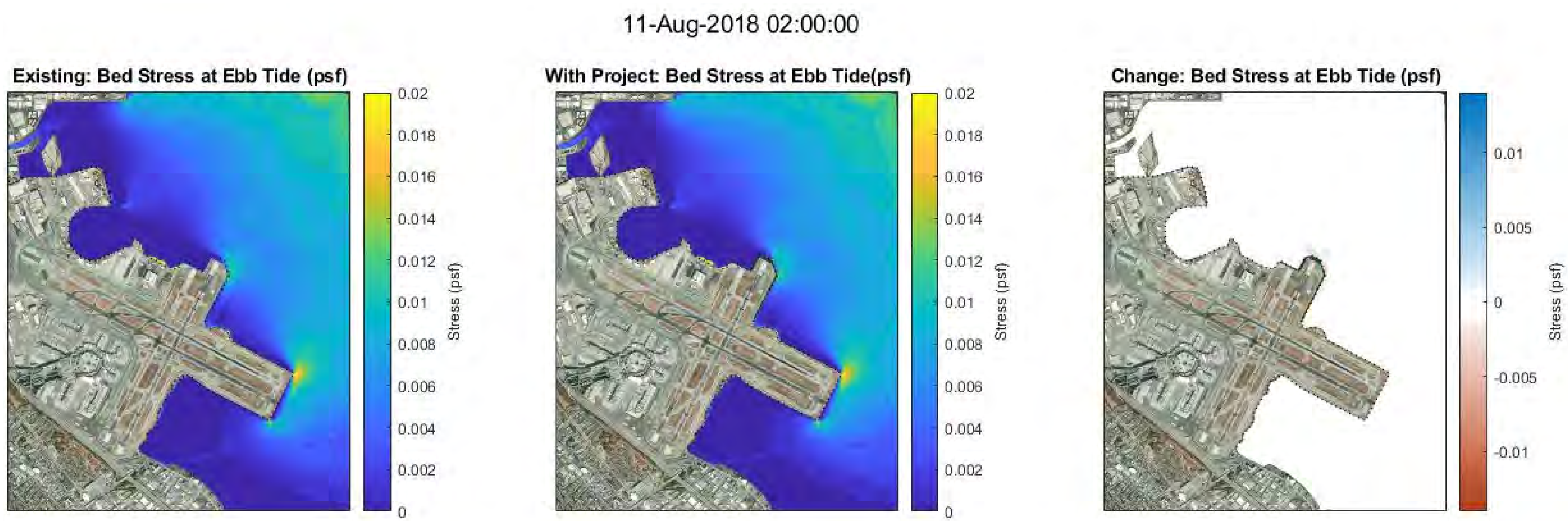


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 18

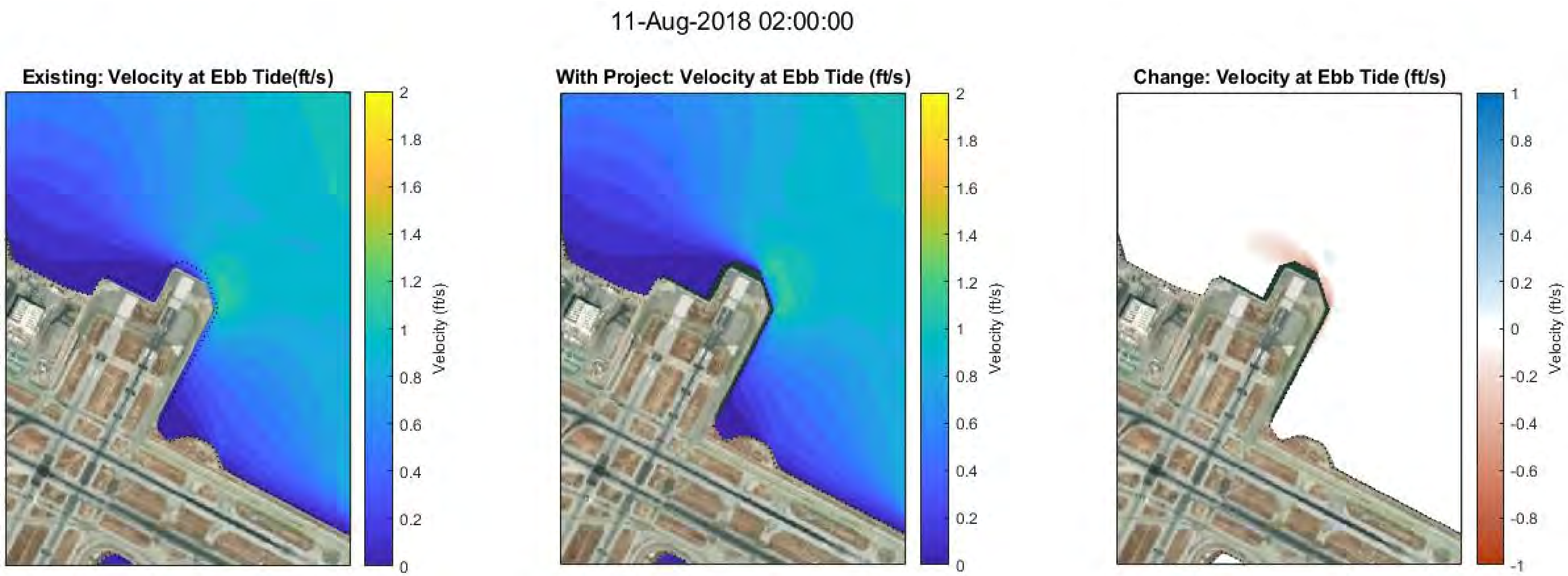
VELOCITY FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE 19

BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018

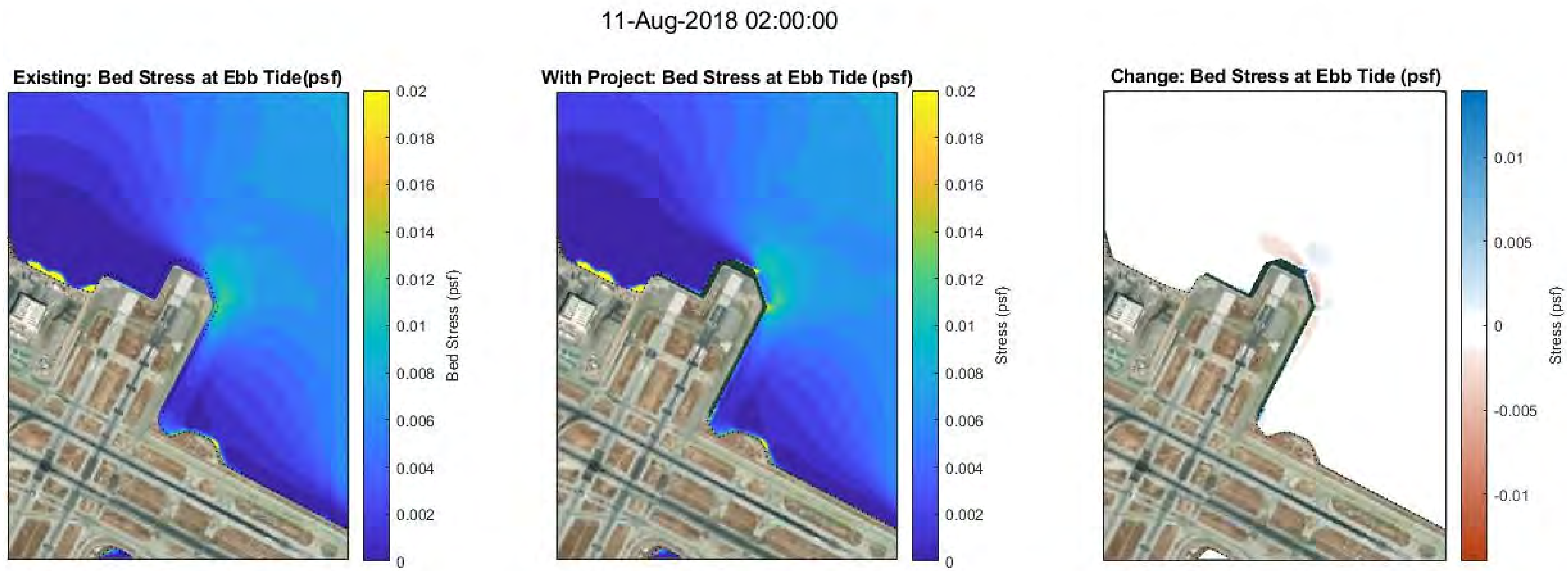


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 20

VELOCITY FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018



SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

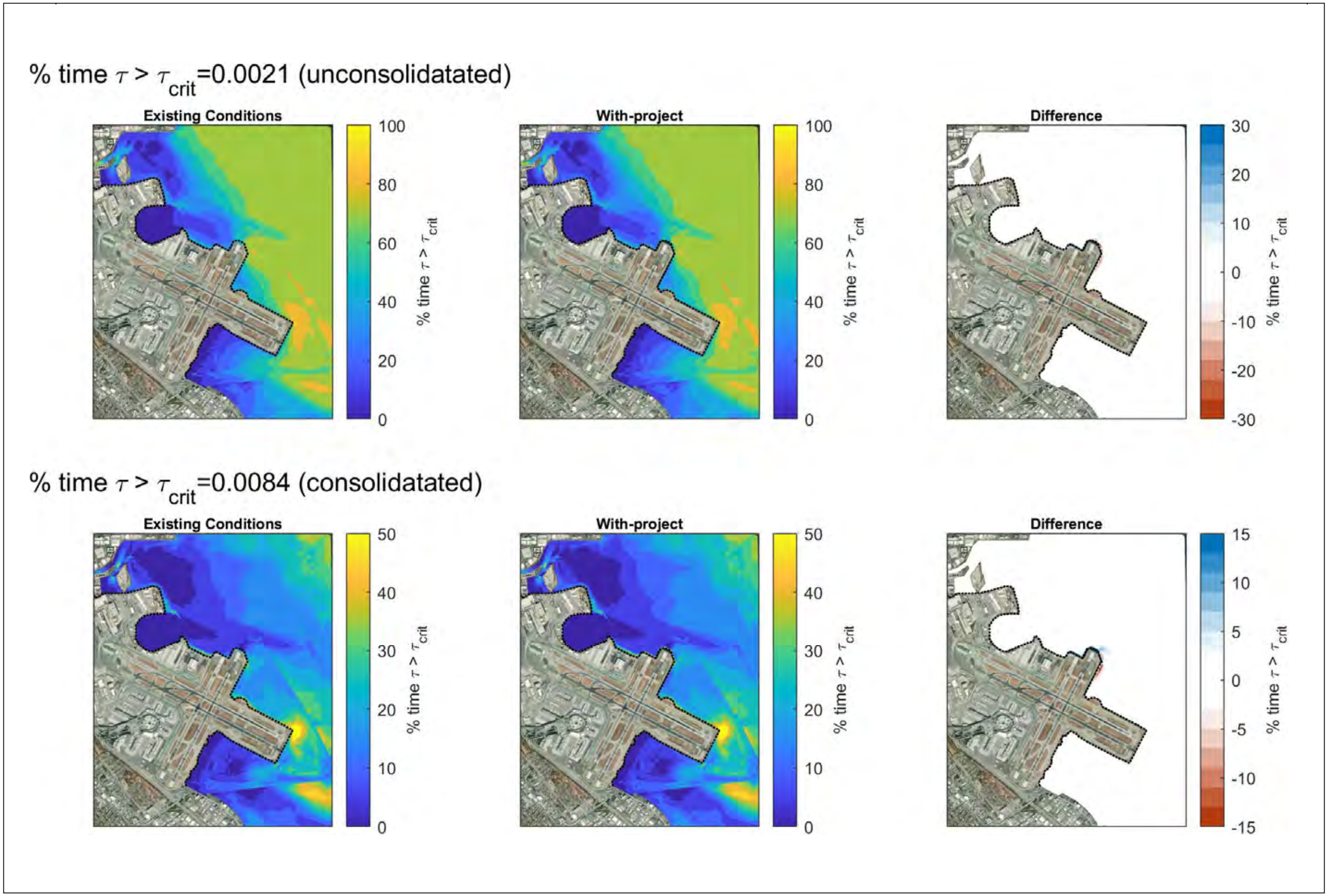
FIGURE 21
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018

As shown in **Figure 22** for the summer 2018 scenario, the only part of the shoreline along the proposed project with any change in combined bed shear stress is immediately adjacent to parts of Reach 7 and Reach 8. Along all other portions of the proposed project shoreline, changes in bed shear stress due to the proposed project are negligible and would not result in disturbance of the existing bed sediments.

Additional detail of Reach 7 and Reach 8 are shown **Figure 23**. Immediately adjacent to portions of Reach 7 and Reach 8 that face northeast and southeast, the percentage time exceeded for bed shear stress is predicted to decrease, dropping from approximately 70 to 50 percent for the unconsolidated top layer of sediment. Just offshore of Reach 7, the percent time exceeded for bed shear stress is predicted to increase by up to approximately 10 percent. These minor changes suggest that the proposed project may, at most, cause some minor re-distribution of the top few inches of the unconsolidated bed right next to Reach 7 and Reach 8. As shown in the bottom row of Figure 23, the changes in percent time exceeding the critical bed shear stress for consolidated sediments are limited to increases or decreases of less than 15 percent in a small region immediately adjacent to Reach 7 and Reach 8. Changes of this magnitude are not substantial enough to affect the lower consolidated layer of sediment. The changes to bed shear stress decrease with distance from Reach 7, such that there is a minor change at the junction of Reach 7 and Reach 8, which then further decreases to negligible change for the remaining southern portions of Reach 8. These changes along shorelines facing northeast and southeast are generally consistent with the changes in tidal velocity (Figure 20). However, the extent of visible change in Figure 23 does not extend as far to the northwest as in Figure 20 because Figure 20 shows only one instant of peak ebb during a spring tide; these strongest tidal currents occur relatively infrequently, so do not play a substantial role in the bed shear stress results that consider the entire Summer 2018 scenario, as in Figure 23.

For the western portion of Reach 7, where there is exposure to waves from the northwest, the percentage time exceeded is predicted to increase for both unconsolidated and consolidated critical bed shear stresses. This increase only occurs along a narrow strip along the outboard shoulder of the proposed open water fill, due to wave breaking on the fill's shoulder. The outboard shoulder of the proposed open water fill would be designed to include rock armor revetment sufficient to resist erosion from these higher bed shear stresses (COWI 2021) and therefore avoid erosion impacts to the bed. This increase bed shear stress in portions of Reach 7 with northwest exposure does not occur in Figure 21 because wind was not blowing from the northwest at the time shown in Figure 21.

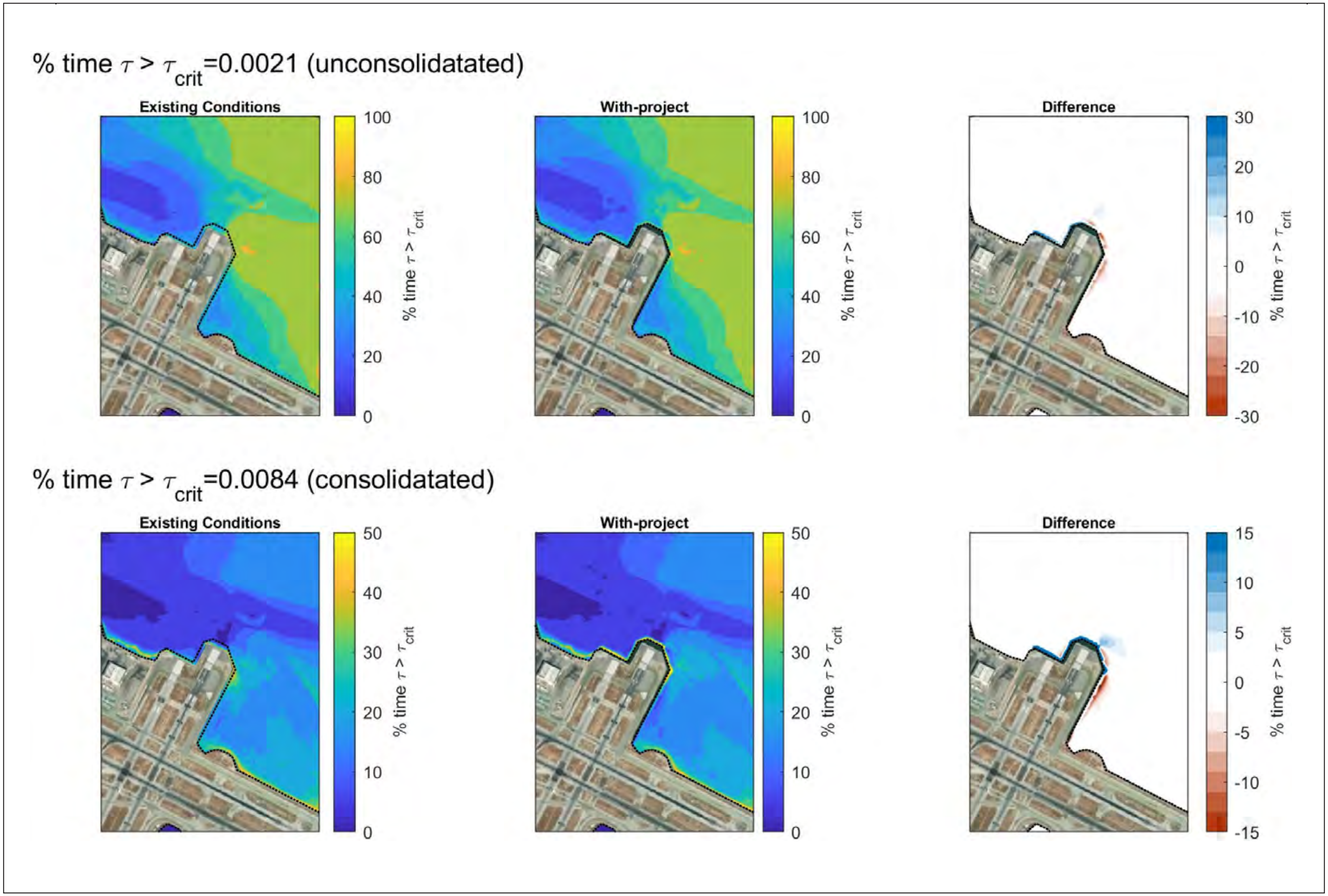
The addition of 3.5 feet of sea-level rise to the summer 2018 conditions does not substantially change the predicted effect that the proposed project would have on velocity and combined bed shear stress. The effects of a deeper water column on the bed are relatively minor. Figures A-1 to A-6 in Appendix A compare existing and with-project conditions for summer 2018 with 3.5 feet of sea-level rise.



SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 22
PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018



SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 23

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018

In summary, for summer 2018 tidal conditions, the results indicate:

- Largest decrease in velocity and shear stress occurs just offshore of the proposed open water fill in the bay along Reach 7. These changes may slightly effect distribution of sediment in the top unconsolidated bed layer, but are not substantial enough to affect the lower consolidated bed layer.
- Slight increase in velocity and shear stress several thousand feet offshore, diminishing to no change at 4,000 feet and beyond.
- Negligible changes near all other shoreline reaches around the Airport and adjoining areas of the bay.
- These findings of limited effects of the proposed open water fill in the bay on the bay sediments persist with the addition of 3.5 feet of sea-level rise.

For the January 2005 (10-year) and adjusted January 1983 (100-year) scenarios, velocities and bed shear stresses respond to with-project conditions in a similar manner. Modeling results for these scenarios are included in Appendix A, Figures A-7 to A-18 for January 2005, and Figures A-19 to A-30 for adjusted January 1983 conditions, as well as in Table A-4 and **Table A-5**.

Along with the higher water levels, these events generate slightly different distributions of current velocity and bed shear stress, since the tides, storm surge, and wind waves are higher for these scenarios. However, the change in velocity and bed shear stress is generally similar in magnitude and location as for Summer 2018 conditions. The one area of difference is along Reach 8, where immediately along the with-project shoreline there are higher predicted bed shear stresses (e.g., Figure A-10 for January 2005 and Figure A-22 for adjusted January 1983). This occurs because waves that would propagate across open water for existing conditions instead break in the shallow water directly above the side slope of the proposed open water fill. This breaking occurs within a narrow strip, typically only one cell wide, that overlap with the outboard shoulder of the proposed open water fill. The outboard shoulder of the proposed open water fill would be designed to include rock armor revetment sufficient to resist erosion from these higher bed shear stresses (COWI 2021) and therefore avoid erosion impacts to the bed. This increase occurs for the January 2005 and adjusted January 1983 events because these storm events include substantial wind forcing from south of the Airport, which causes waves to impinge upon Reach 8. Winds during Summer 2018 are predominantly from the northwest, so do not generate substantial waves along the southeast aspect of Reach 8. The interaction of waves in the immediate vicinity of the shoreline is also addressed in more detail with the XBeach modeling presented in Section 4.3. The addition of 3.5 feet of sea-level rise to the January 2005 and adjusted January 1983 conditions does not substantially change the predicted effect that the proposed project would have on velocity and combined bed shear stress.

Overall, the area whose hydrodynamics are affected by the proposed project includes the portion of the bay immediately adjacent to Reach 7 and the northern portion of Reach 8. Along Reach 7, the affected area extends approximately 300 feet from the proposed shoreline. Along Reach 8, the affected area extends only approximately 100 feet from the proposed shoreline and is limited to the northern portion of this reach, near its juncture with Reach 7. In the affected area, changes in bed shear stress are similar to the critical bed shear stress for the top layer of unconsolidated sediment and may cause some re-distribution within the top few inches of the bed. In all areas, the bed shear stress remains well below the critical shear stress for the lower layer of consolidated sediment, so with-project conditions would continue to not disturb this layer, as is the case for existing conditions.

4.2 Extreme Wind and Wave Conditions

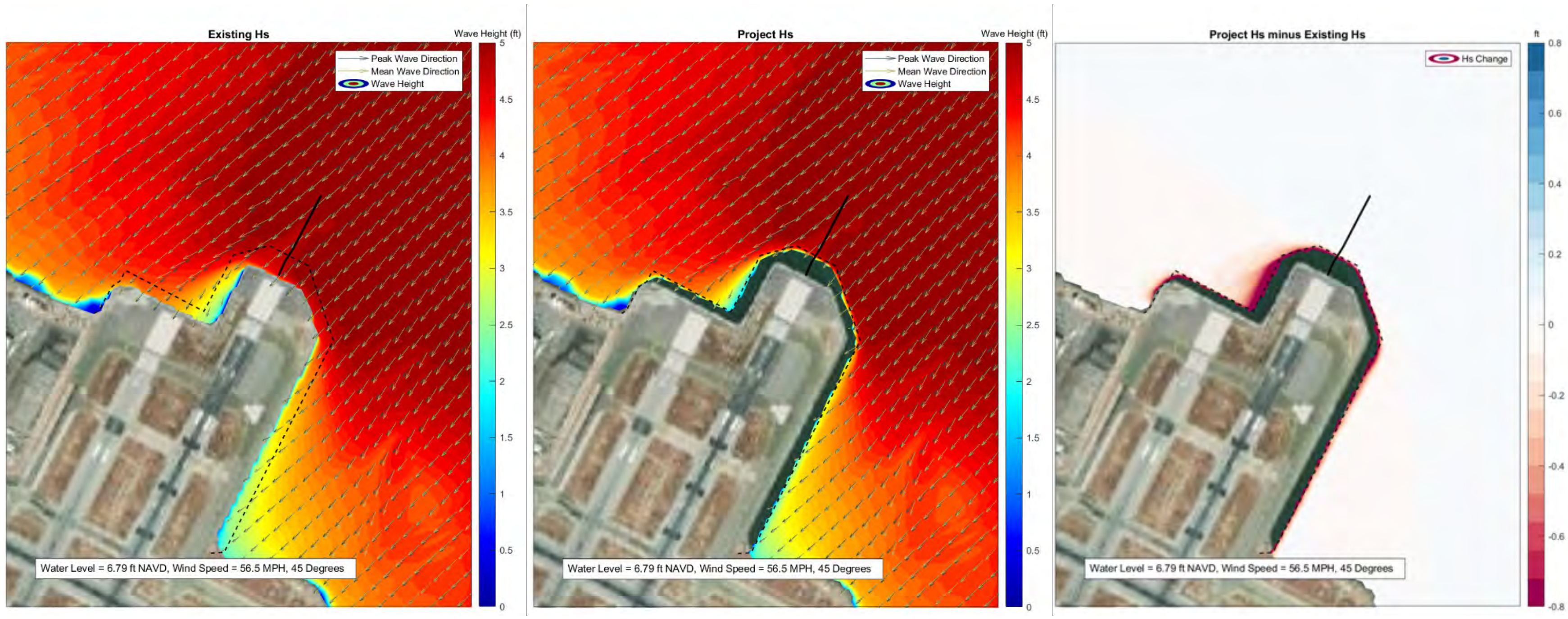
Wave-induced bed shear stress maps were calculated for nine cases with a 100-year wind speed. As noted in Section 3.3.5, p. 36, the 2-minute averaging duration wind speed shown in Table 3, p. 11, was converted to a 30-minute averaging duration for modeling, yielding a wind speed of 56.5 mph. The nine cases include all combinations of three wind directions (northeast – 45 degrees, southeast – 135 degrees, and north-northwest – 335 degrees) and three water levels (MHHW, MSL, and MLLW).

Figure 24, **Figure 26**, and **Figure 28** plot the existing, with-project, and change in significant wave height for MHHW and the 100-year wind speed from each of the three directions. Overall, the changes in wave heights due to the proposed project are limited to the vicinity of the proposed open water fill. By extending into the bay, the proposed open water fill would intercept and reduce wave heights. The largest extent of wave reduction occurs for wind from the southeast (Figure 26). The other water levels, MSL and MLLW, had similar or lesser change between existing and project conditions.

Figure 25, **Figure 27**, and **Figure 29** plot the existing, with-project, and change in bed shear stress for MHHW from each of the three directions. When water levels were at MHHW, the largest nearshore differences in bed shear stress were predicted because the greater water depths enabled larger waves to propagate to the shoreline. The other water levels, MSL and MLLW, had similar or lesser change between existing and project conditions.

The difference plots for these three wind directions indicates that along much of the shoreline, there is no change in bed shear stress between existing and with-project conditions. For some portions right along the Reach 7 and Reach 8 shoreline, there are reduced bed shear stresses. These are the result of being closer to the shoreline, with the proposed extension of Reach 7 and Reach 8 into the bay. Waves from the southeast (Figure 27) are sheltered more substantially to the lee (northwest) of the proposed shoreline protection system for Runway 19, resulting in reduced bed shear stresses over a larger area. However, the reduction remains only in the area immediately offshore of Reach 7. There are no substantial changes in wave conditions that extend to shoreline beyond the Airport's shoreline.

The proposed project tends to slightly reduce bed shear stresses when compared to existing conditions in Reaches 7 and 8. This occurs for two reasons: (1) the proposed project's extension of the shoreline shelters some areas in the lee of prevailing winds, such as the west of Reach 7, and (2) the extension of the shoreline results in deeper water at the shoreline toe, which tends to reduce bed shear stresses. The extent of the changes in bed shear stress is generally limited to approximately 100 feet from the shoreline in Reach 7 and Reach 8, and there is no significant change outside of Reach 7 and Reach 8.

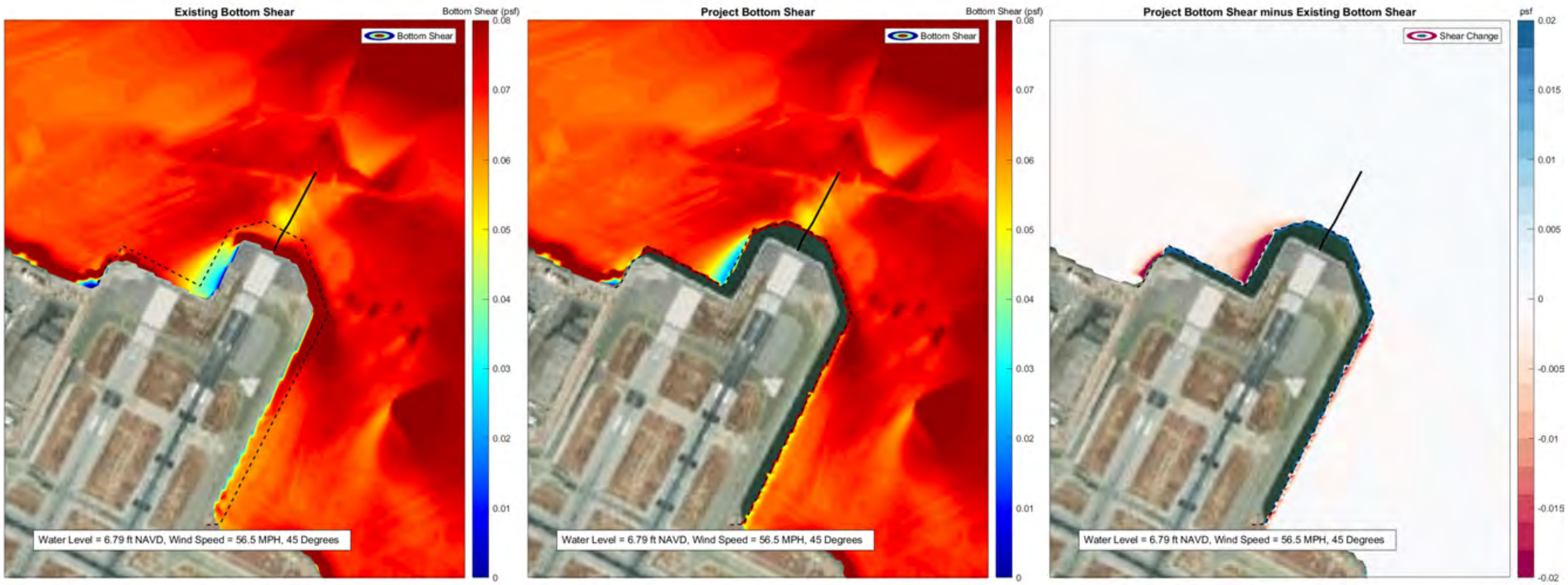


SOURCE: ESA SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 24

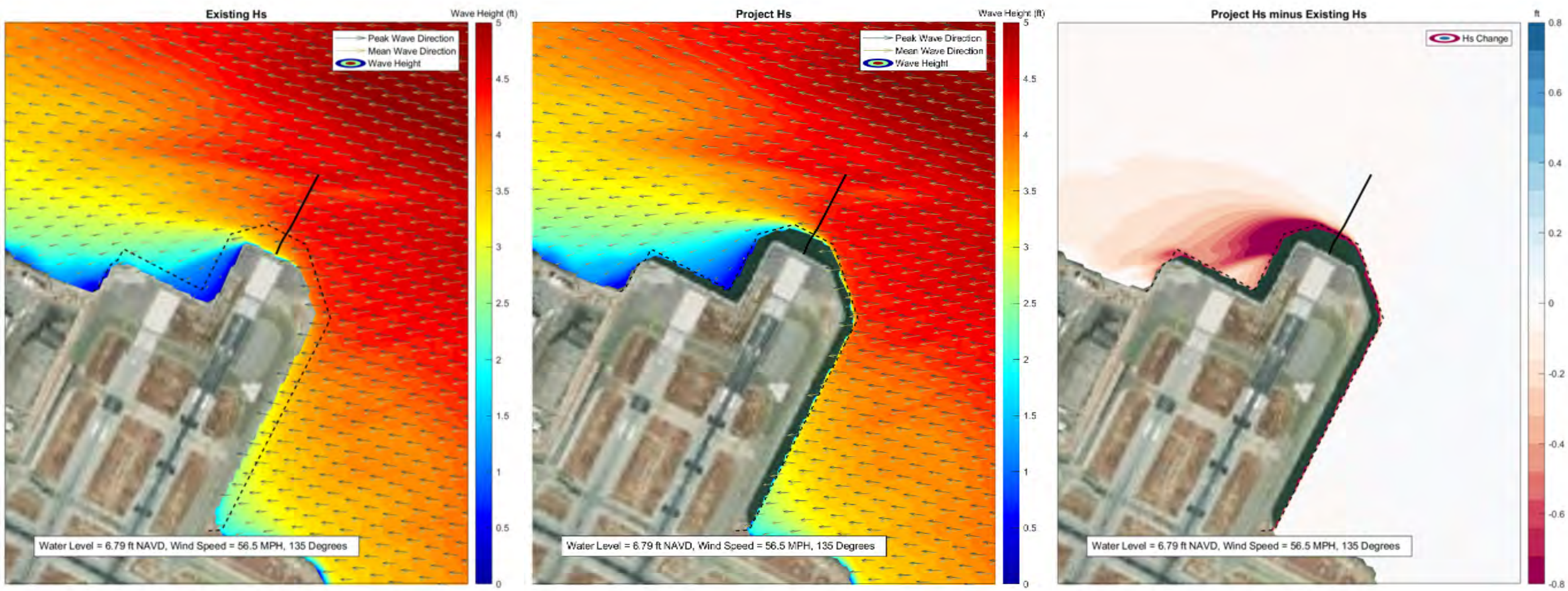
SIGNIFICANT WAVE HEIGHT ALONG REACHES 7 AND 8 MHHW WITH 100- YEAR WIND FROM NORTHEAST (45 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)



SOURCE: ESA SWAN modeling results (2021)

FIGURE 25

BED SHEAR STRESS ALONG REACHES 7 AND 8 MHHW WITH 100- YEAR WIND ROM NORTHEAST (45 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)

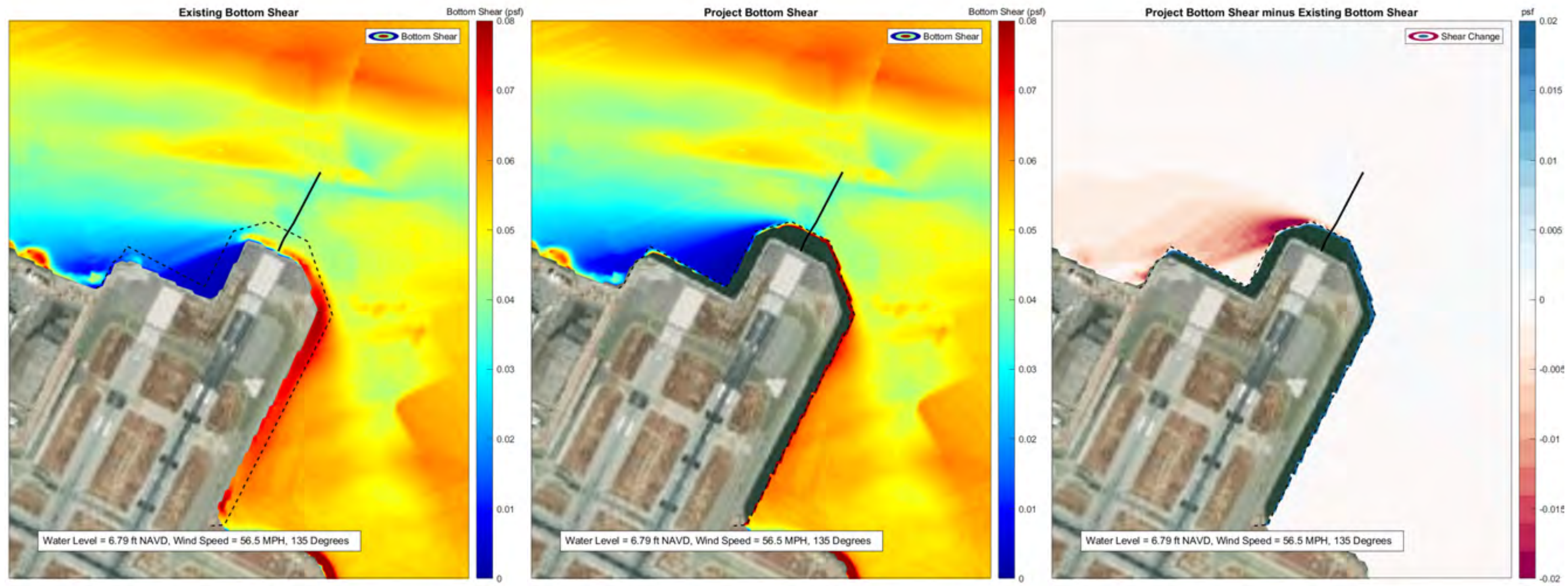


SOURCE: ESA SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 26

SIGNIFICANT WAVE HEIGHT ALONG REACHES 7 AND 8 MHHW WITH 100- YEAR WIND FROM SOUTHEAST (135 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)

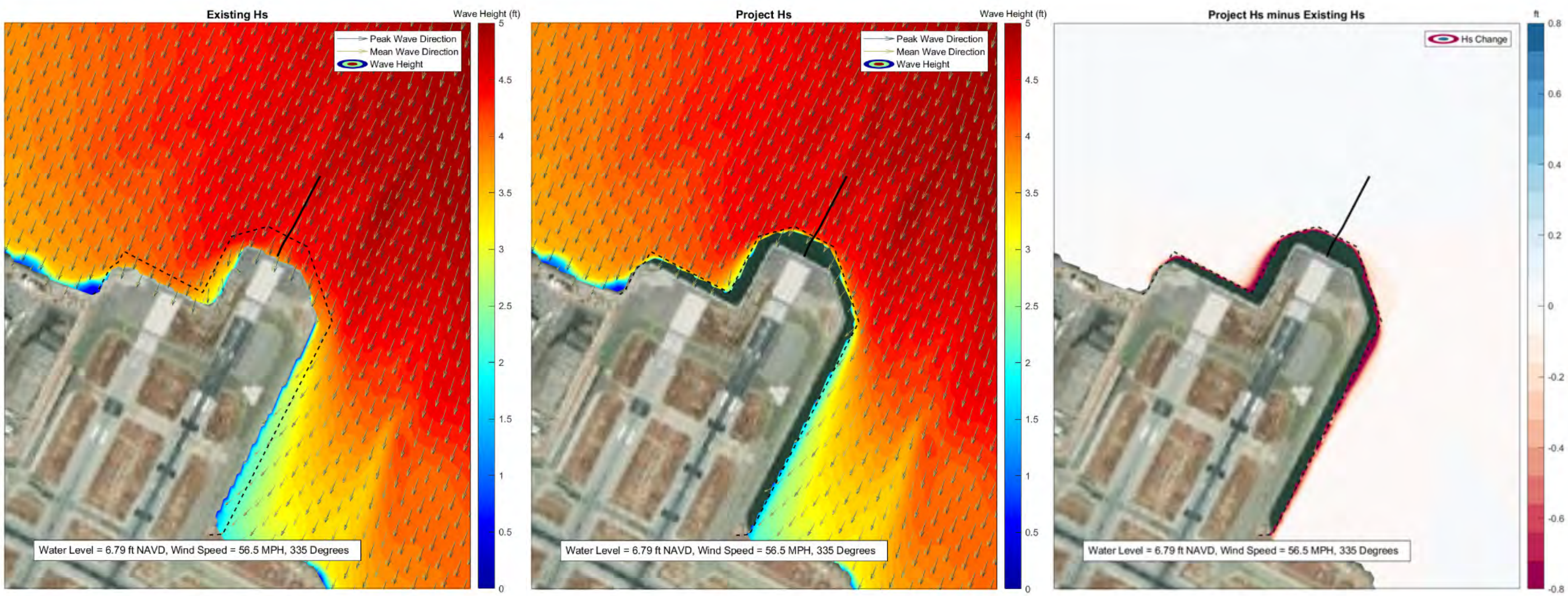


SOURCE: ESA SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 27

BED SHEAR STRESS ALONG REACHES 7 AND 8 MHHW WITH 100- YEAR WIND FROM SOUTHEAST (135 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)

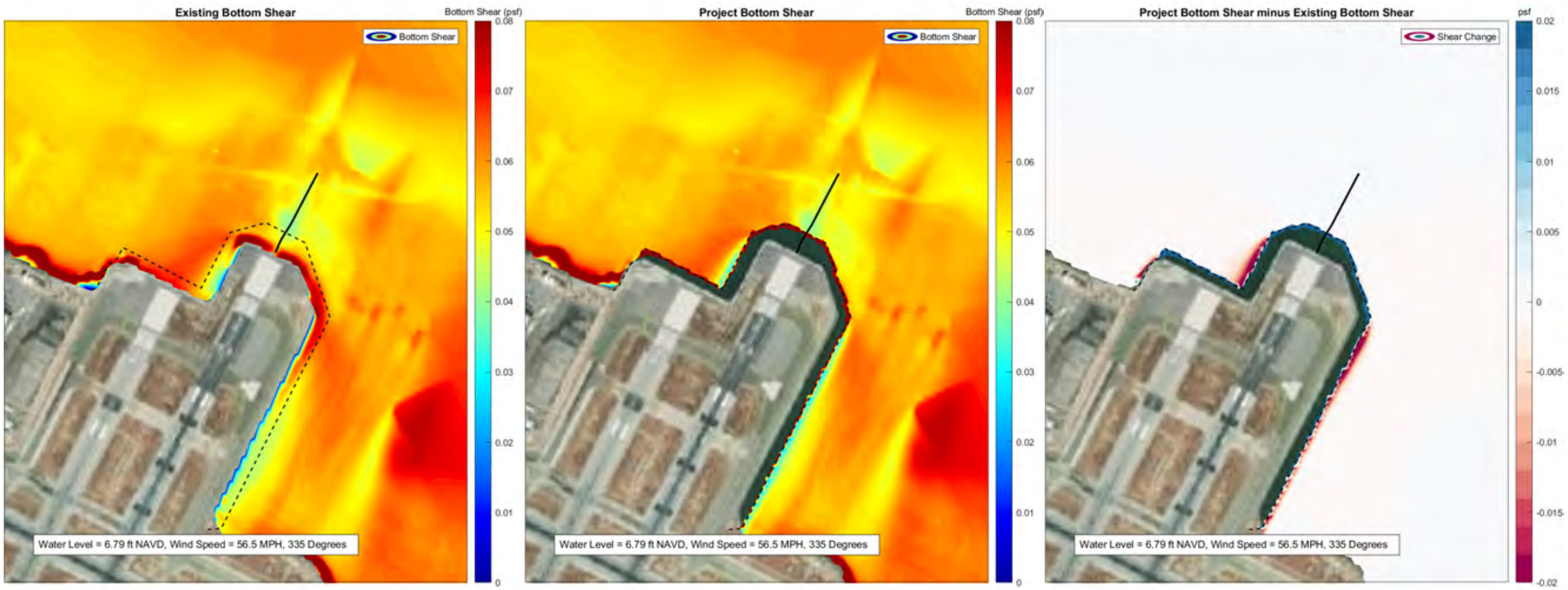


SOURCE: ESA SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 28

SIGNIFICANT WAVE HEIGHT ALONG REACHES 7 AND 8 MHHW WITH 100- YEAR WIND FROM NORTHWEST (335 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)



SOURCE: ESA SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE 29

BED SHEAR STRESS ALONG REACHES 7 AND 8 MHHW WITH 100-YEAR WIND FROM NORTHWEST (335 DEGREES), EXISTING (LEFT), PROJECT (MIDDLE), AND DIFFERENCE (LEFT)

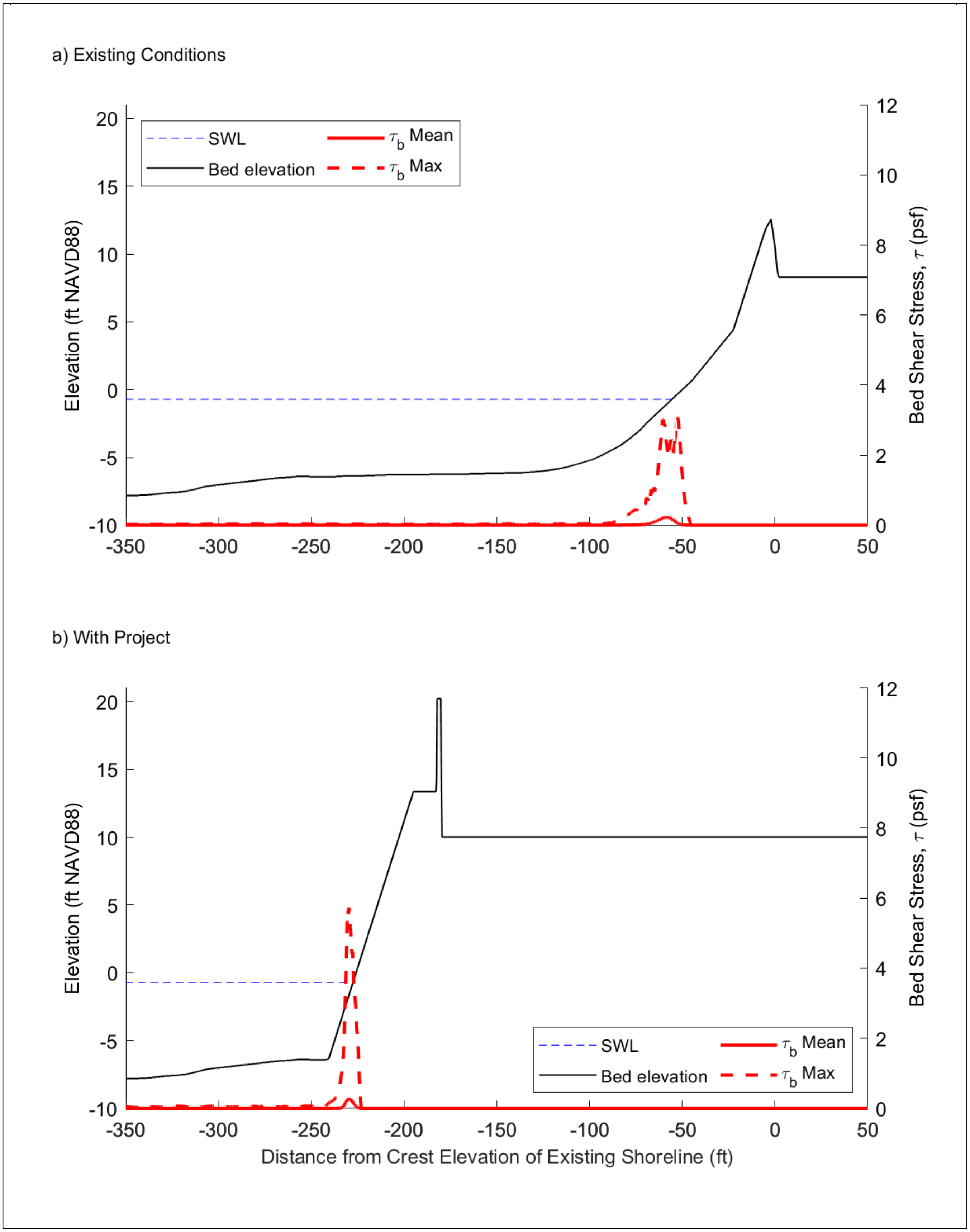
The SWAN model used to simulate bay waves does not fully represent wave processes where the waves interact with shoreline structures, such as wave breaking, wave reflection, and the swash zone. These processes can cause local bed shear stress and erosion potential. Refer to the shoreline wave modeling results in Section 4.3, p. 60, for assessments of potential project impacts immediately adjacent to the shoreline.

4.3 Shoreline Wave Modeling

Results of the shoreline wave modeling using the XBeach model quantify the likely changes immediately adjacent to the shoreline, where waves interact with the shoreline's structures. This enables the comparison of bed shear stresses for the existing and with-project conditions for a range of water levels.

At Reach 7, model results for MLLW and MSL water levels showed greater mean and maximum bed shear stresses over a narrower region of the bed for the with-project case compared to the existing case (**Figure 30** and **Figure 31**) due to the steeper bed slope for the with-project bathymetry; however, this higher-stress region is still within the section of the fill that will have rock armor (COWI 2021a). For MHHW and 100-year SWL water levels at Reach 7, the magnitude of the mean and maximum bed shear stresses were increased and peak values were translated further offshore for the with-project case, but the shape of the bed shear stress curves were similar (**Figure 32** and **Figure 33**). Again, the higher-stress region was located within the rock-armored section of the with-project fill. Over the bay sediments, for all cases, both mean and maximum bed shear stress remains below the critical bed shear stress for consolidated bed sediment (Table 8, p. 43). Since the peak bed shear stresses for this reach are observed at the armored slope, the results are insensitive to the offshore bathymetry and the location of the cross-section is expected to be representative of the effects for the entire reach.

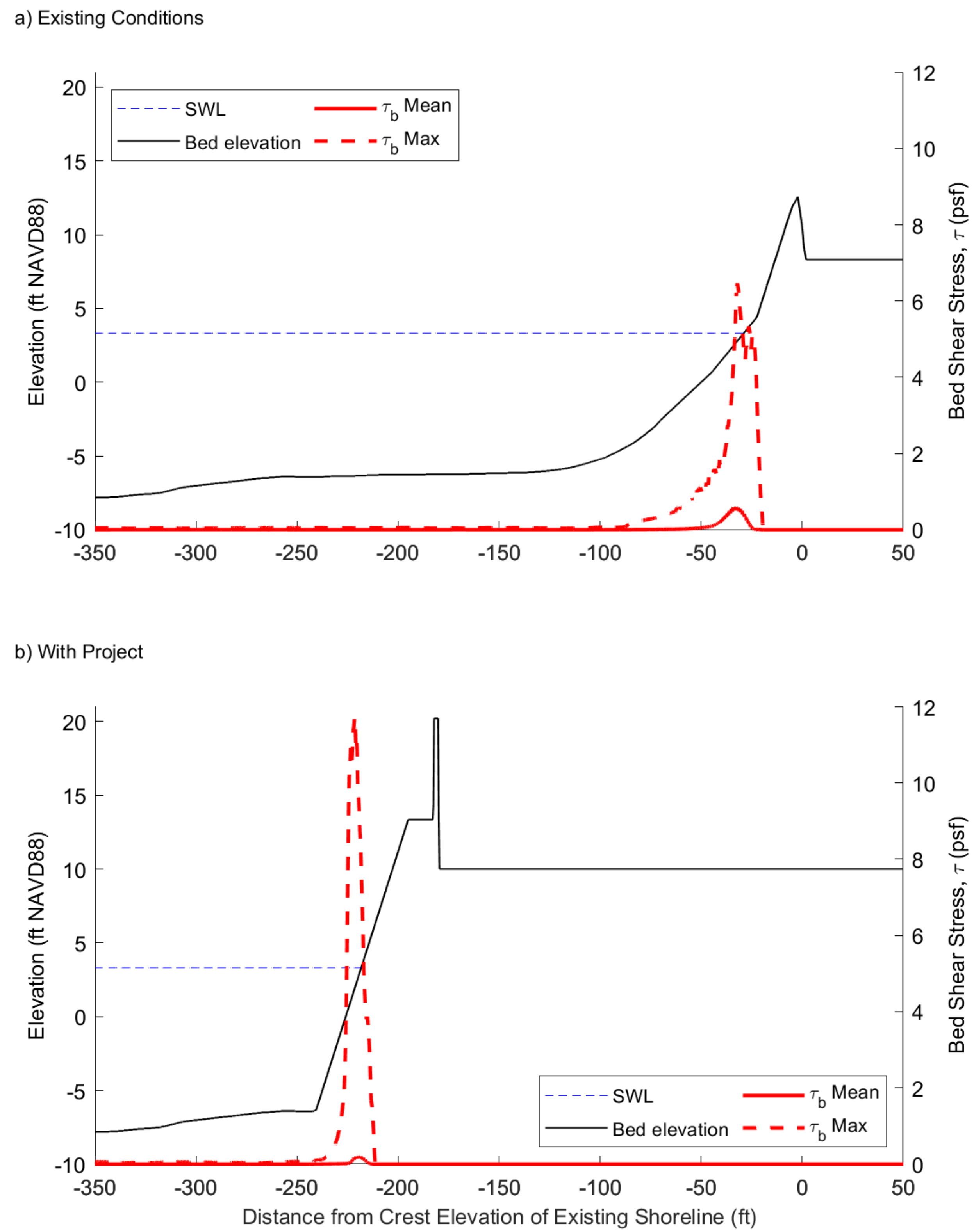
At Reach 8, where the bed elevation adjacent to the shoreline structure is higher, model results for the MLLW water level include a scenario in which the bed in front of the proposed fill goes dry. As a result, the bed shear stresses peak offshore of the structure over bay mud (**Figure 34**). While the maximum bed shear stresses are large enough to exceed the critical shear stress for consolidated bed sediment (Table 8), there is no substantial change between existing and with-project conditions. Large waves occurring at low tide may erode the bed, but the extent and magnitude of this erosion potential are unchanged as a result of the proposed project. For MSL, MHHW, and 100-year SWL water levels at Reach 8, the shape and magnitude of the mean and maximum bed shear stresses were similar for the two cases and have the same offshore translation for the with-project case (**Figure 35**, **Figure 36**, and **Figure 37**). As with Reach 7, the higher-stress region in the with-project case was located within the armored fill section.



SOURCE: ESA XBeach modeling results, 2021

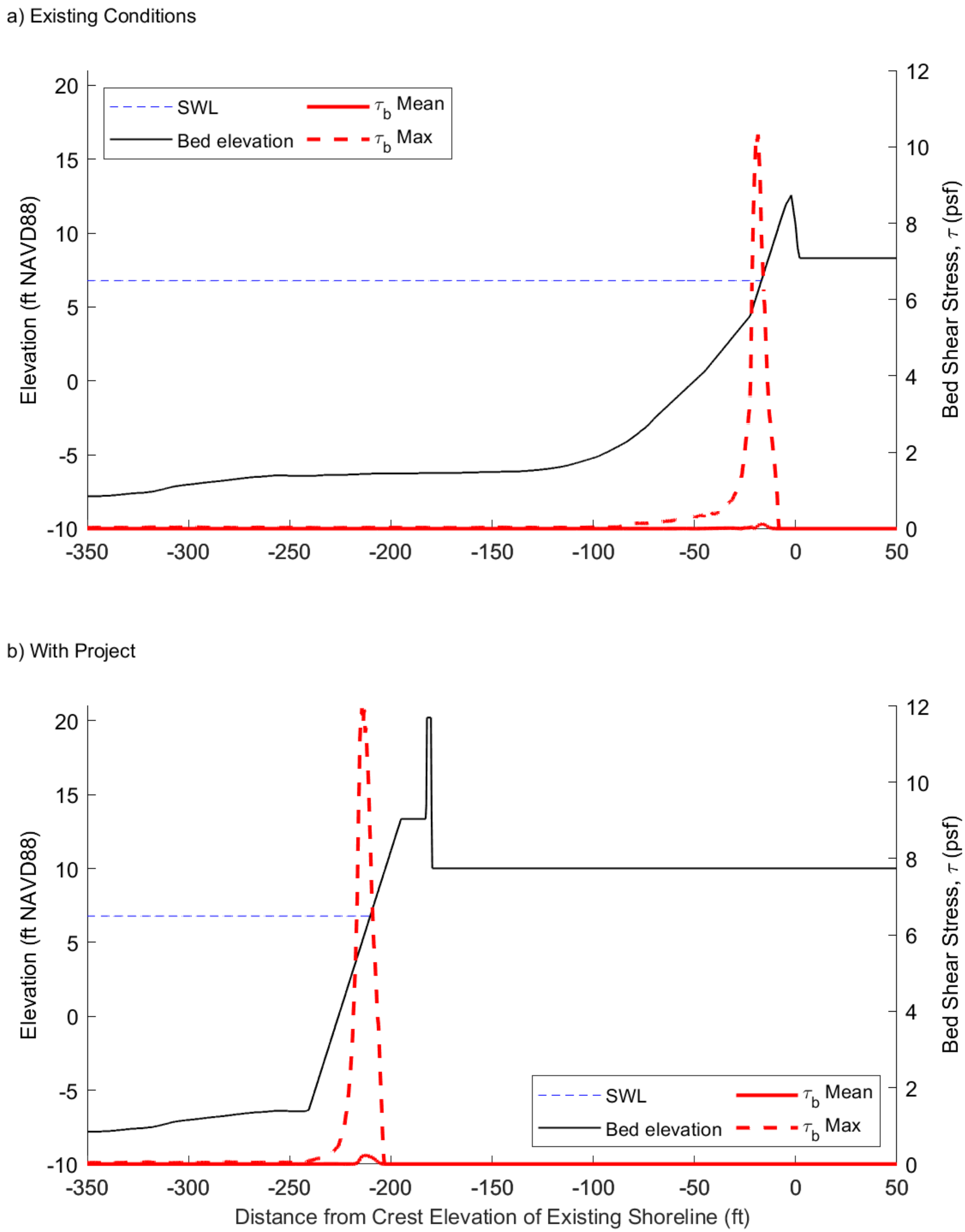
SFO Shoreline Protection Program

FIGURE 30
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 7, MLLW



SOURCE: ESA XBeach modeling results, 2021

FIGURE 31
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 7, MSL



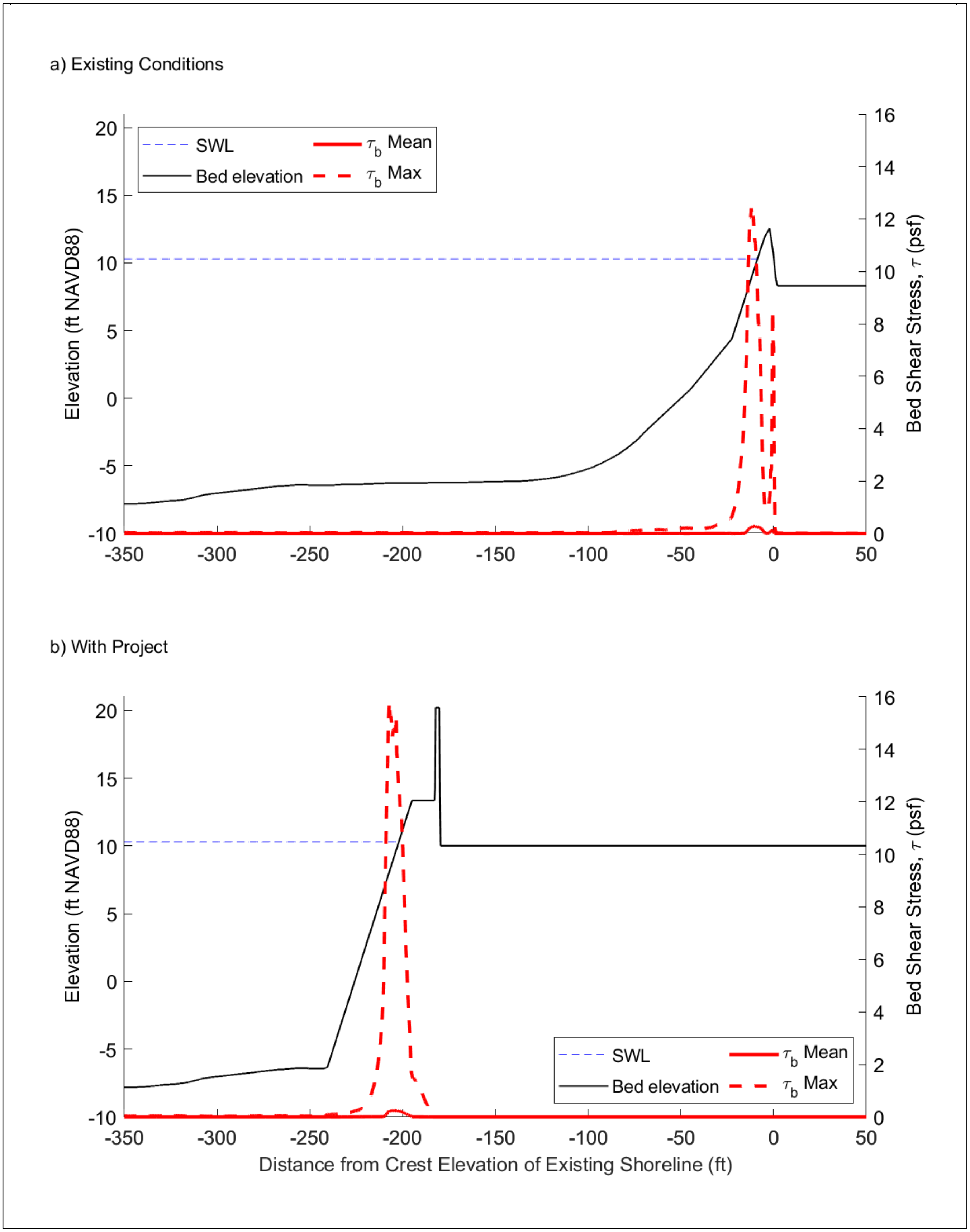
SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE 32

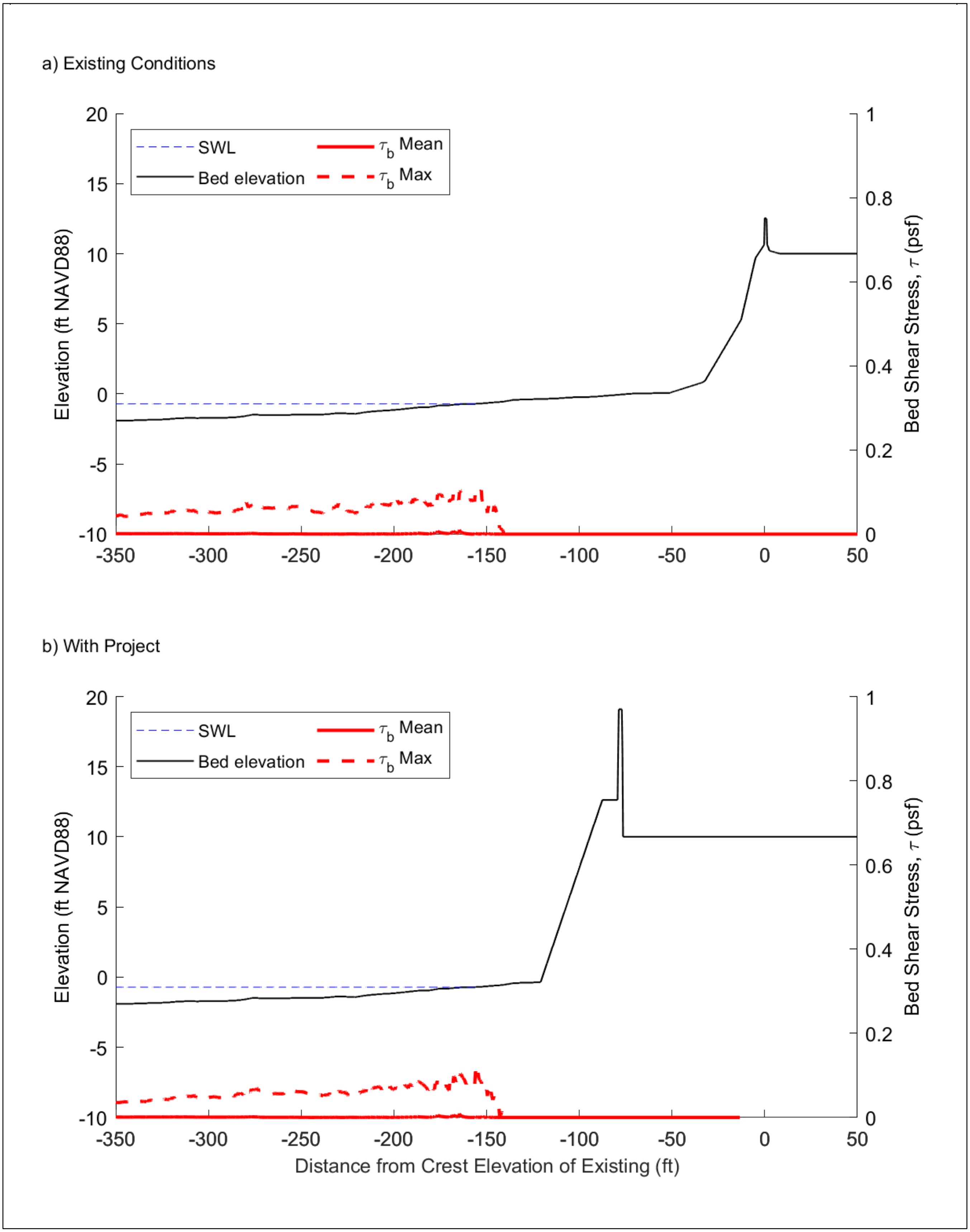
SHORELINE WAVES—PREDICTED BED SHEAR STRESS

REACH 7, MHHW



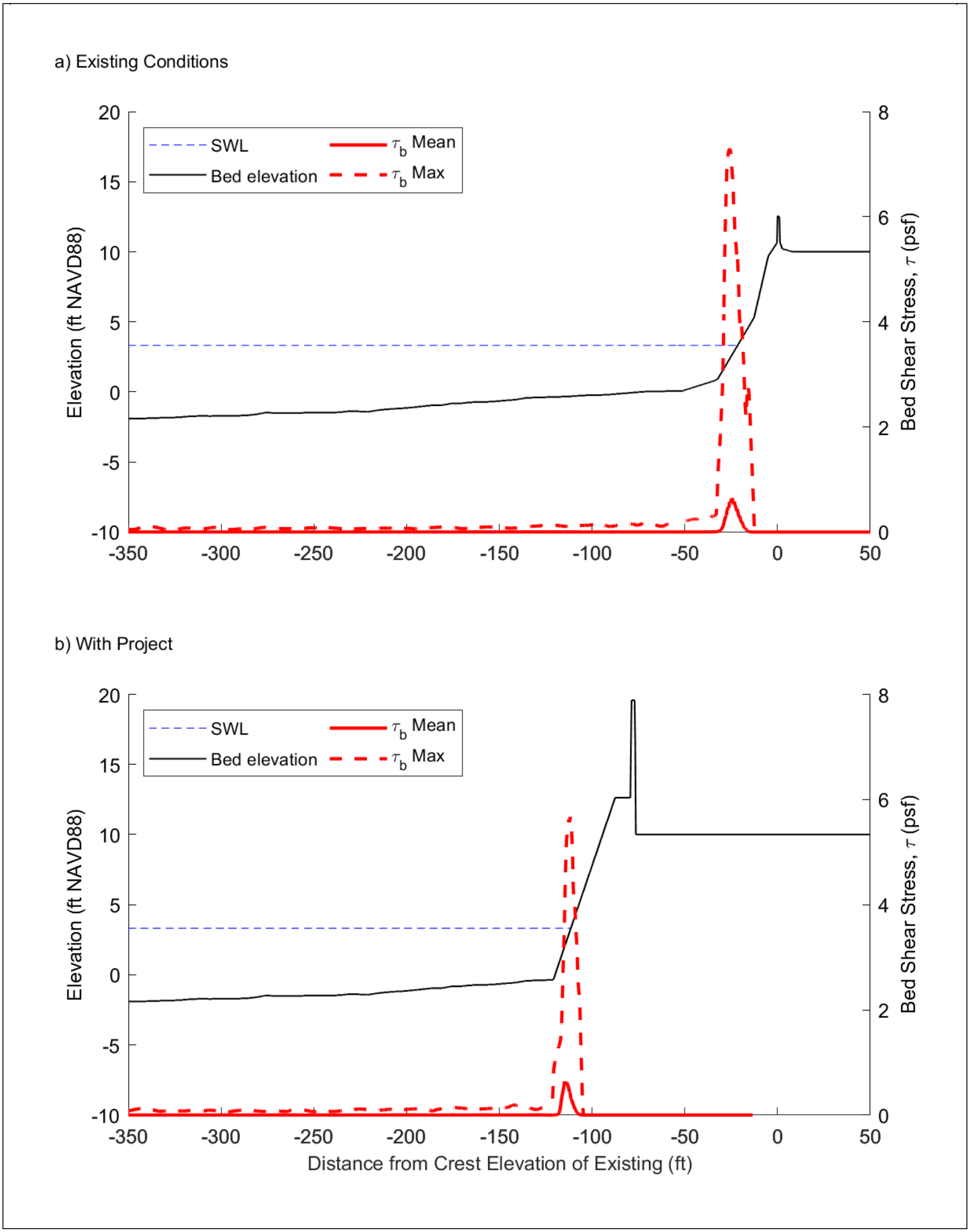
SOURCE: ESA XBeach modeling results, 2021

FIGURE 33
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 7, 100-YEAR SWL



SOURCE: ESA XBeach modeling results, 2021

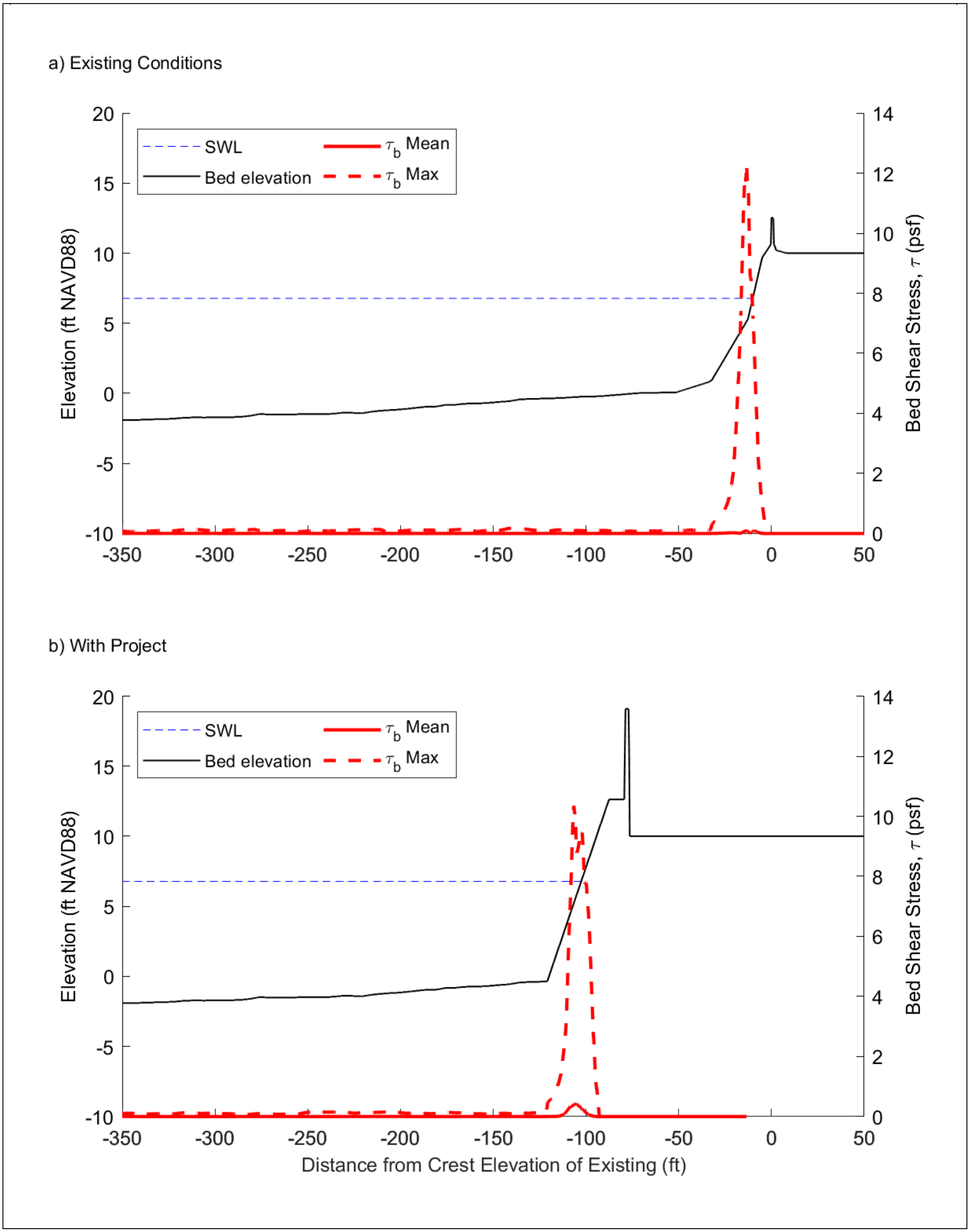
FIGURE 34
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 8, MLLW



SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

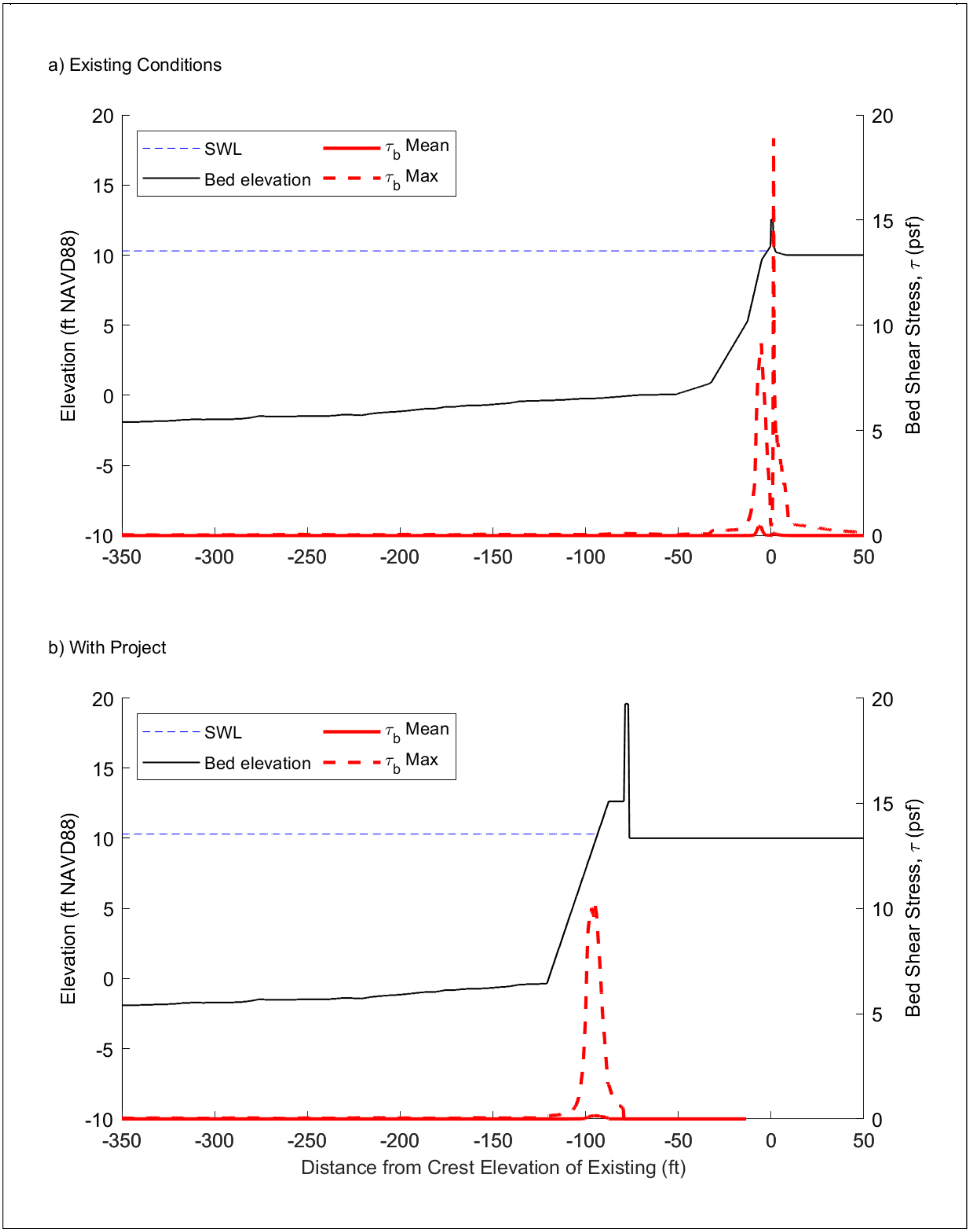
FIGURE 35
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 8, MSL



SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE 36
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 8, MHHW



SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE 37
SHORELINE WAVES—PREDICTED BED SHEAR STRESS
REACH 8, 100-YEAR SWL

In general, for all model runs, the mean bed shear stress for the with-project case was small and equal to the existing conditions at distances greater than approximately 25 feet from the intersection of the still water level with the shoreline structures. Figures A-31 to A-38 in the Appendix compare shoreline wave model output in greater detail for a 200-foot region bayward of the armored slope. These results suggest that mean shear stresses that would occur with the proposed project conditions are similar to those for existing conditions, with some horizontal translation due to the addition of fill. In general, maximum bed shear stress is predicted to increase for with-project conditions, but these increases occur over fill that will be protected with rock armor. The extent and rock sizing for the rock armor is assumed to be specified in the proposed project's design so as to not be susceptible to erosion. Sea-level rise of 3.5 feet will raise water levels, and thereby shift the zones of high bed shear stress landward, to areas also protected by rock armor.

INTENTIONALLY BLANK

SECTION 5
References

Achete, F.M., M. Wegen, D. Roelvink, and B. Jaffe. 2015. A 2-D process-based model for suspended sediment dynamics: a first step towards ecological modeling. *Hydrology and Earth System Sciences* 19(6), pp. 2837–2857.

AECOM. 2016. *San Francisco Bay Tidal Datums and Extreme Tides Study*. Prepared for Bay Conservation and Development Commission.

AECOM and Telamon Engineering Consultants. 2018. *Shoreline Protection Plan: Conceptual Design Study*. Prepared for San Francisco International Airport, March 2018.

BakerAECOM. 2012. *A Central San Francisco Bay Coastal Flood Hazard Study: San Francisco County, California Study Report*. Prepared for FEMA.

Barnard, P.L., A.C. Foxgrover, E.P. Elias, L.H. Erikson, J.R. Hein, M. McGann, K. Mizell, R.J. Rosenbauer, P.W. Swarzenski, R.K. Takesue, and F.L. Wong. 2013. Integration of bed characteristics, geochemical tracers, current measurements, and numerical modeling for assessing the provenance of beach sand in the San Francisco Bay Coastal System. *Marine Geology* 345: 181–206.

Bay Conservation and Development Commission (BCDC), Caltrans, Metropolitan Transportation Commission, Association of Bay Area Governments, and Bay Area Regional Collaborative. 2020. *Adapting to Rising Tides Bay Area: Regional Sea-Level Rise Vulnerability and Adaptation Study*.

Brand, A., J.R. Lacy, K. Hsu, D. Hoover, S. Gladding, and M.T. Stacey. 2010. Wind-enhanced resuspension in the shallow waters of South San Francisco Bay: Mechanisms and potential implications for cohesive sediment transport. *Journal of Geophysical Research: Oceans* 115(C11)

Burchard, H., and H. Baumert. 1998. The Formation of Estuarine Turbidity Maxima Due to Density Effects in the Salt Wedge. A Hydrodynamic Process Study. *Journal of Physical Oceanography* 28:309–321.

California Coastal Commission (CCC). 2015. *California Coastal Commission Sea-level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea-level Rise in Local Coastal Programs and Coastal Development Permits*, adopted August 12, 2015. http://www.coastal.ca.gov/climate/slrguidance.html.

———. 2018. *Interpretive Guidelines for Addressing Sea-Level Rise in Local Coastal Programs and Coastal Development Permits: Science Update*, adopted November 7.

Carignan, K.S., L.A. Taylor, B.W. Eakins, R.J. Caldwell, D.Z. Friday, P.R. Grothe, and E. Lim. 2011. *Digital Elevation Models of Central California and San Francisco Bay: Procedures, Data Sources, and Analysis*. National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NEDIS NGDC-52.

Chou, Y.-J., K.S. Nelson, R.C. Holleman, O.B. Fringer, M.T. Stacey, J.R. Lacy, et al. 2018. Three-dimensional modeling of fine sediment transport by waves and currents in a shallow estuary. *Journal of Geophysical Research: Oceans* 123. https://doi.org/10.1029/2017JC013064.

City and County of San Francisco (CCSF). 2010. Ordinance 56-10 Amending the floodplain management program established by Chapter 2A, Article XX, Sections 2A.280–2A.285 to the San Francisco Administrative Code; providing requirements for designating floodplains and for construction and development in floodplains, February 2.

———. 2020. *Sea-Level Rise Vulnerability and Consequence Assessment*.

Conomos, T.J. 1979. Properties and Circulation of San Francisco Bay Waters. In *San Francisco Bay: The Urbanized Estuary*, ed. T.J. Conomos. San Francisco: Pacific Division of the American Association for the Advancement of Science.

COWI. 2020. Evaluation of Existing Trestles. Technical memorandum No. TM-04. Prepared for the SFO Shoreline Protection Program, May 21.

COWI. 2021a. SFO Shoreline Protection Program: Conceptual Design Development Reach Map, April 17.

COWI. 2021b. *SFO Shoreline Protection Program: Conceptual Design Development Trestle 19L New Plan and Section*, April 30.

Deltares NL. 2019. San Francisco Bay-Delta Community Model website. www.d3d-baydelta.org, modeling files for Bay-Delta 2D model accessed August 9, 2019.

Deltares. 2021. *Delft3D-WAVE Simulation of Short-crested Waves with SWAN User Manual*.

DHI. 2011. *Regional Coastal Hazard Modeling Study for North and Central San Francisco Bay, Final Draft Report*, October.

Egan, G., M. Cowherd, K. Scheu, F. Spada, A. Manning, C. Jones, G. Chang, O. Fringer, and S. Monismith. 2019. South San Francisco Bay boundary layer and sediment dynamics field data. Stanford Digital Repository. https://purl.stanford.edu/wv787xr0534, accessed March 15, 2021.

eTrac. 2020. Bathymetric Survey Adjacent to San Francisco Airport.

Federal Emergency Management Agency (FEMA). 2019. Flood Insurance Study: San Mateo County. Flood insurance study number 06081CV001D. Effective April 6, 2019.

———. 2021. Flood Insurance Study (FIS) and Flood Insurance Rate Map for City and County of San Francisco, California and Incorporated Areas. Effective March 23, 2021. FIS Number 060298V000A. FIRMs 0602980244A, 0602980263A, 0602980282A, and 0602980301A.

Griggs, G., J. Arvai, D. Cayan, R. DeConto, J. Fox, H.A. Fricker, R.E. Kopp, C. Tebaldi, and E.A. Whiteman. 2017. *Rising Seas in California: An Update on Sea-Level Rise Science*. Prepared for California Ocean Science Trust.

Hartmann. 1969. Das Stabgitter in Instationarer Stromungsbewegung. Mitt. Des Instituts fur Wasserbau und Wasswerwirtschaft.

Jaffe, B.E., and A.C. Foxgrover. 2006. Sediment Deposition and Erosion in South San Francisco Bay, California from 1956 to 2005: U.S. Geological Survey Open-File Report 2006-1287, 24p, https://doi.org/10.3133/ofr20061287

Livsey, D.N., and M.A. Downing-Kunz. 2020. A summary of water-quality monitoring in San Francisco Bay in water year 2017. U.S. Geological Survey Scientific Investigations Report 2020-5064, 78p, https://doi.org/10.3133/sir20205064

National Oceanic and Atmospheric Administration (NOAA). 2021. *Highest and Lowest Water Levels Report, Station 9414290*. https://tidesandcurrents.noaa.gov/reports.html?id=9414290, accessed March 12, 2021.

NOAA National Geophysical Data Center. 2010. San Francisco Bay, California 1/3 arc-second NAVD88 Coastal Digital Elevation Model. NOAA National Centers for Environmental Information, accessed January 27, 2021.

Ocean Protection Council (OPC). 2014. San Francisco Bay Habitat Mapping for California Seafloor Mapping Program. https://coast.noaa.gov/digitalcoast/data/.

———. 2018. *State of California Sea-Level Rise Guidance 2018 Update*. Prepared by the California Natural Resources Agency and the California Ocean Protection Council, March.

———. 2020. *Strategic Plan to Protect California's Coast and Ocean 2020–2025*.

Roelvink, J.A. 1993. Dissipation in random wave groups incident on a beach. *Journal of Coastal Engineering* 19:127–150.

Roelvink, J.A., A.J.H.M. Reniers, A.R. Van Dongeren, J.S.M. Van Thiel de Vries, R.T. McCall, and J.M. Lescinski. 2009. Modelling storm impacts on beaches, dunes and barrier islands. *Coastal Engineering* 56(11–12):1133–1152. http://dx.doi.org/10.1016/j.coastaleng.2009.08.006.

Schraga, T.S., E.S. Nejad, C.A. Martin, and J.E. Cloern. 2018. USGS measurements of water quality in San Francisco Bay (CA), beginning in 2016 (ver. 3.0, March 2020): U.S. Geological Survey data release, https://doi.org/10.5066/F7D21WGF.

Seibt, C., Peeters, F., Graf, M., Sprenger, M. and Hofmann, H. 2013. Modeling wind waves and wave exposure of nearshore zones in medium-sized lakes. *Limnology and Oceanography* 58(1), pp. 23–36.

US Army Corps of Engineers (USACE). 2002. Coastal Engineering Manual, Engineer Manual 1110-2-1100. In six volumes. Washington, DC.

van der Wegen, M., J. Reyns, B. Jaffe, A. Foxgrover. 2018. *Modeling morphodynamic development in the Alviso Slough system, South San Francisco Bay, California*. Prepared for South Bay Salt Pond Restoration Project.

van der Wegen, M., J.A. Roelvink, B.E. Jaffe. 2019. Morphodynamic resilience of intertidal mudflats on a seasonal time scale. *Journal of Geophysical Research: Oceans* 124, 8290–8308. https://doi.org/10.1029/2019JC015492.

INTENTIONALLY BLANK

Appendix A
Additional Hydrodynamic and Wave Modeling Results

APPENDIX A
Additional Hydrodynamic and Wave Modeling Results

Tables

Figures

TABLE A-1
HYDRODYNAMIC MODEL ACCURACY – ABSOLUTE DIFFERENCES

Type of Event	Location	Difference Modeled – Observed (feet)
Summer Tides (July 15–August 15, 2018)	Presidio	
	8/9/18 21:00	-0.15
	8/10/18 22:00	-0.25
	Alameda	
	8/9/18 22:00	+0.12
	8/10/18 23:00	+0.08
	Redwood City	
	8/9/18 22:00	+0.13
	8/10/18 23:00	+0.06
10-Year Flood (January 1–14, 2005)	Alameda	
	1/8/05 09:00	+0.08
	1/10/05 11:00	+0.16
	San Leandro Marina	
	1/8/05 09:00	+0.20
	1/10/05 11:00	+0.22
	San Mateo Br.	
	1/8/05 09:00	+0.03
	1/10/05 11:00	+0.10
	Redwood City	
	1/8/05 10:00	+0.33
	1/10/05 12:00	+0.24
100-Year Flood	Presidio	
(January 23–30, 1983, unadjusted)	1/26/83 9:00	-0.08
	1/27/83 10:00	-0.89
	1/28/83 11:00	-0.40
	1/29/83 12:00	-0.49
	Alameda	
	1/26/83 9:00	+0.05
	1/27/83 10:00	-0.50
	1/28/83 11:00	-0.30
	1/29/83 12:00	-0.36
	San Mateo Bridge	
	1/26/83 10:00	+0.15
	1/27/83 10:00	-0.55
	1/28/83 11:00	-0.36
	1/29/83 12:00	-0.29

TABLE A-2
SWAN BAY WAVE MODEL OUTPUT USED FOR XBEACH SHORELINE WAVE MODEL INPUT AT REACH 7

Project Condition	Wind Direction (° from North)	Significant Wave Height (feet)	Wave Period (s)
Mean Lower-Low Water (MLLW), Wind Speed = 56.5 mph			
No Project	45	2.5	3.0
No Project	**135**	**2.6**	**2.9**
No Project	335	2.2	2.7
Project	45	2.5	3.0
Project	**135**	**2.6**	**2.9**
Project	335	2.2	2.7
Mean Sea Level (MSL), Wind Speed = 56.5 mph			
No Project	**45**	**4.0**	**3.9**
No Project	135	3.9	3.7
No Project	335	3.7	3.6
Project	**45**	**4.0**	**3.9**
Project	135	3.9	3.7
Project	335	3.7	3.6
Mean Higher-High Water (MHHW), Wind Speed = 56.6 mph			
No Project	**45**	**5.3**	**4.5**
No Project	135	4.9	4.1
No Project	335	4.6	4.1
Project	**45**	**5.3**	**4.5**
Project	135	4.9	4.1
Project	335	4.6	4.1
100-Year Still Water Level (100-year SWL), Wind Speed = 45.2 mph			
No Project	**45**	**5.8**	**4.6**
No Project	135	4.8	4.1
No Project	335	4.5	4.0
Project	**45**	**5.8**	**4.6**
Project	135	4.8	4.1
Project	335	4.5	4.0

NOTES:
Wind speeds shown are 30-minute averages of values reported in Table 3.
Bolded text indicates conditions selected as input to shoreline wave modeling.

TABLE A-3
SWAN BAY WAVE MODEL OUTPUT USED FOR XBEACH SHORELINE WAVE MODEL INPUT AT REACH 8

Project Condition	Wind Direction (° from North)	Significant Wave Height (feet)	Wave Period (s)
Mean Lower-Low Water (MLLW), Wind Speed = 56.6 mph			
No Project	**45**	**1.3**	**1.9**
No Project	135	1.2	1.7
No Project	335	1.2	1.9
Project	**45**	**1.3**	**1.9**
Project	135	1.2	1.7
Project	335	1.2	1.9
Mean Sea Level (MSL), Wind Speed = 56.6 mph			
No Project	**45**	**2.8**	**3.4**
No Project	135	2.6	2.9
No Project	335	2.7	3.4
Project	**45**	**2.8**	**3.4**
Project	135	2.6	2.9
Project	335	2.7	3.4
Mean Higher-High Water (MHHW), Wind Speed = 56.6 mph			
No Project	**45**	**4.3**	**4.1**
No Project	135	3.8	3.7
No Project	335	4.1	4.1
Project	**45**	**4.3**	**4.1**
Project	135	3.8	3.7
Project	335	4.1	4.1
100-Year Still Water Level (100-year SWL), Wind Speed = 45.2 mph			
No Project	**45**	**5.2**	**4.6**
No Project	135	4.6	4.3
No Project	335	4.3	4.0
Project	**45**	**5.2**	**4.6**
Project	135	4.6	4.4
Project	335	4.3	4.0

NOTES:
Wind speeds shown are 30-minute averages of values reported in Table 3.
Bolded text indicates conditions selected as input to shoreline wave modeling

TABLE A-4
COMPARISON OF HYDRODYNAMIC VELOCITY AND BED SHEAR STRESS BETWEEN EXISTING AND WITH-PROJECT CONDITIONS

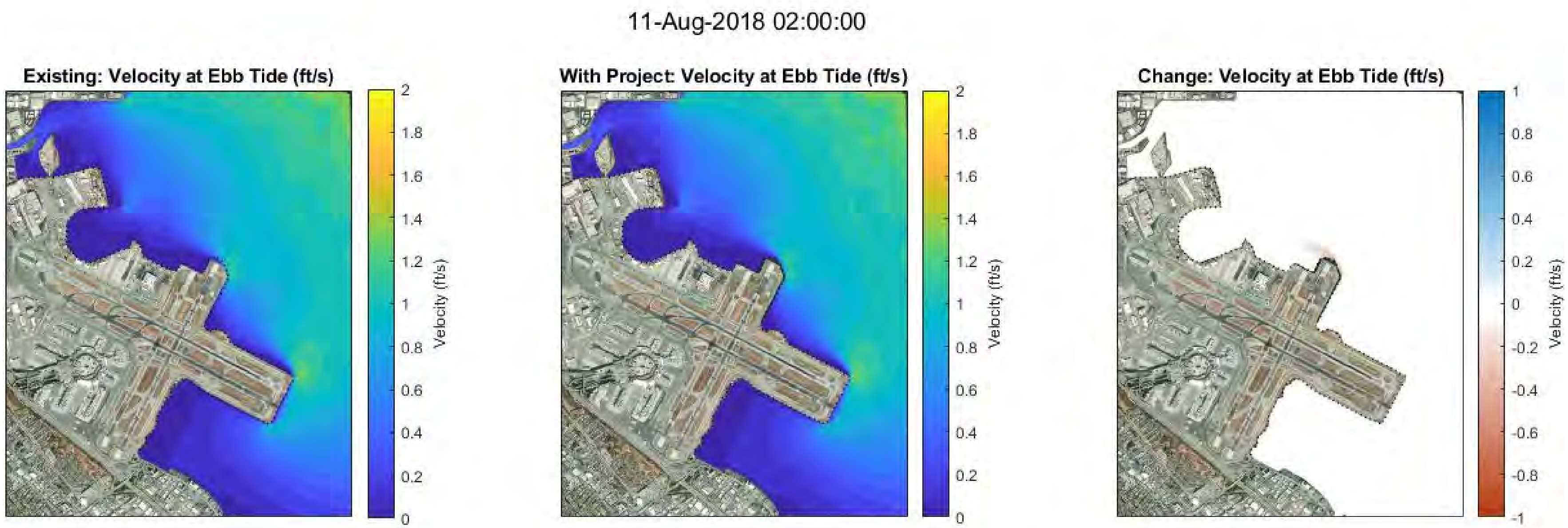
		Existing				With-Project			
Pt ID (see Fig. A-39)	Reach Location	Avg. Velocity (feet/sec)	Avg. Bed Shear Stress (psf)	% Time > τ_{crit} soft mud	% Time > τ_{crit} consolidated mud	Avg. Velocity (feet/sec)	Avg. Bed Shear Stress (psf)	% Time > τ_{crit} unconsol. mud	% Time > τ_{crit} consol. mud
Summer 2018									
1	Reach 5 – Seaplane Harbor 2	0.021	0.0001	1%	0%	0.021	0.0001	1%	0%
2	Reach 6 – Superbay	0.057	0.0321	50%	40%	0.053	0.0319	52%	41%
3	Reach 7 – Runway 19 (west)	0.115	0.0021	23%	6%	0.101	0.0022	24%	7%
4	Reach 7 – Runway 19 (middle)	0.503	0.0041	68%	7%	0.550	0.0047	73%	12%
5	Reach 7 – 1,000 feet Offshore	0.443	0.0043	65%	10%	0.459	0.0046	68%	11%
6	Reach 7 - 2,000 feet Offshore	0.492	0.0058	74%	17%	0.491	0.0059	74%	19%
7	Reach 7 – 3,200 feet Offshore	0.533	0.0056	73%	15%	0.529	0.0056	73%	16%
8	Reach 7 – 4,000 feet Offshore	0.593	0.0055	74%	18%	0.588	0.0055	73%	18%
9	Reach 12 – Runway 28	0.541	0.0047	62%	19%	0.534	0.0046	62%	18%
10	Reach 14 – Mudflat	0.103	0.0022	6%	3%	0.098	0.0022	6%	3%
January 2005 (10-year)									
1	Reach 5 – Seaplane Harbor 2	0.018	0.0000	0%	0%	0.018	0.0000	0%	0%
2	Reach 6 – Superbay	0.051	0.0047	18%	11%	0.046	0.0043	17%	10%
3	Reach 7 – Runway 19 (west)	0.103	0.0005	4%	1%	0.093	0.0004	4%	1%
4	Reach 7 – Runway 19 (middle)	0.507	0.0031	57%	4%	0.554	0.0037	63%	8%
5	Reach 7 – 1,000 feet Offshore	0.455	0.0028	52%	4%	0.472	0.0030	54%	4%
6	Reach 7 - 2,000 feet Offshore	0.502	0.0037	60%	7%	0.505	0.0037	60%	7%
7	Reach 7 – 3,200 feet Offshore	0.539	0.0038	61%	8%	0.540	0.0038	62%	8%
8	Reach 7 – 4,000 feet Offshore	0.596	0.0042	64%	14%	0.596	0.0041	65%	14%
9	Reach 12 – Runway 28	0.551	0.0058	62%	25%	0.549	0.0058	61%	25%
10	Reach 14 – Mudflat	0.095	0.0042	13%	7%	0.094	0.0040	13%	7%
Adjusted January 1983 (100-year)									
1	Reach 5 – Seaplane Harbor 2	0.015	0.0000	0%	0%	0.016	0.0000	0%	0%
2	Reach 6 – Superbay	0.062	0.0048	23%	12%	0.057	0.0039	20%	9%
3	Reach 7 – Runway 19 (west)	0.100	0.0003	2%	0%	0.087	0.0002	2%	0%
4	Reach 7 – Runway 19 (middle)	0.573	0.0047	70%	13%	0.636	0.0056	74%	26%
5	Reach 7 – 1,000 feet Offshore	0.504	0.0044	65%	14%	0.531	0.0047	67%	15%
6	Reach 7 - 2,000 feet Offshore	0.537	0.0057	69%	19%	0.547	0.0058	70%	19%
7	Reach 7 – 3,200 feet Offshore	0.573	0.0055	70%	20%	0.580	0.0056	71%	20%
8	Reach 7 – 4,000 feet Offshore	0.629	0.0056	72%	24%	0.635	0.0057	72%	24%
9	Reach 12 – Runway 28	0.545	0.0062	67%	25%	0.552	0.0063	68%	25%
10	Reach 14 – Mudflat	0.091	0.0036	20%	8%	0.092	0.0039	19%	9%

ABBREVIATIONS: feet/sec = feet per second; psf = pounds per square foot; SLR = sea-level rise

TABLE A-5
COMPARISON OF HYDRODYNAMIC VELOCITY AND BED SHEAR STRESS BETWEEN EXISTING AND WITH-PROJECT CONDITIONS + 3.5 FEET SEA LEVEL RISE

Pt ID (see Fig. A-39)	Reach Location	Existing				With-Project			
		Avg. Velocity (feet/sec)	Avg. Bed Shear Stress (psf)	% Time > τ_{crit} soft mud	% Time > τ_{crit} consolidated mud	Avg. Velocity (feet/sec)	Avg. Bed Shear Stress (psf)	% Time > τ_{crit} soft mud	% Time > τ_{crit} consolidated mud
Summer 2018 + 3.5 ft SLR									
1	Reach 5 – Seaplane Harbor 2	0.015	0.0001	2%	0%	0.015	0.0001	2%	0%
2	Reach 6 – Superbay	0.078	0.0208	59%	42%	0.074	0.0212	59%	41%
3	Reach 7 – Runway 19 (west)	0.134	0.0015	12%	5%	0.118	0.0014	12%	4%
4	Reach 7 – Runway 19 (middle)	0.565	0.0041	68%	7%	0.613	0.0047	71%	13%
5	Reach 7 – 1,000 feet Offshore	0.488	0.0036	62%	6%	0.508	0.0038	64%	6%
6	Reach 7 - 2,000 feet Offshore	0.491	0.0040	63%	8%	0.495	0.0041	63%	8%
7	Reach 7 – 3,200 feet Offshore	0.514	0.0039	63%	7%	0.514	0.0039	63%	6%
8	Reach 7 – 4,000 feet Offshore	0.556	0.0039	64%	8%	0.555	0.0039	64%	7%
9	Reach 12 – Runway 28	0.427	0.0026	44%	5%	0.421	0.0025	43%	5%
10	Reach 14 – Mudflat	0.074	0.0003	3%	0%	0.076	0.0003	2%	0%
January 2005 (10-year) + 3.5 ft SLR									
1	Reach 5 – Seaplane Harbor 2	0.013	0.0000	0%	0%	0.013	0.0000	1%	0%
2	Reach 6 – Superbay	0.065	0.0024	15%	6%	0.056	0.0021	14%	6%
3	Reach 7 – Runway 19 (west)	0.123	0.0003	2%	0%	0.110	0.0003	1%	1%
4	Reach 7 – Runway 19 (middle)	0.567	0.0034	60%	5%	0.616	0.0040	63%	11%
5	Reach 7 – 1,000 feet Offshore	0.494	0.0027	51%	2%	0.516	0.0030	55%	3%
6	Reach 7 - 2,000 feet Offshore	0.500	0.0029	52%	3%	0.506	0.0030	53%	4%
7	Reach 7 – 3,200 feet Offshore	0.523	0.0030	53%	4%	0.526	0.0030	53%	4%
8	Reach 7 – 4,000 feet Offshore	0.564	0.0033	56%	7%	0.565	0.0033	56%	7%
9	Reach 12 – Runway 28	0.459	0.0035	46%	11%	0.459	0.0038	46%	11%
10	Reach 14 – Mudflat	0.070	0.0015	11%	5%	0.067	0.0021	13%	6%
Adjusted January 1983 (100-year) + 3.5 ft SLR									
1	Reach 5 – Seaplane Harbor 2	0.012	0.0000	0%	0%	0.012	0.0000	0%	0%
2	Reach 6 – Superbay	0.063	0.0032	23%	11%	0.055	0.0026	18%	8%
3	Reach 7 – Runway 19 (west)	0.121	0.0003	1%	0%	0.103	0.0002	0%	0%
4	Reach 7 – Runway 19 (middle)	0.607	0.0046	70%	14%	0.653	0.0053	72%	22%
5	Reach 7 – 1,000 feet Offshore	0.529	0.0039	63%	10%	0.547	0.0041	64%	11%
6	Reach 7 - 2,000 feet Offshore	0.532	0.0044	63%	14%	0.532	0.0044	63%	14%
7	Reach 7 – 3,200 feet Offshore	0.556	0.0043	64%	13%	0.552	0.0043	63%	13%
8	Reach 7 – 4,000 feet Offshore	0.599	0.0044	66%	17%	0.593	0.0044	65%	16%
9	Reach 12 – Runway 28	0.452	0.0037	54%	11%	0.441	0.0035	53%	10%
10	Reach 14 – Mudflat	0.074	0.0025	22%	8%	0.072	0.0025	21%	8%

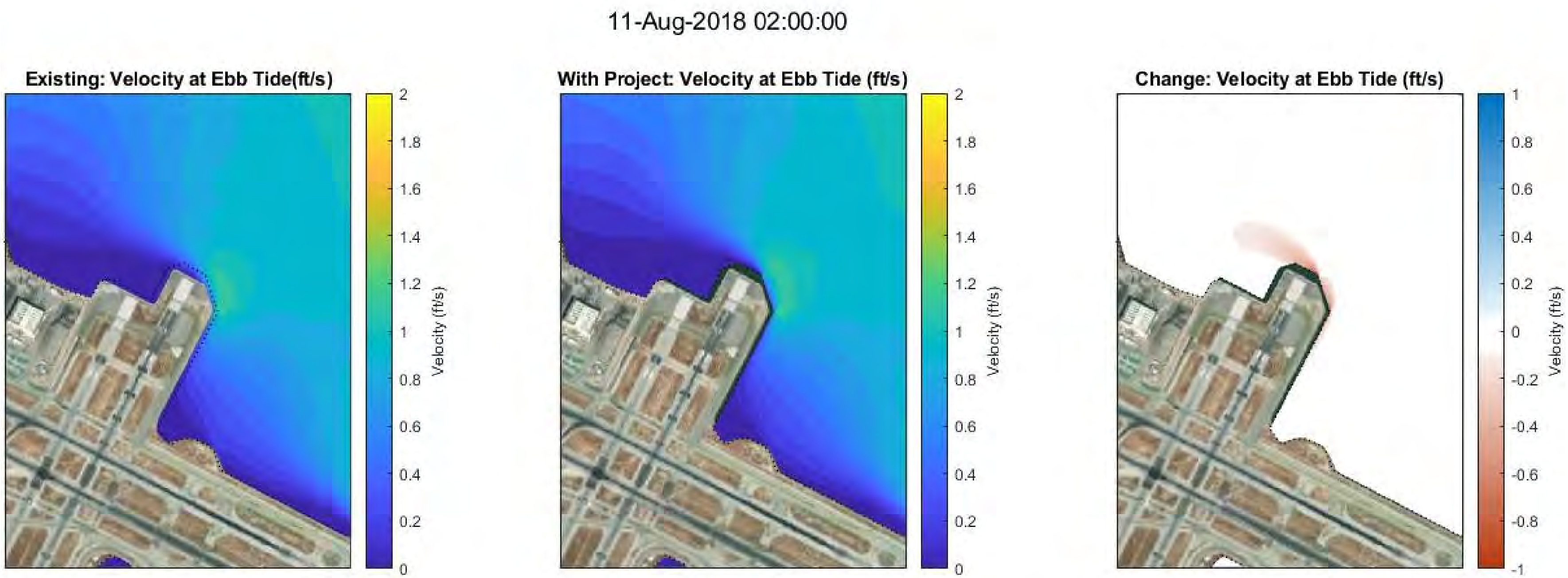
ABBREVIATIONS: feet/sec = feet per second; psf = pounds per square foot; SLR = sea-level rise



SOURCE: ESA Delft3D and SWAN modeling results (2021)

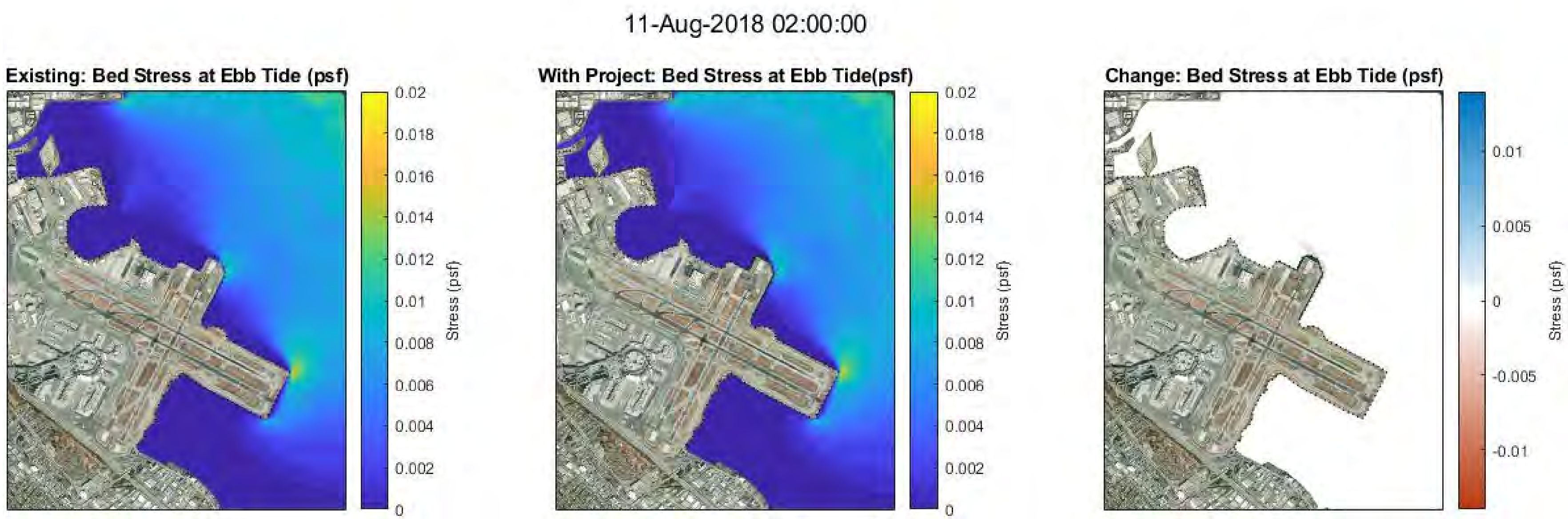
FIGURE A-1

VELOCITY FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE



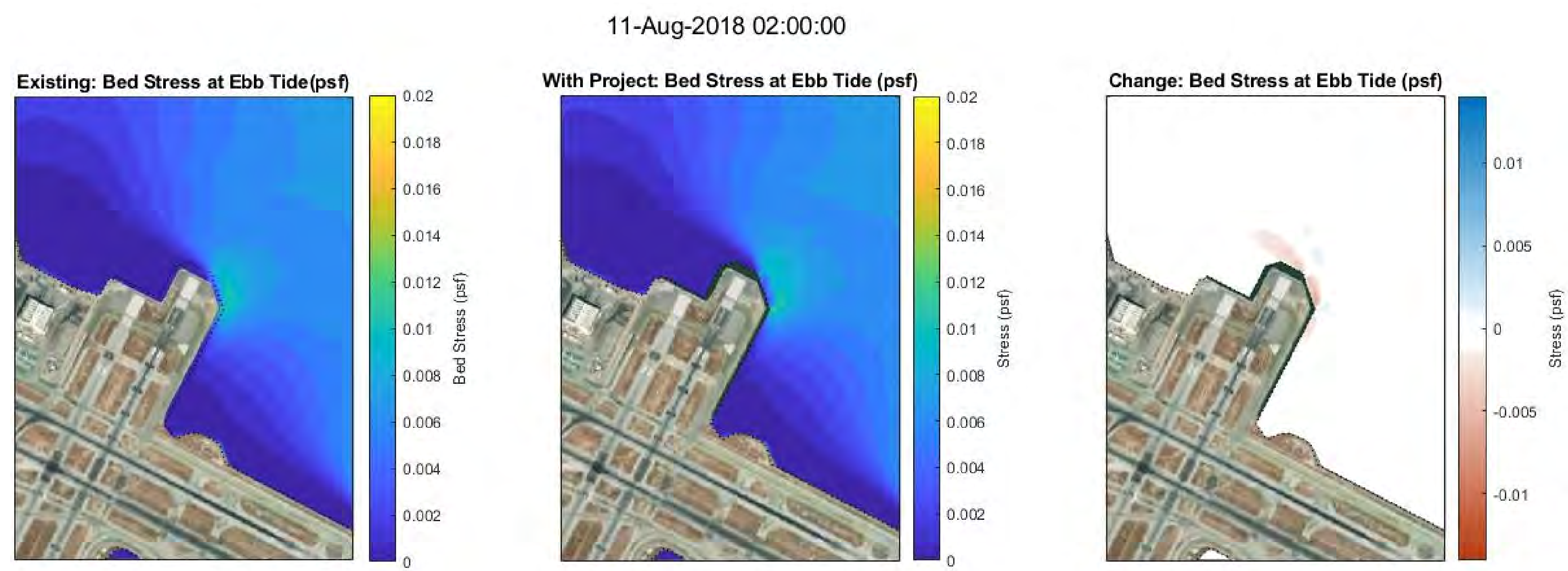
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-2
VELOCITY FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

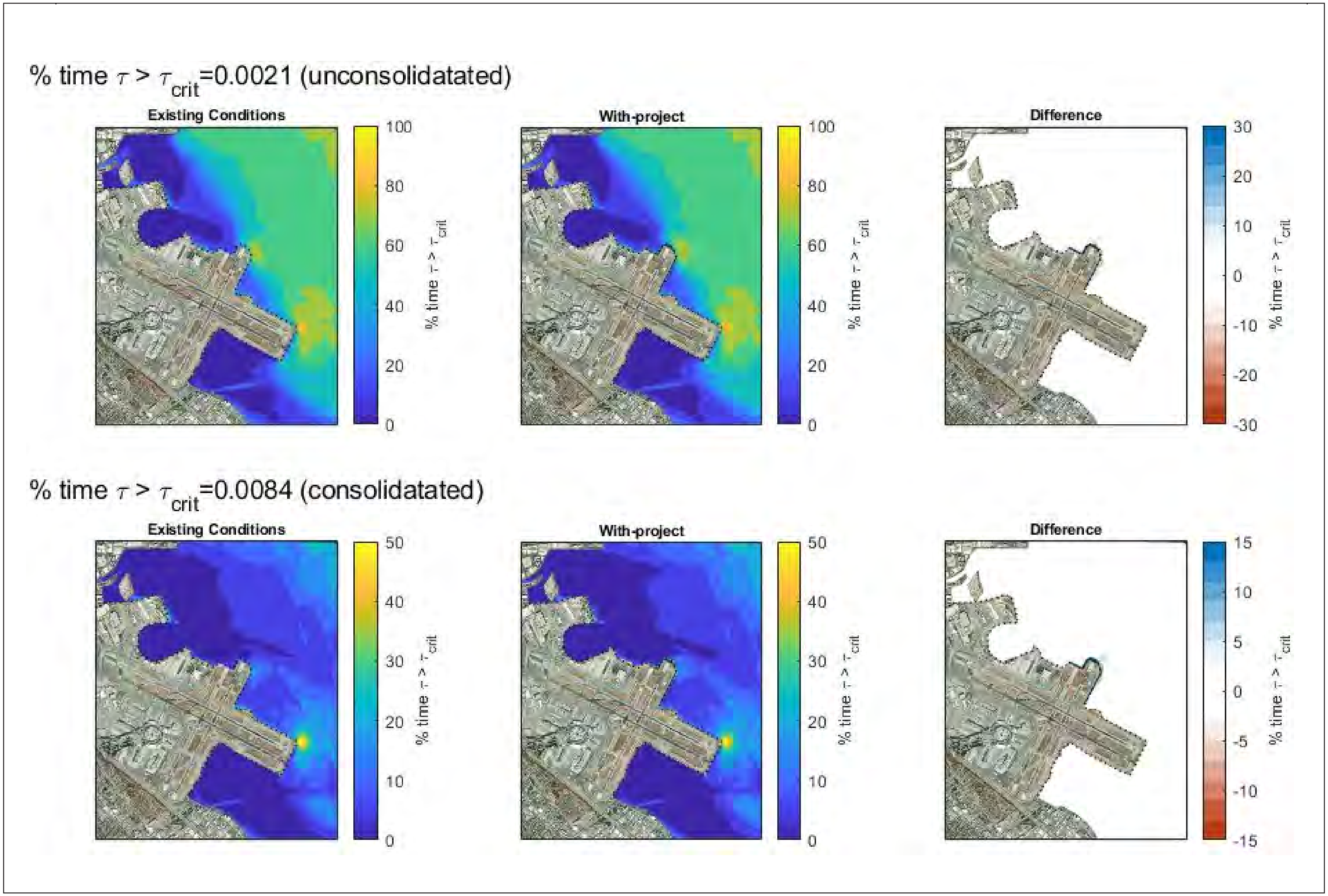
FIGURE A-3
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

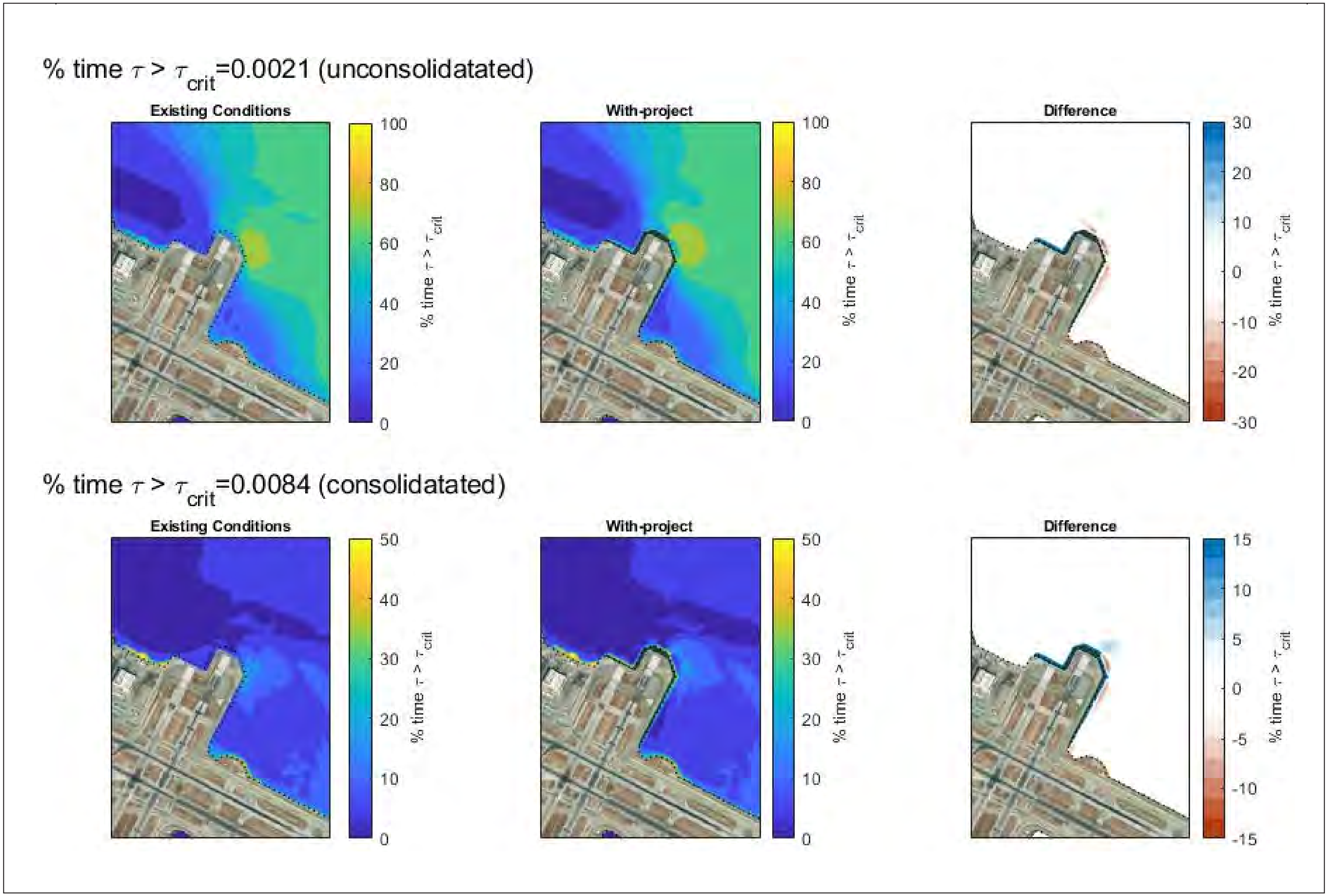
FIGURE A-4
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-5

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE

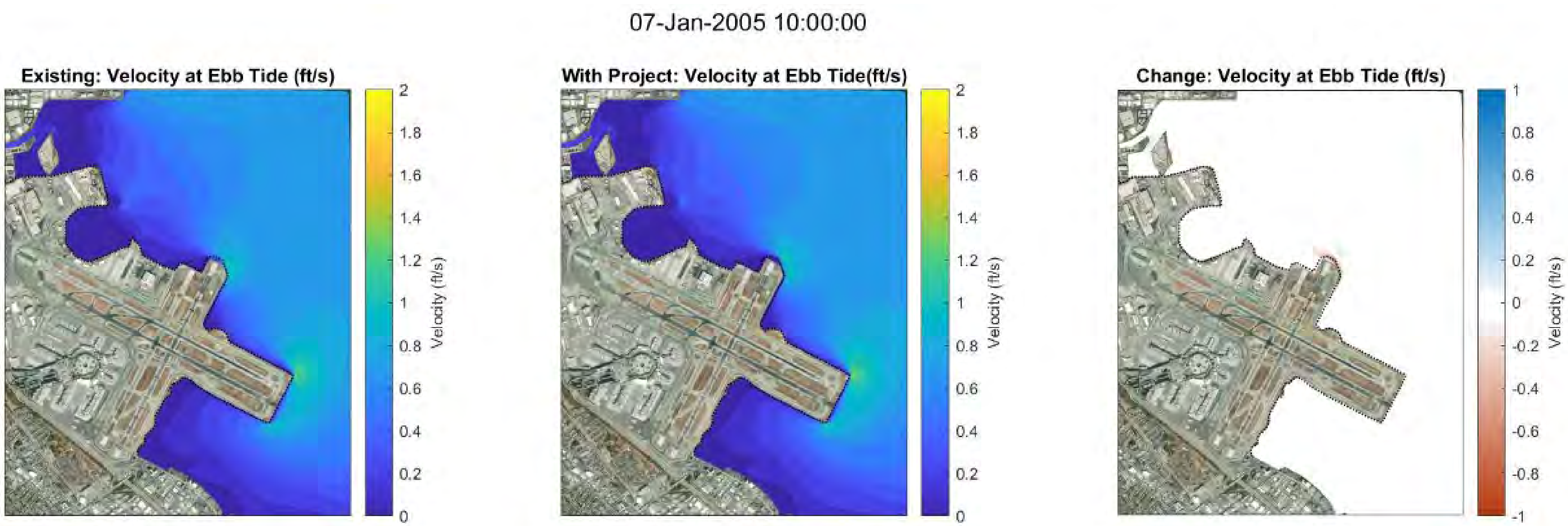


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

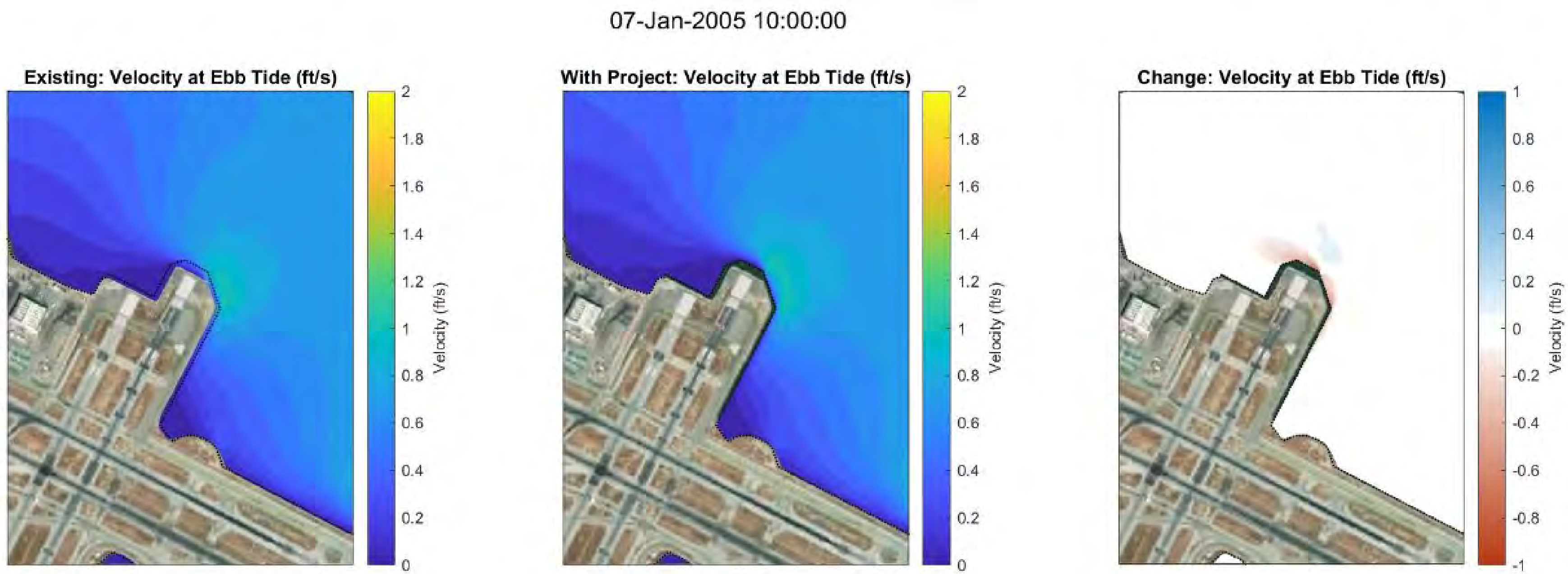
FIGURE A-6

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE SUMMER 2018 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

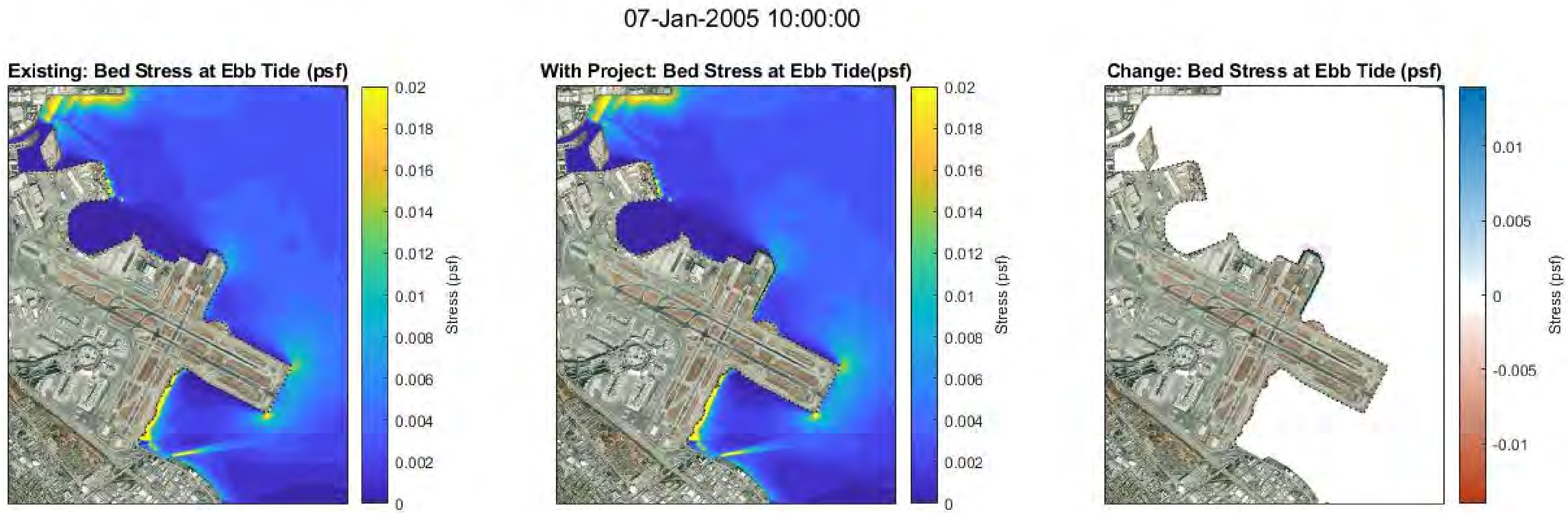
FIGURE A-7
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 2005



SOURCE: ESA Delft3D and SWAN modeling results (2021)

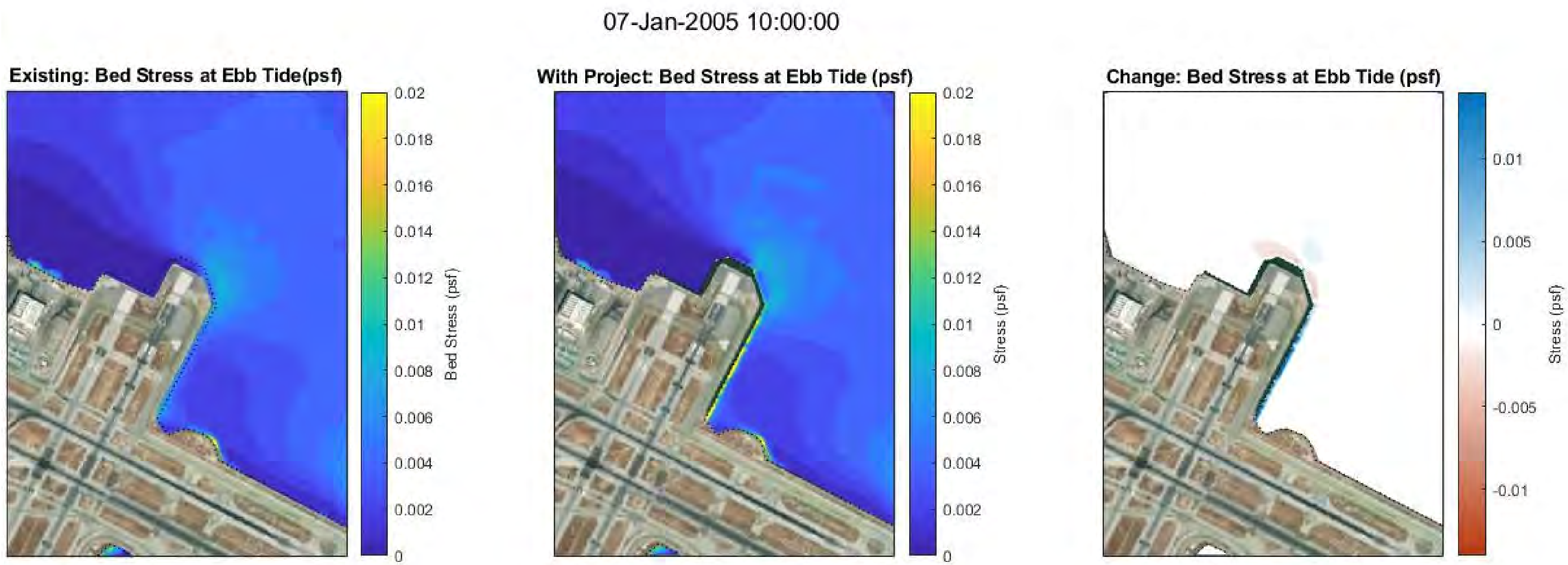
SFO Shoreline Protection Program

FIGURE A-8
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005



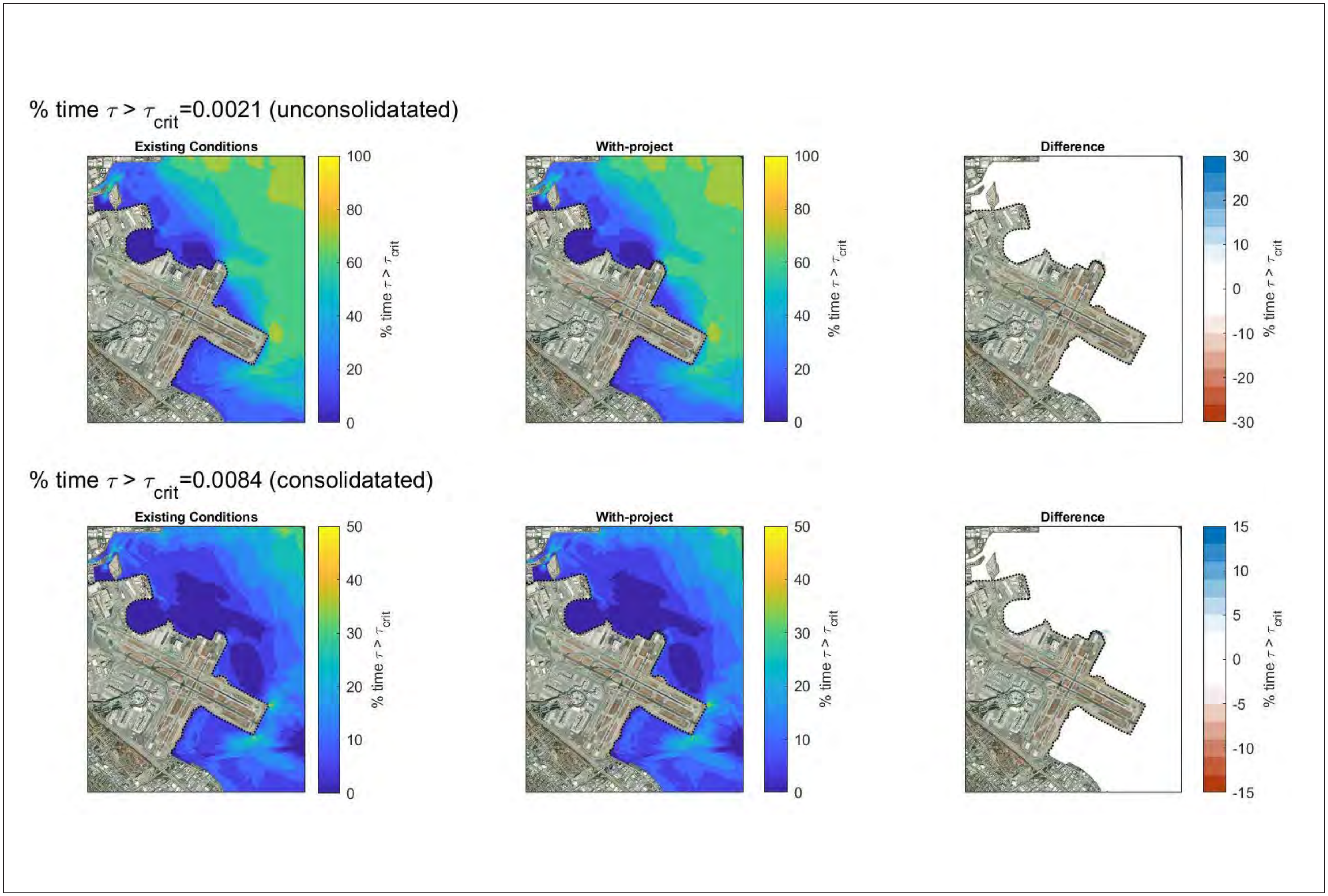
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-9
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-10
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005

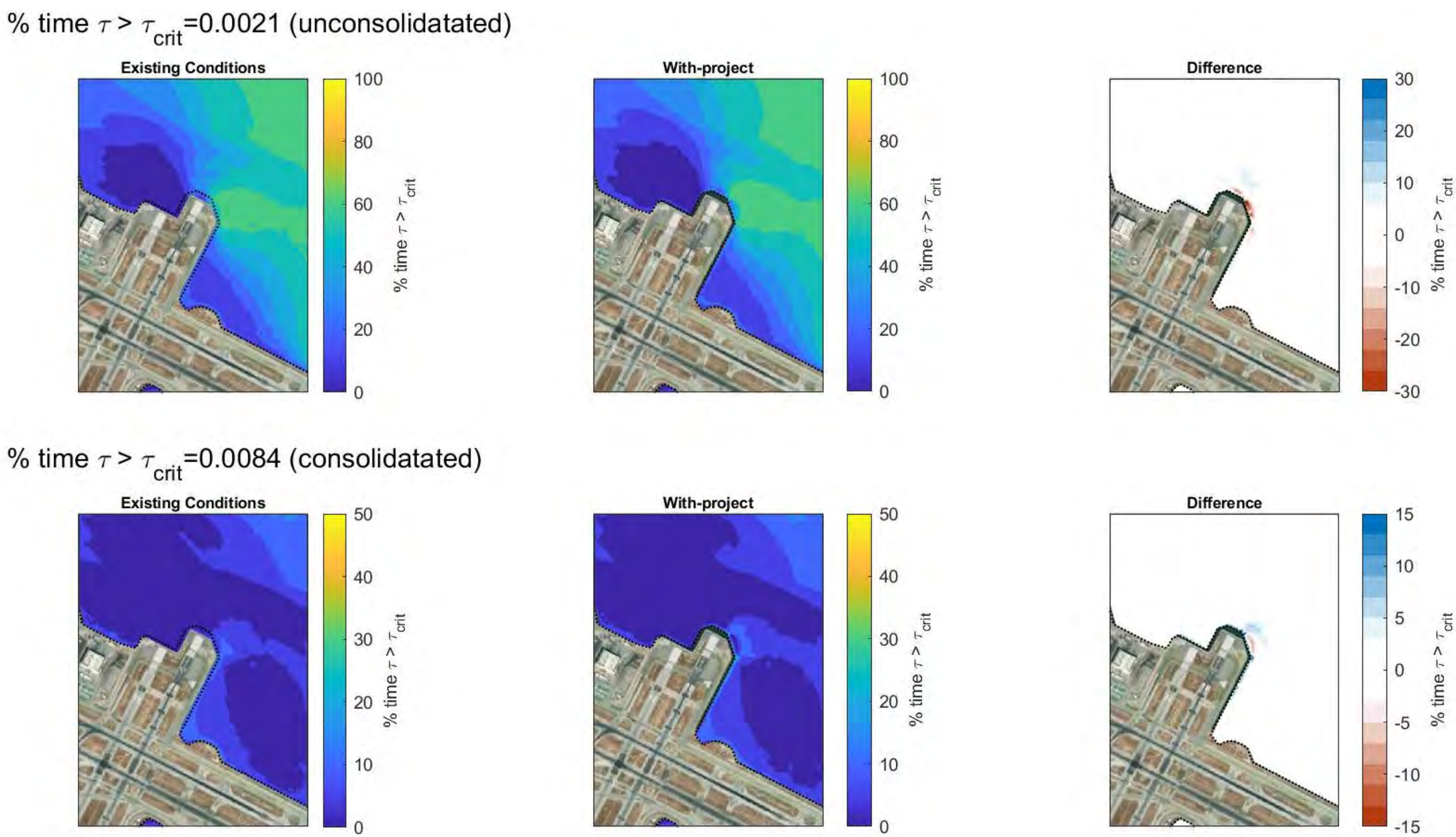


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

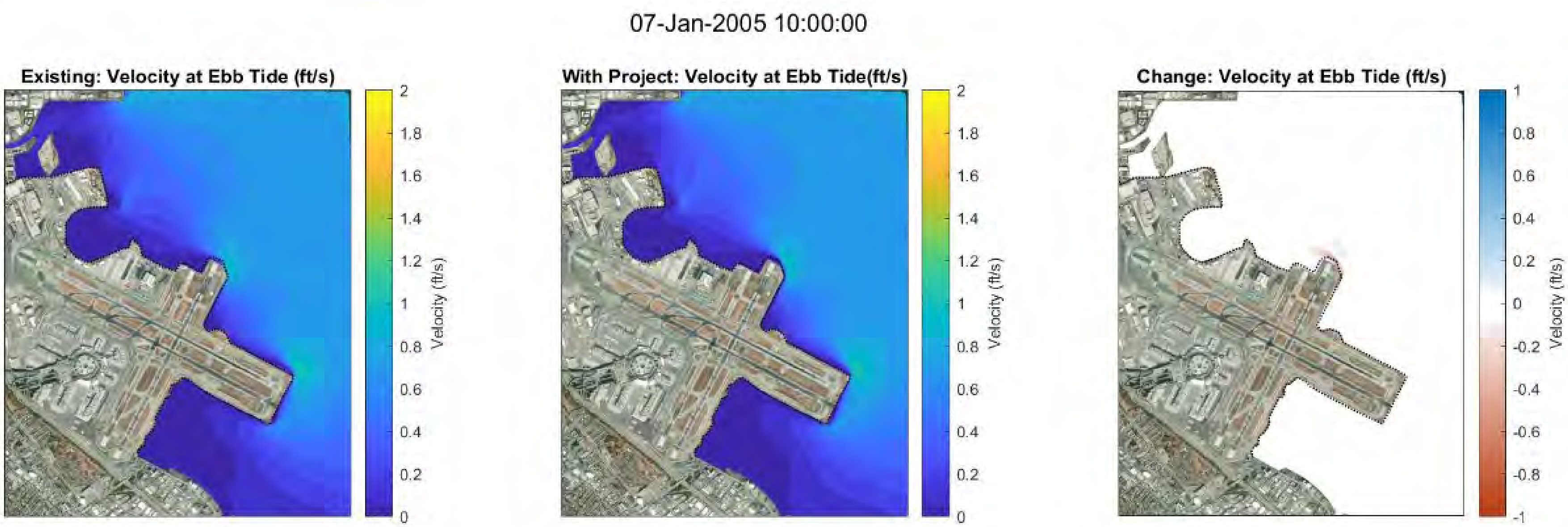
FIGURE A-11

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 2005



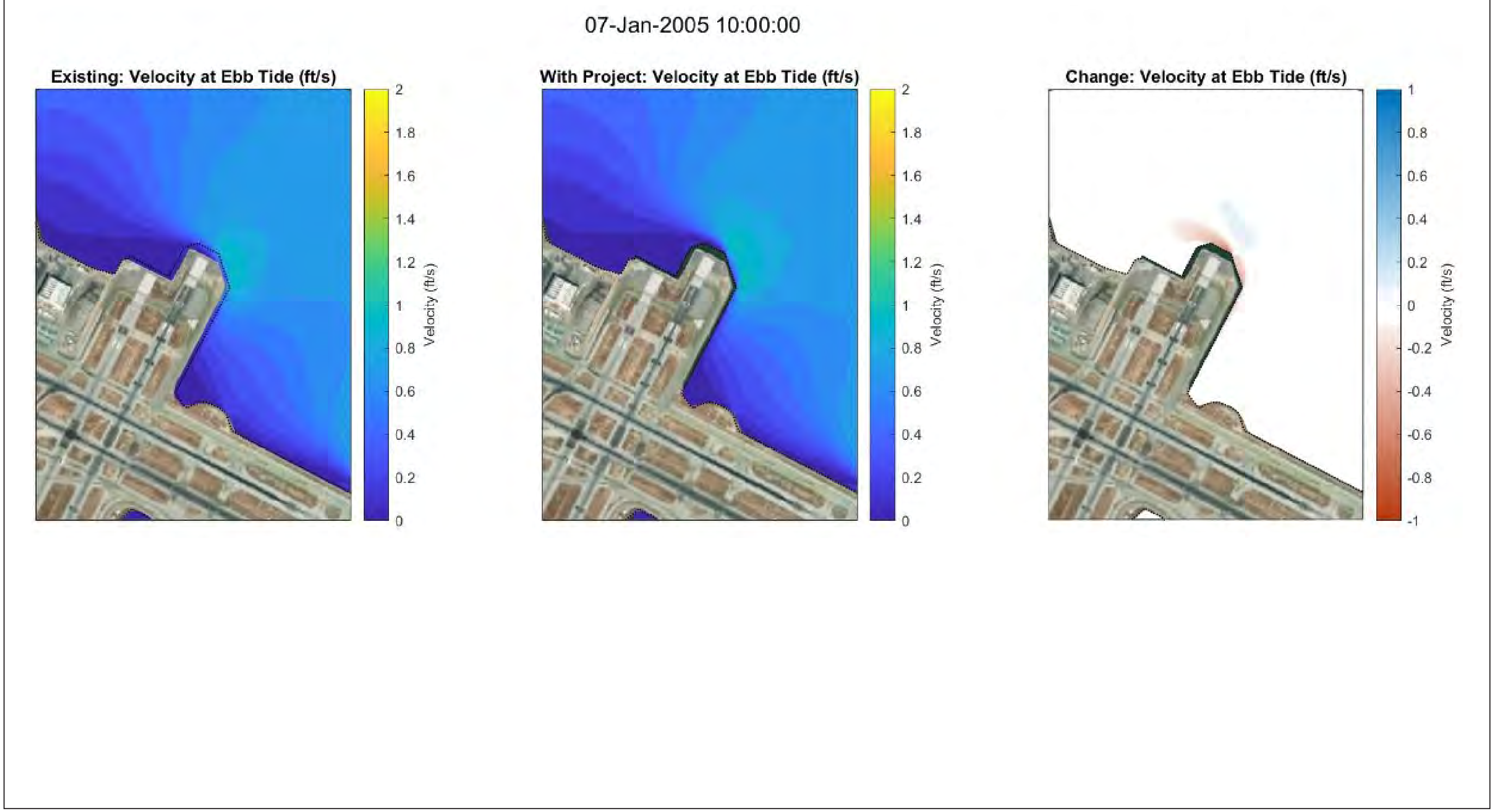
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-12
PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 2005



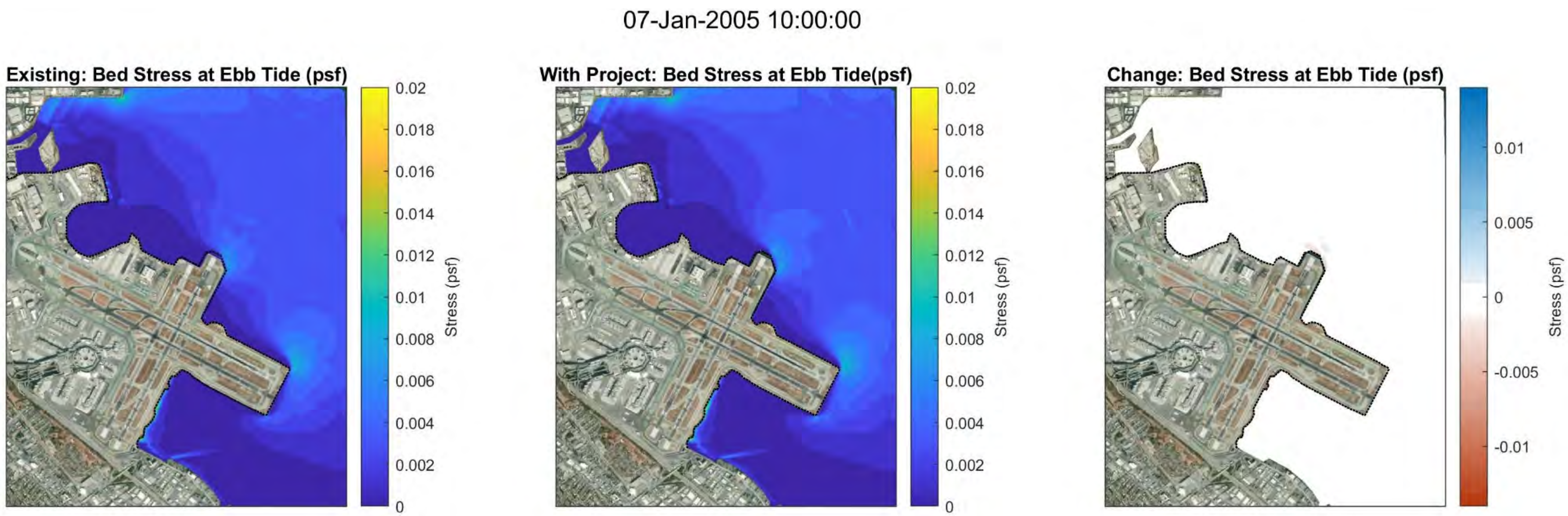
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-13
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



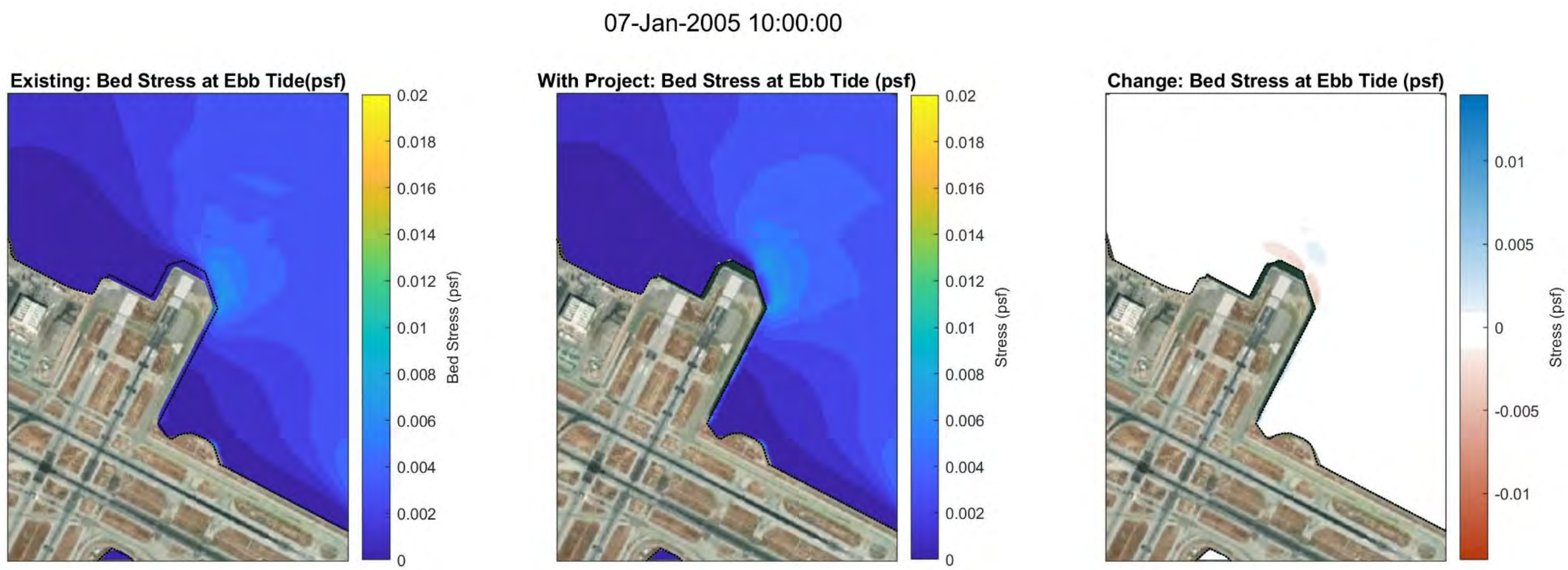
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-14
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



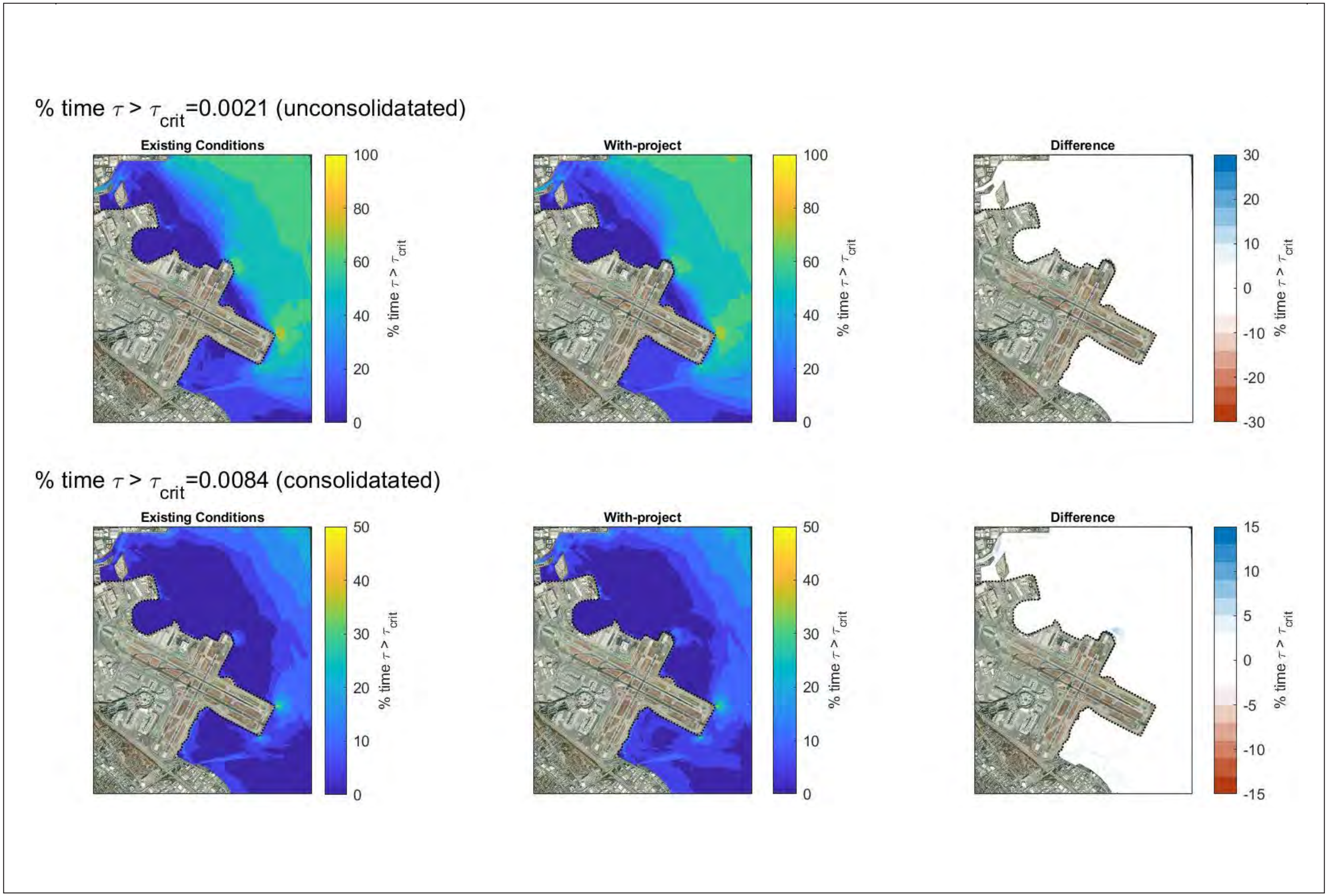
SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-15
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

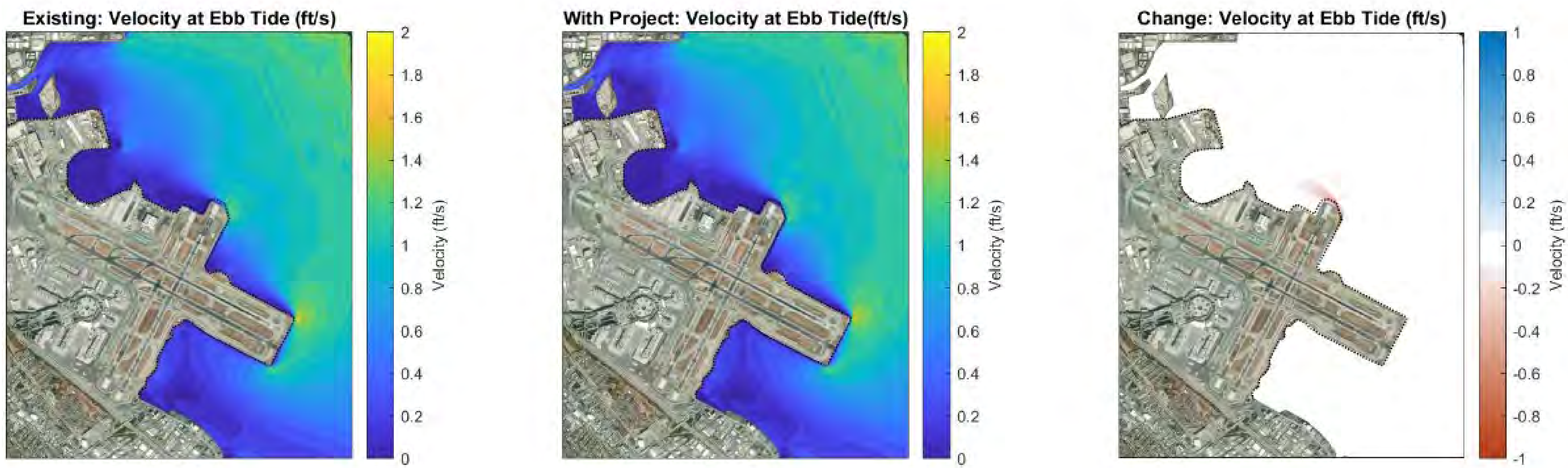
FIGURE A-16
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

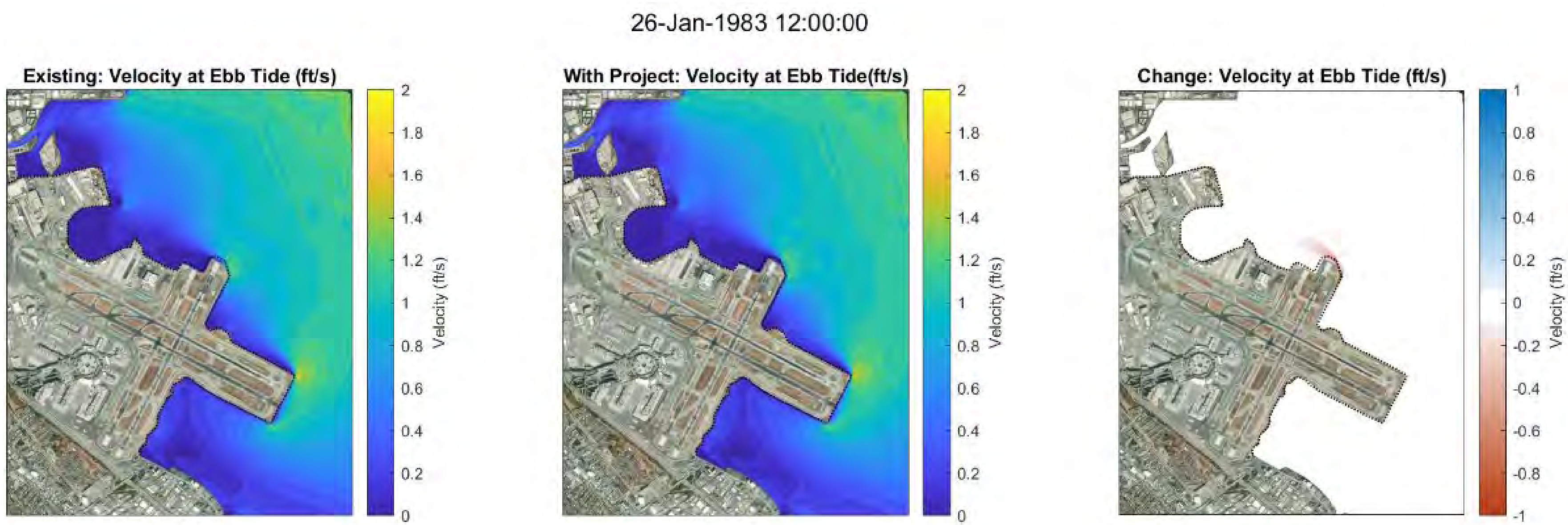
FIGURE A-17
PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS
EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

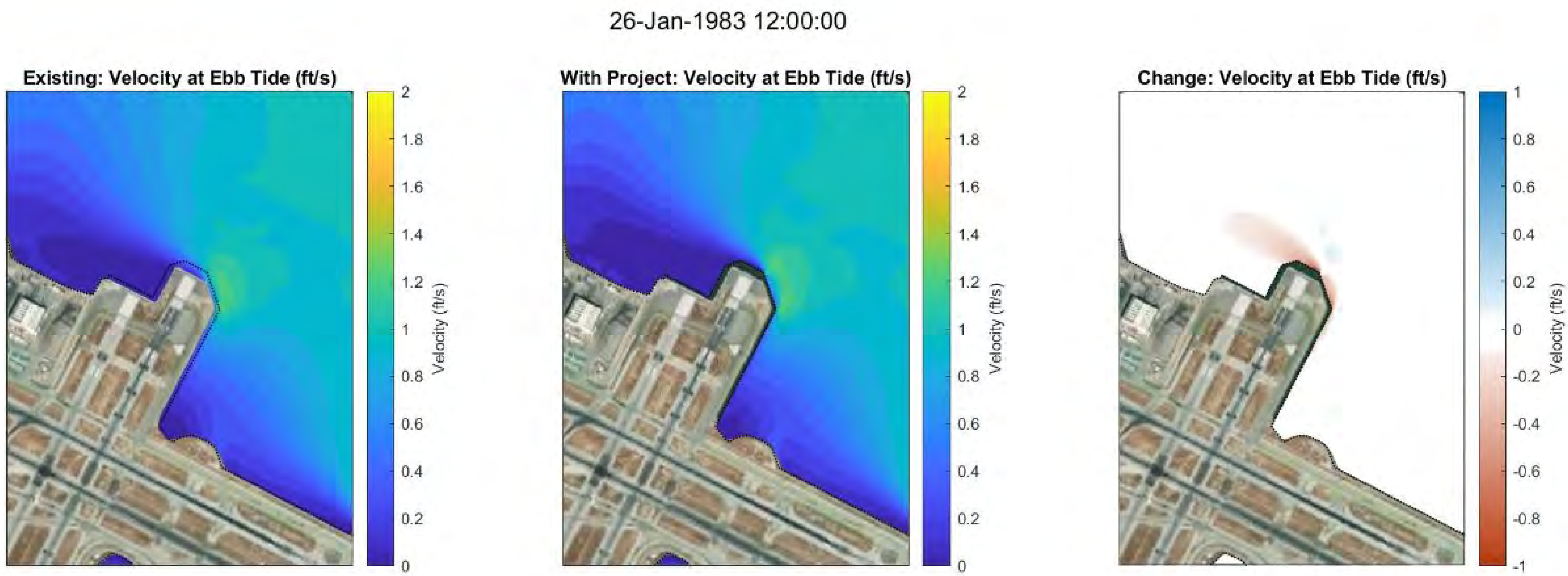
FIGURE A-18

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 2005 + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-19
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED)

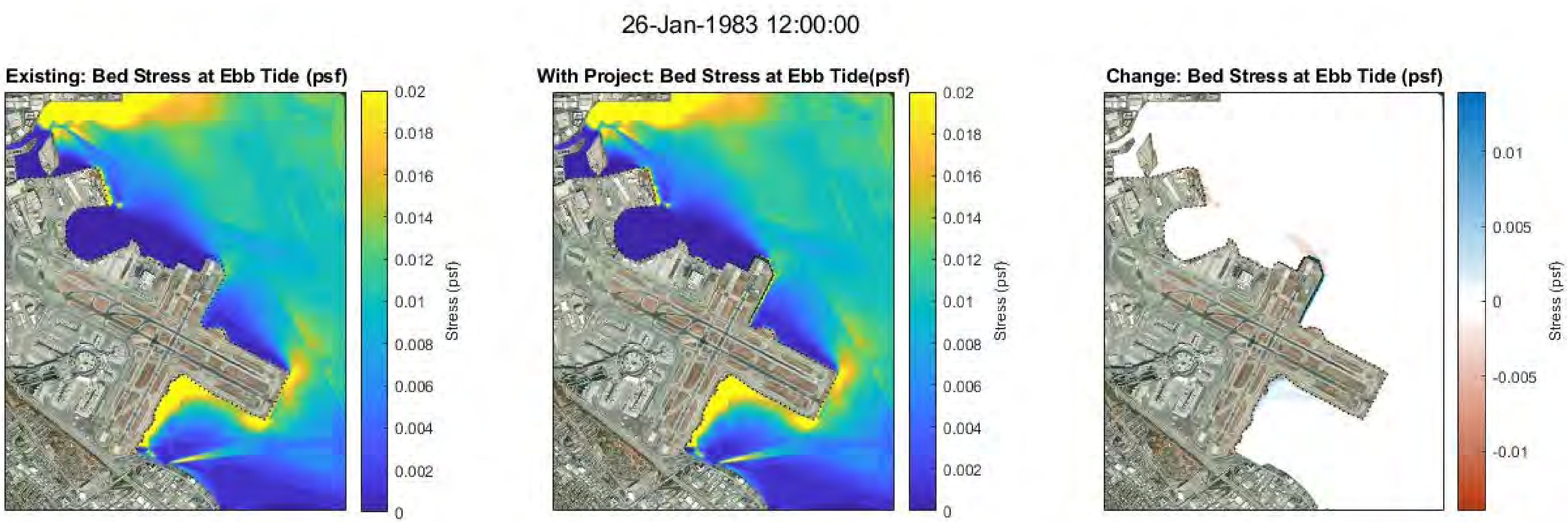


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE A-20

VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED)

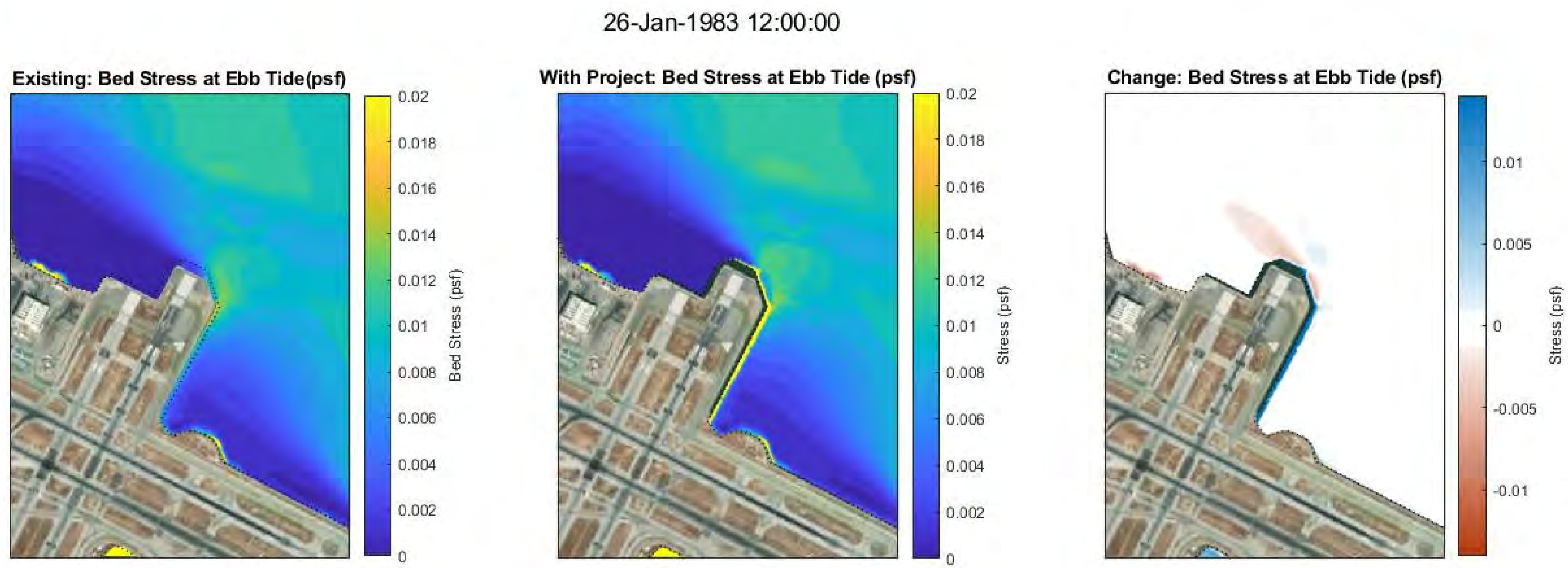


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE A-21

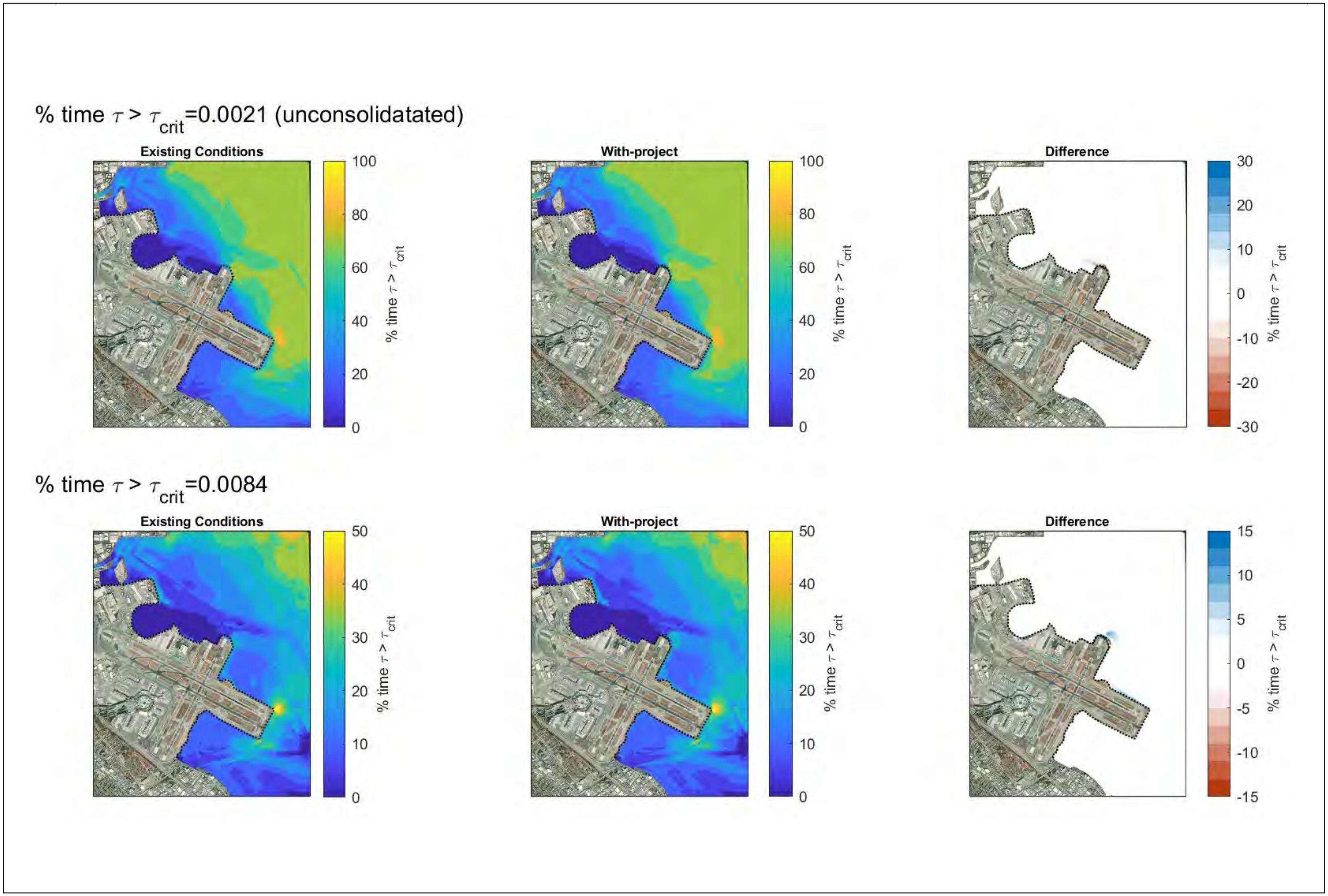
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED)



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-22

BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED)

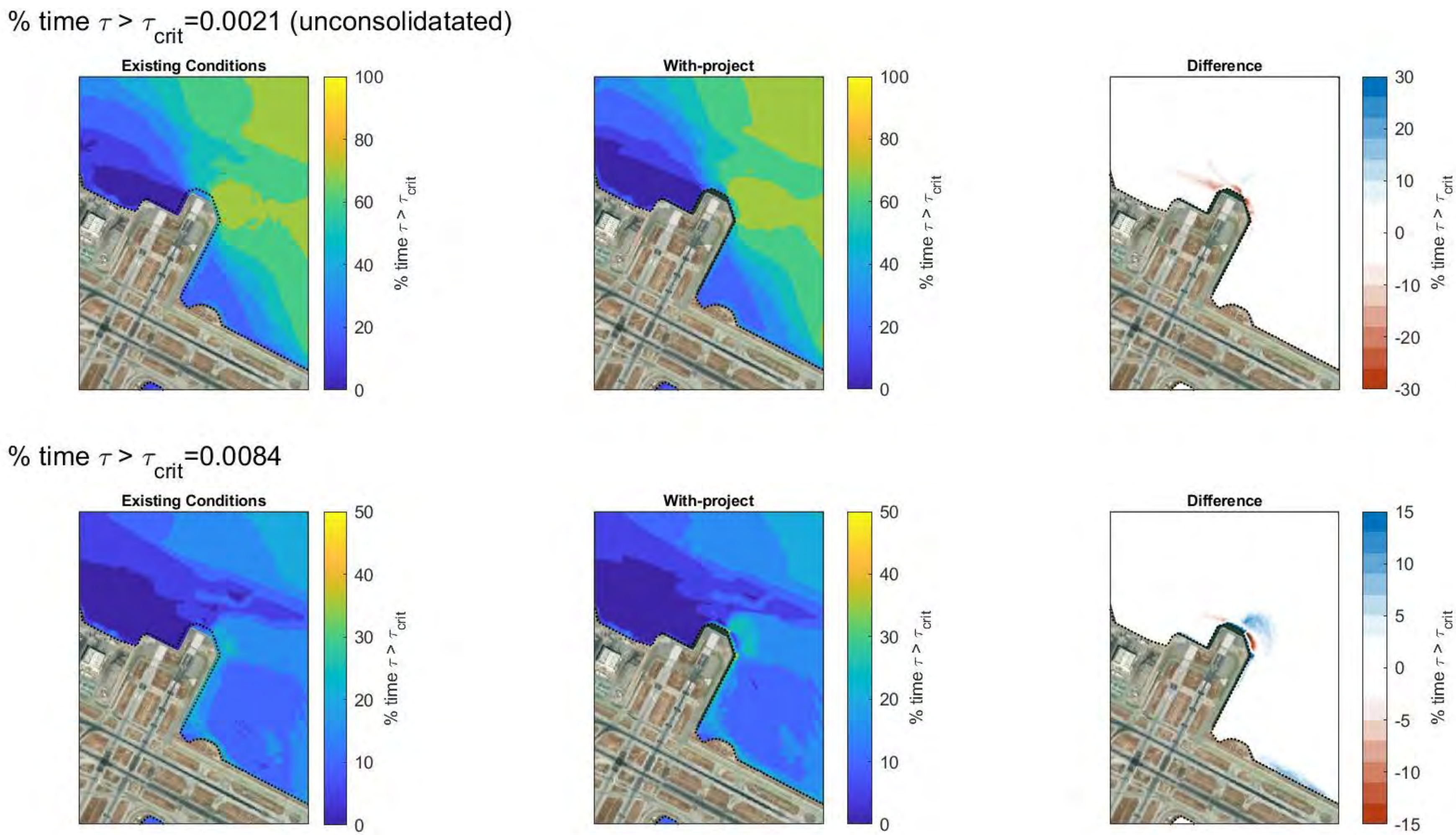


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

FIGURE A-23

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED)

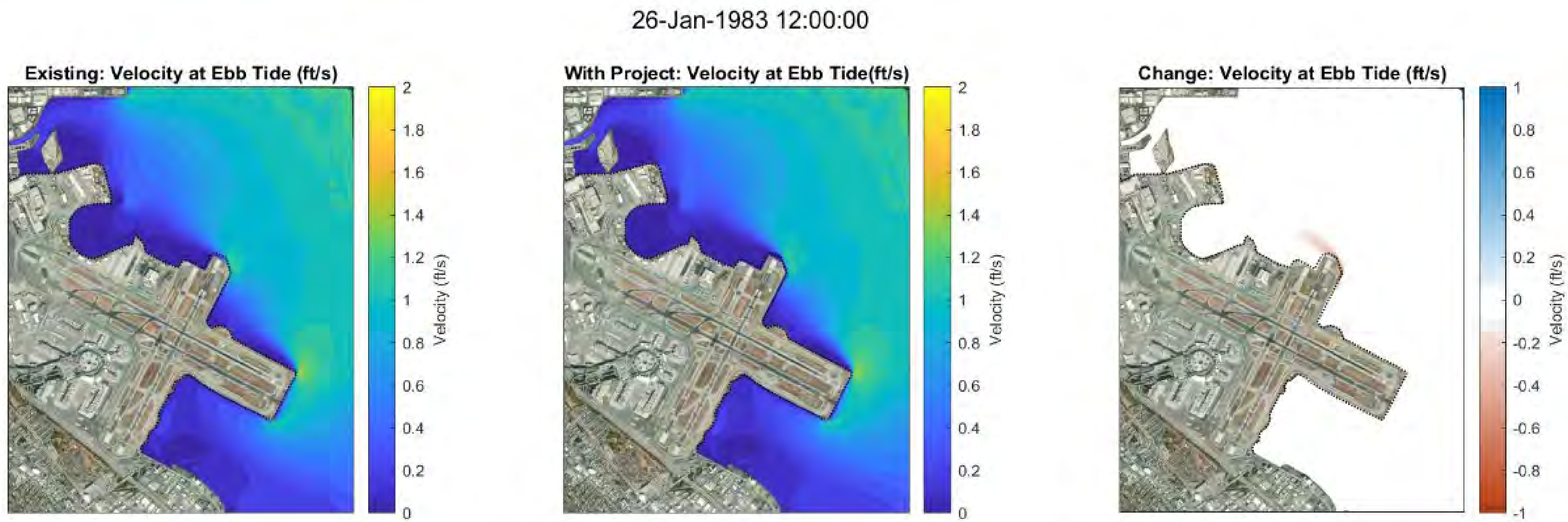


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

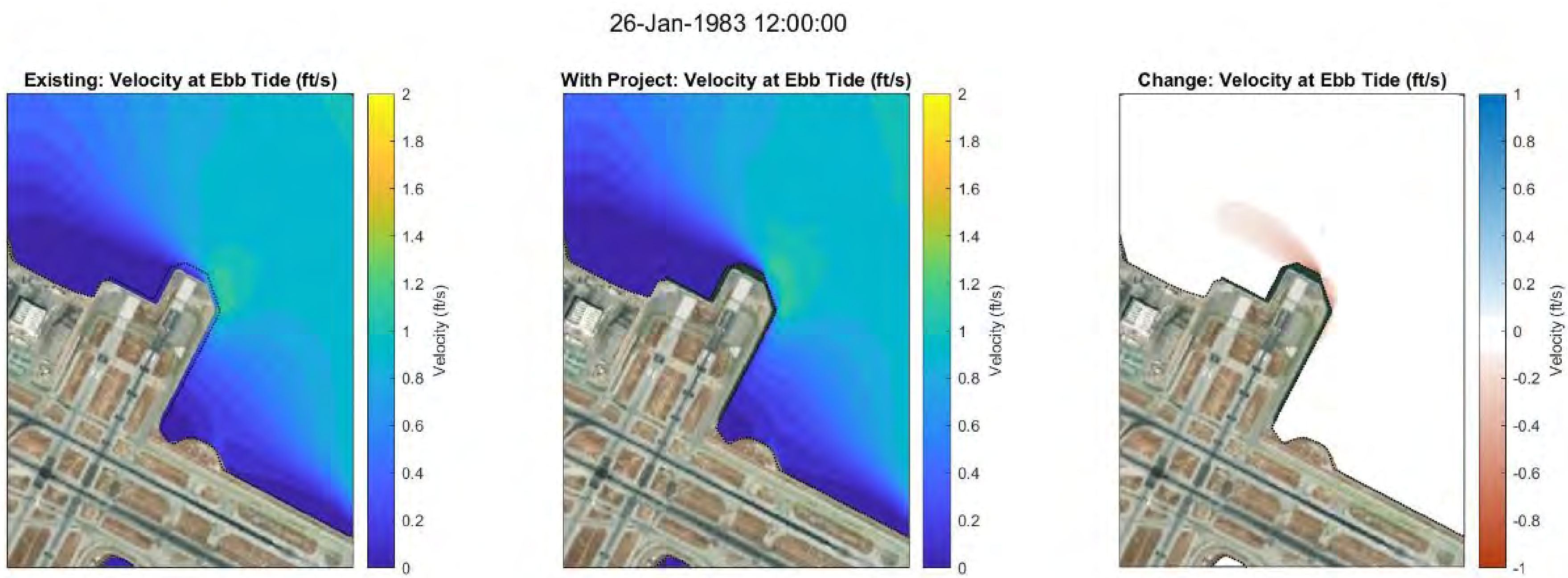
FIGURE A-24

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED)



SOURCE: ESA Delft3D and SWAN modeling results (2021)

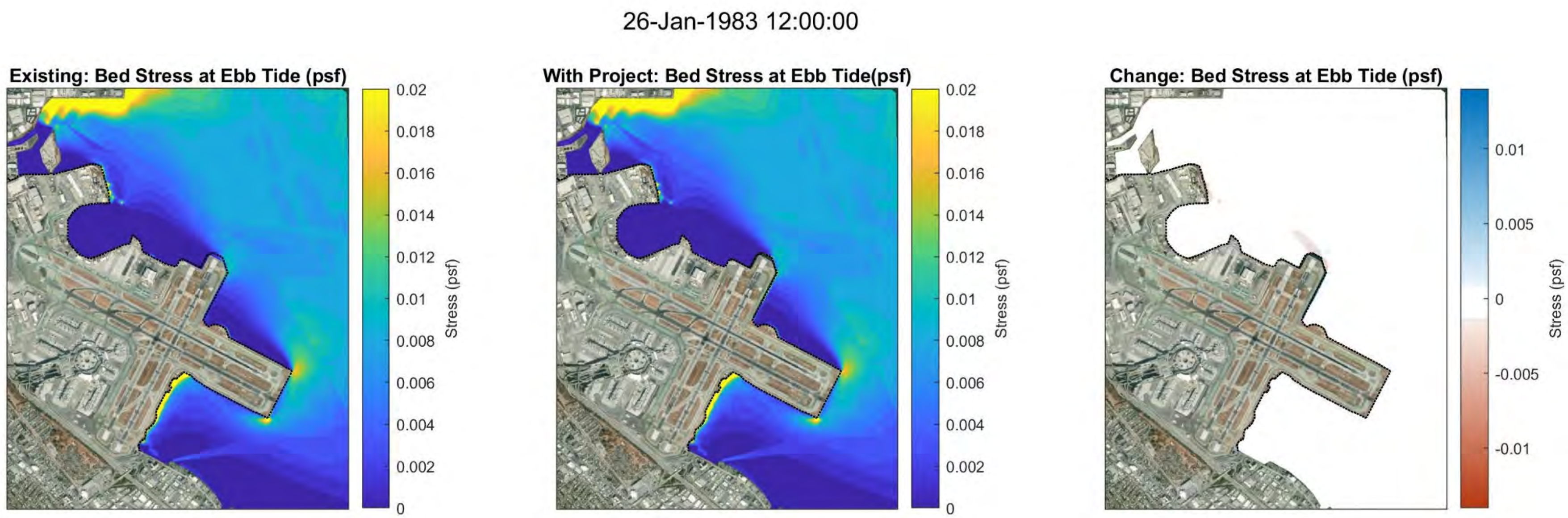
FIGURE A-25
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

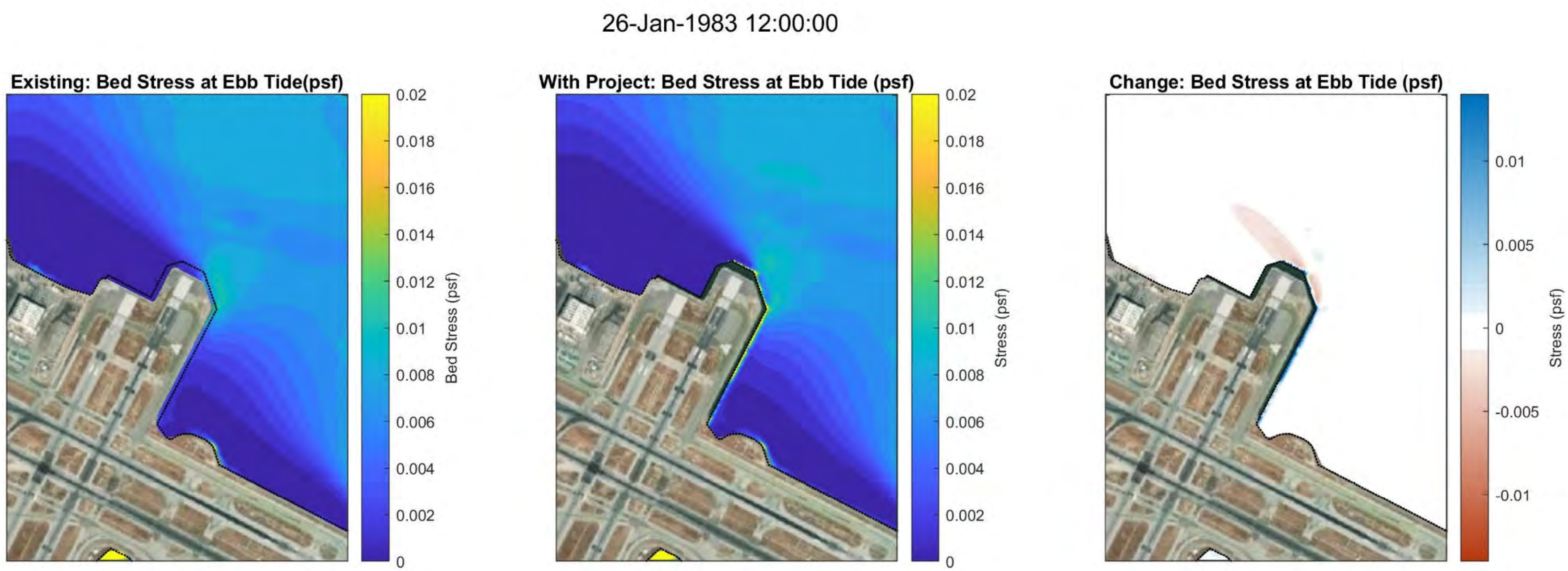
SFO Shoreline Protection Program

FIGURE A-26
VELOCITY FROM COUPLED HYDRODYNAMIC AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-27
BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE

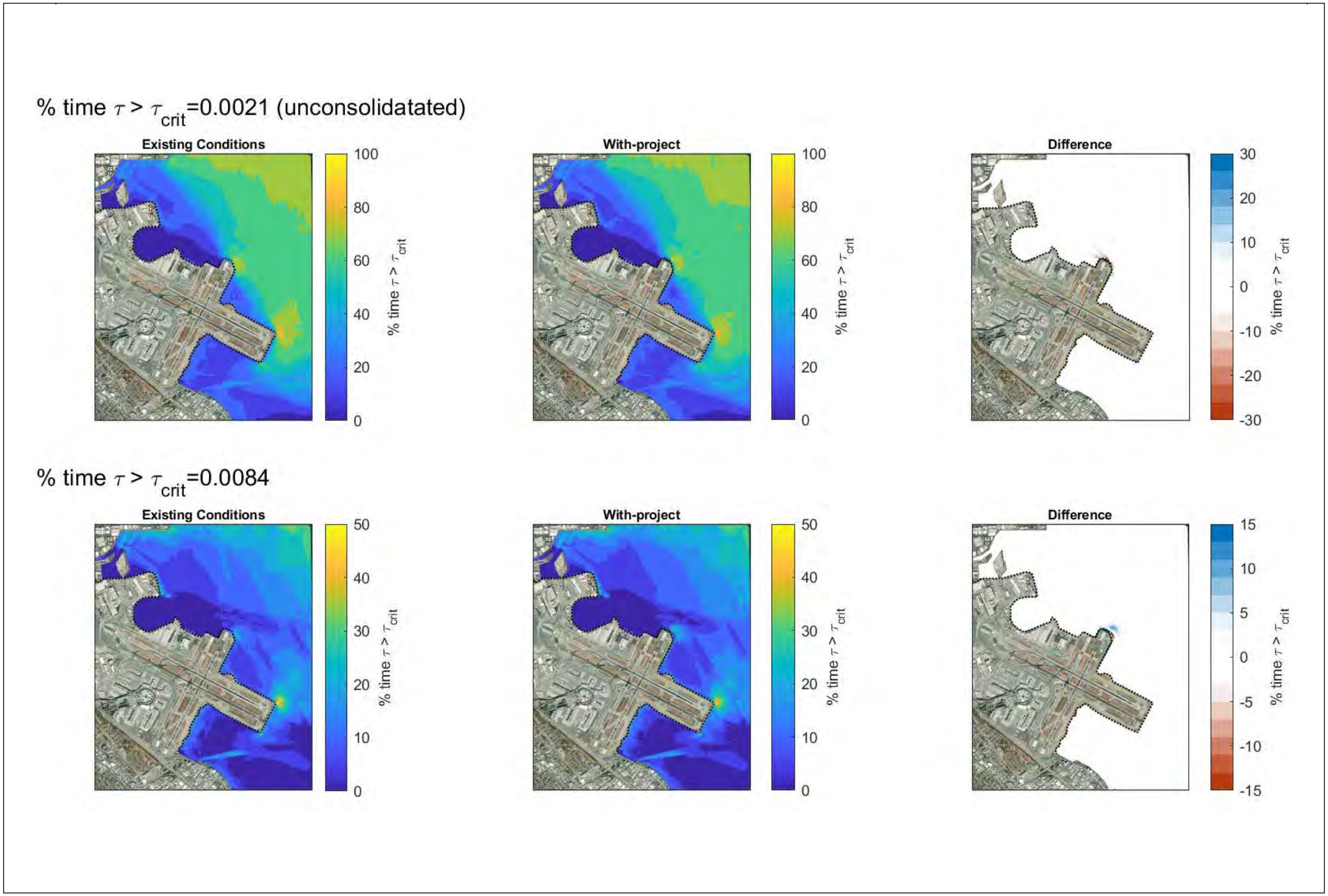


SOURCE: ESA Delft3D and SWAN modeling results (2021)

SFO Shoreline Protection Program

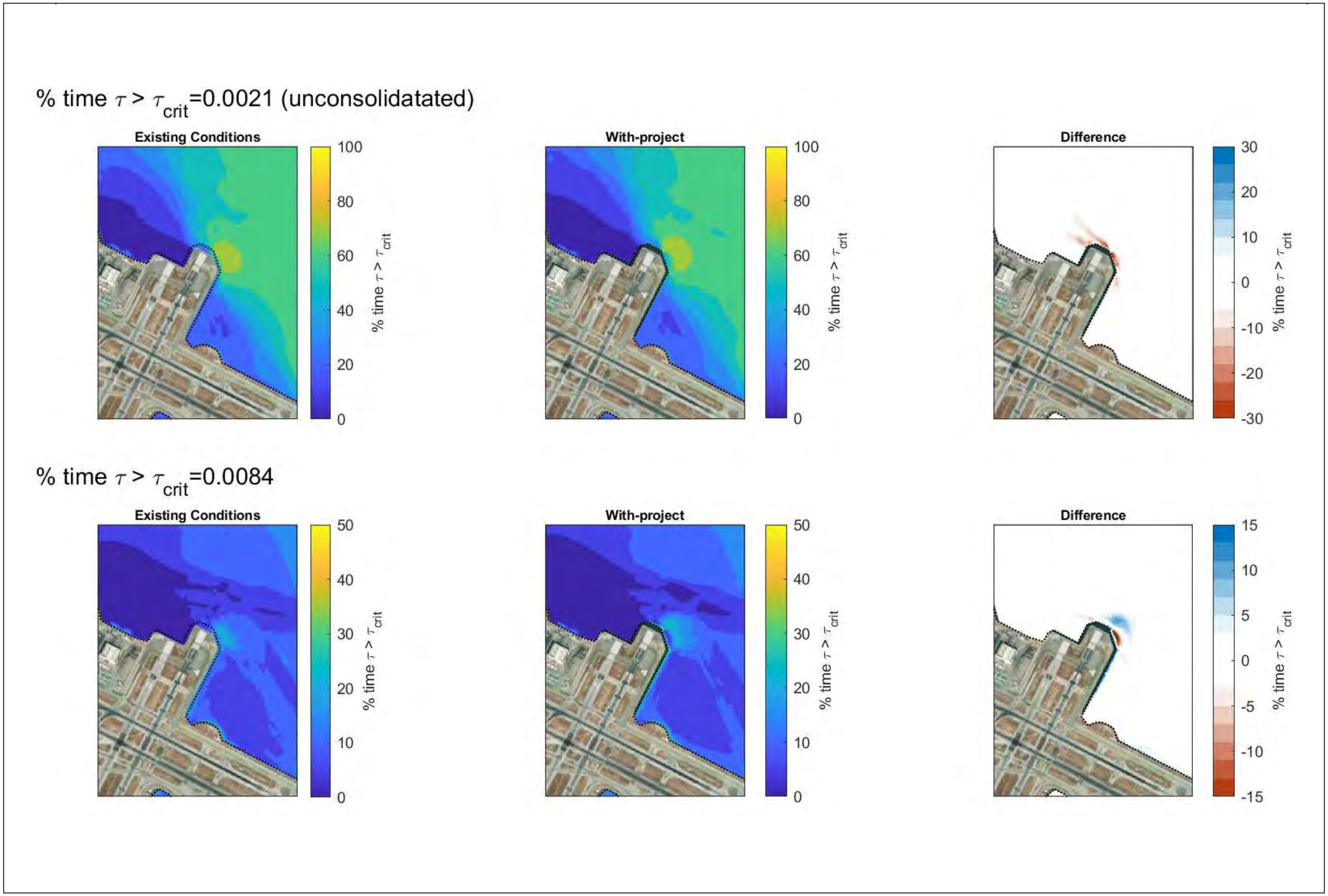
FIGURE A-28

BED SHEAR STRESS FROM COUPLED HYDRODYNAMICS AND WAVE MODELING
EBB TIDE FOR EXISTING CONDITIONS, WITH-PROJECT CONDITIONS, AND DIFFERENCE
JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

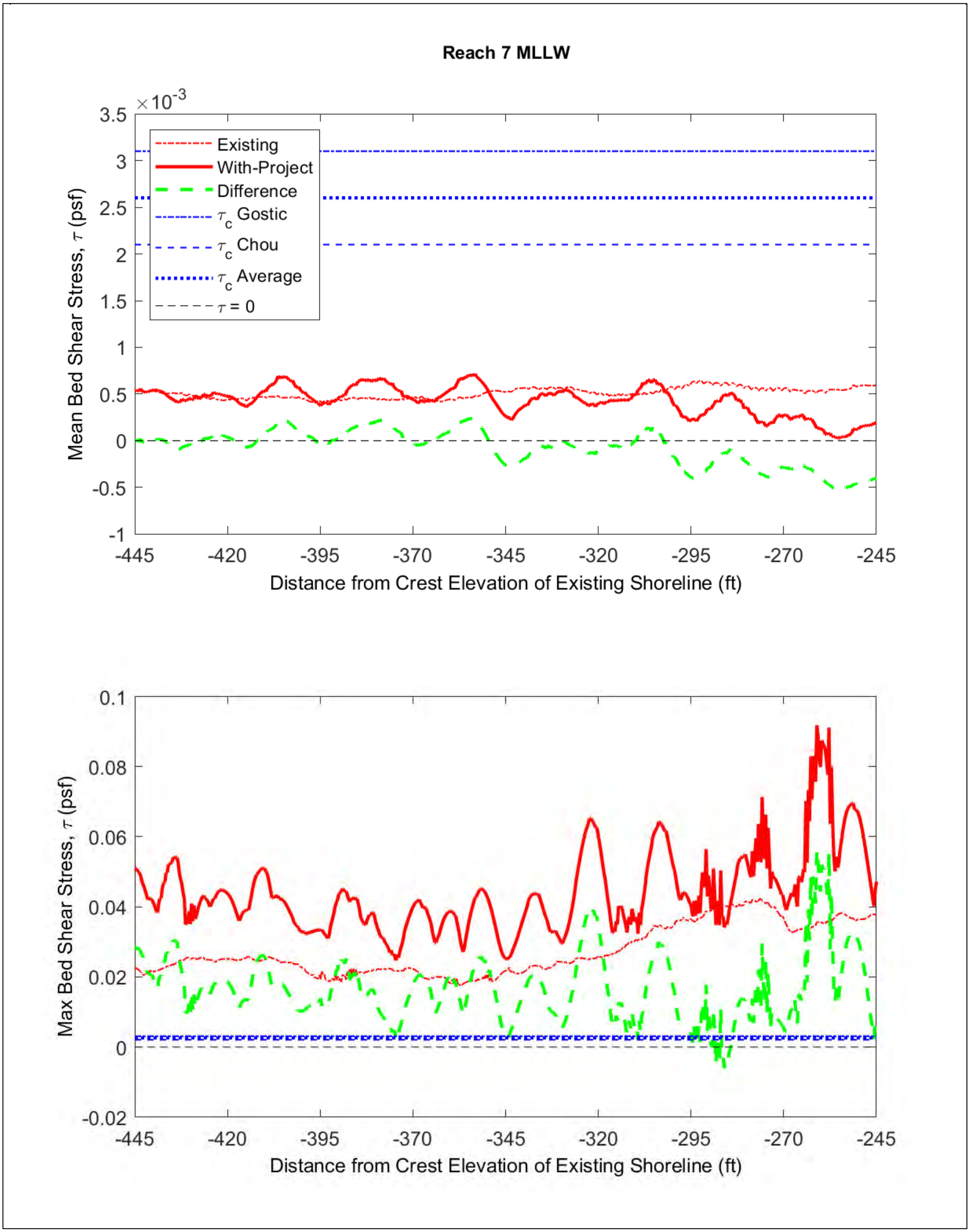
FIGURE A-29
PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA Delft3D and SWAN modeling results (2021)

FIGURE A-30

PERCENT TIME BED SHEAR STRESS EXCEEDS CRITICAL BED SHEAR STRESS EXISTING CONDITIONS, PROJECT CONDITIONS, AND DIFFERENCE JANUARY 1983 (ADJUSTED) + 3.5 FEET SEA-LEVEL RISE



SOURCE: ESA XBeach modeling results, 2021

FIGURE A-31

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 7, MLLW

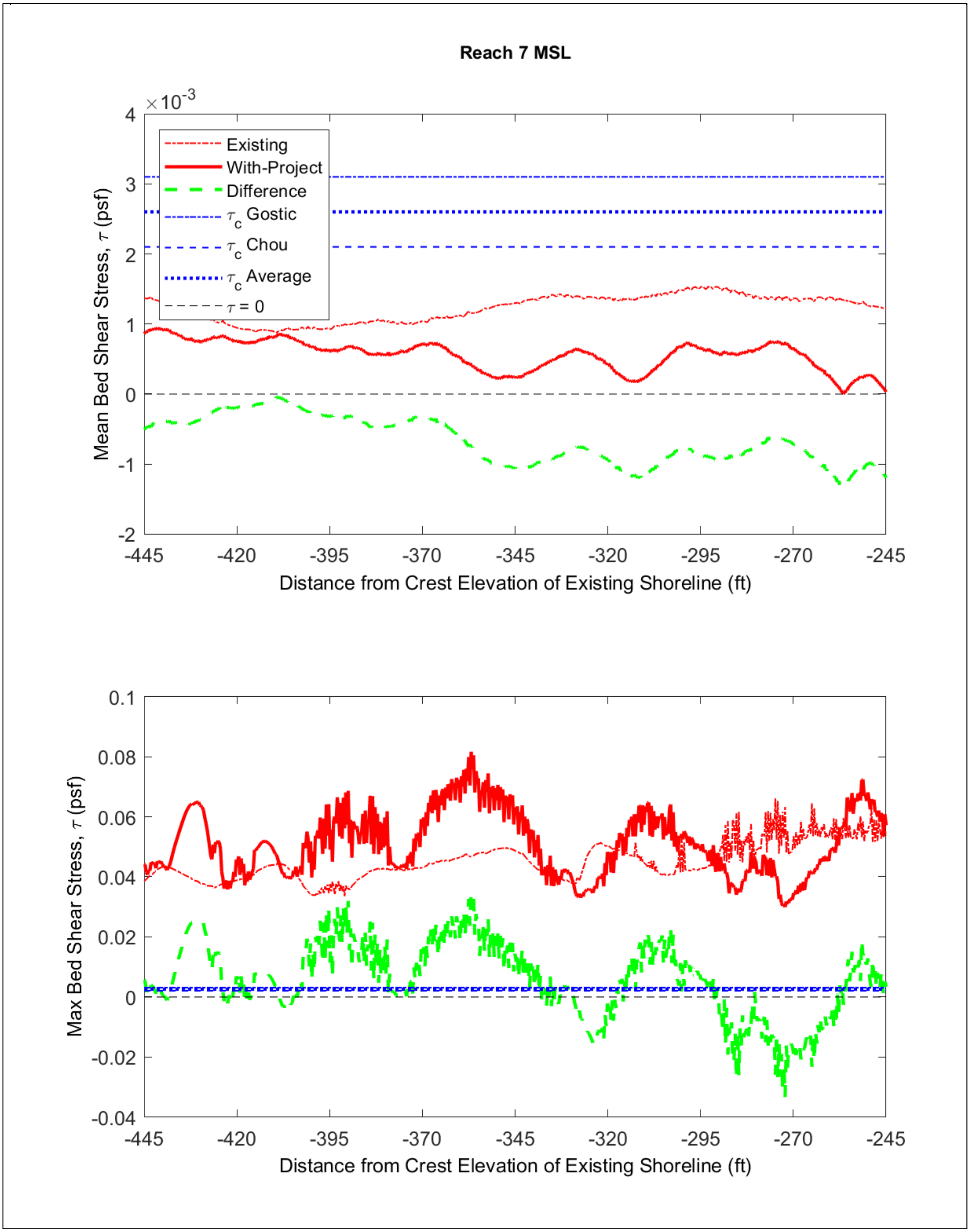
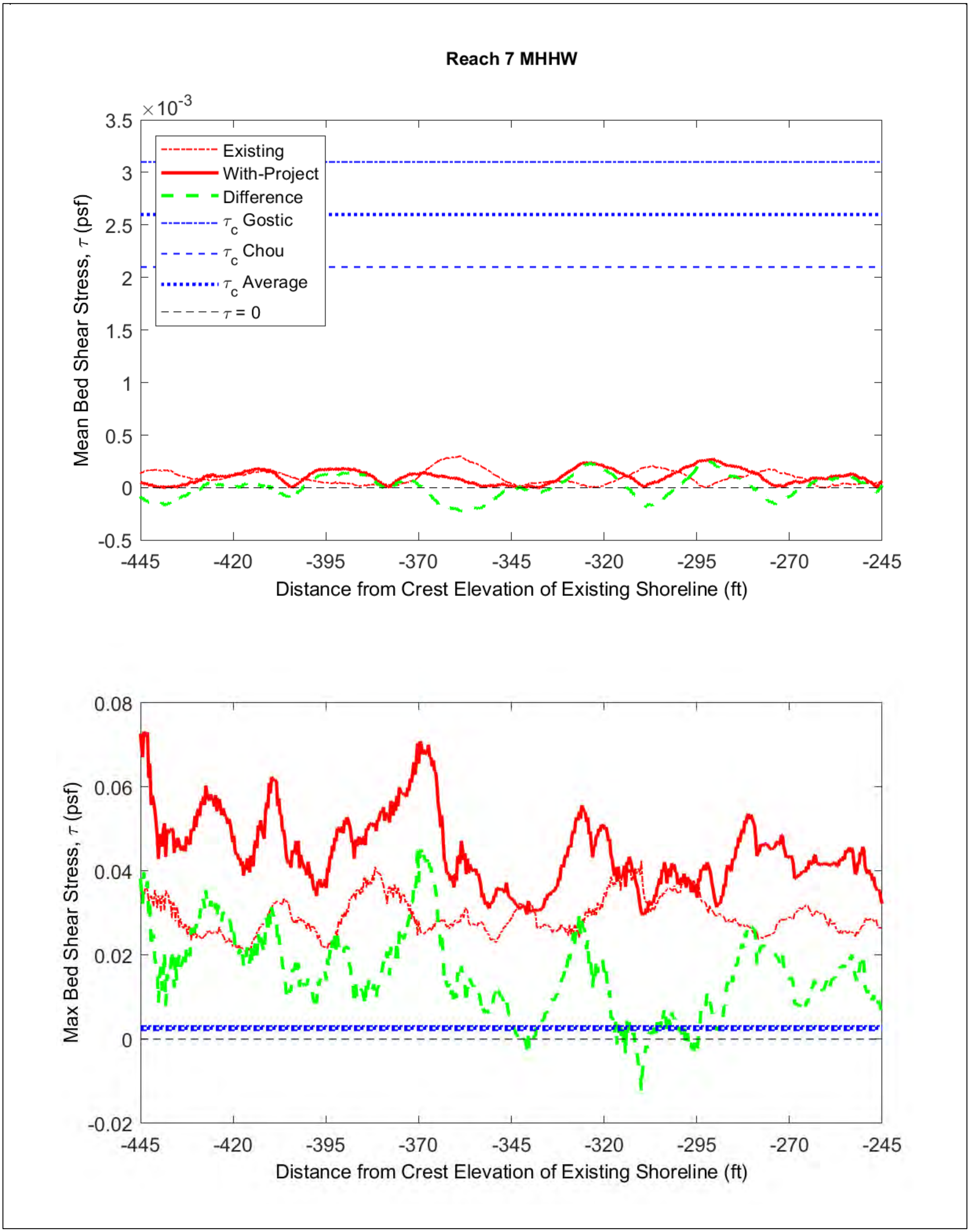


FIGURE A-32

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 7, MSL

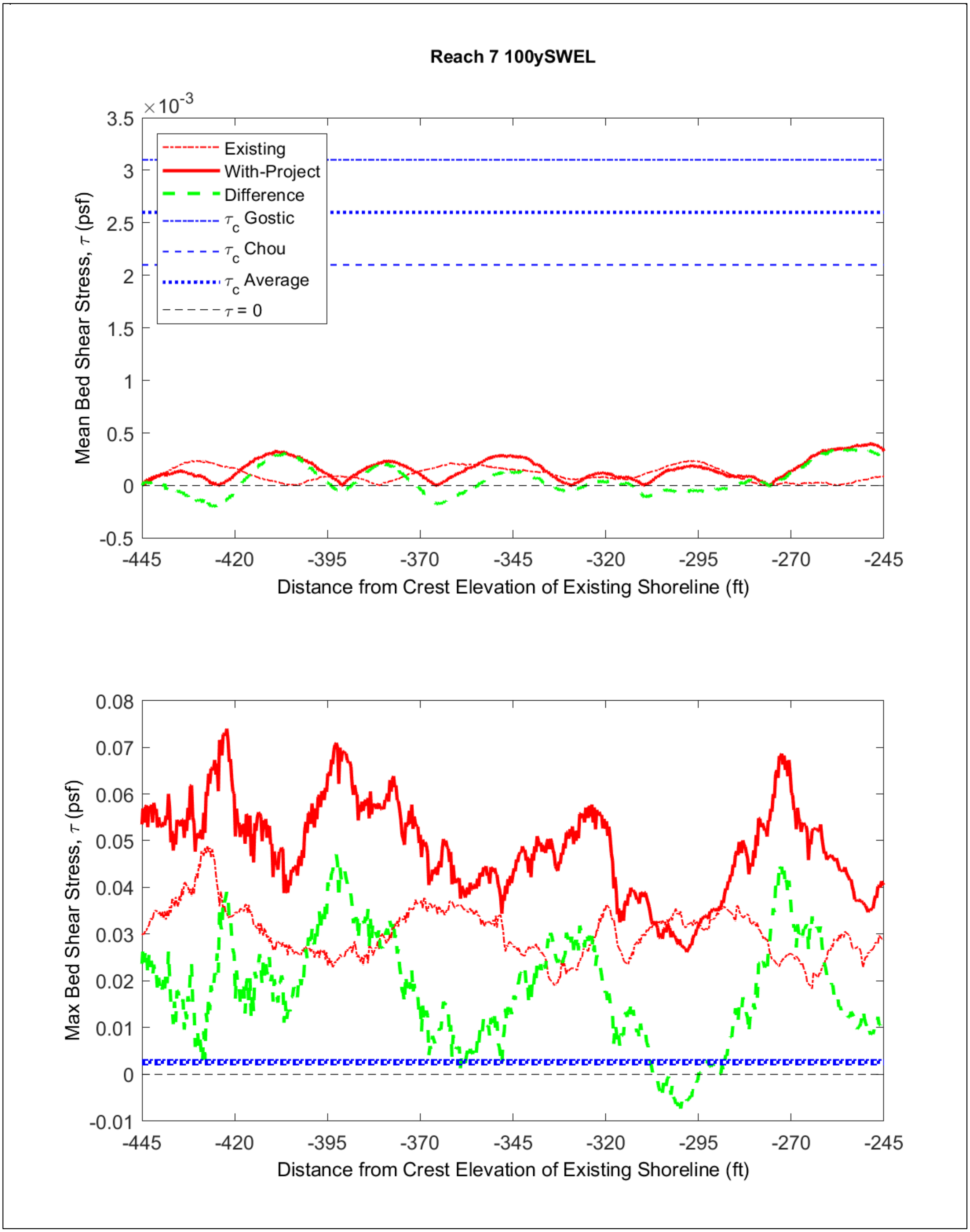


SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE A-33

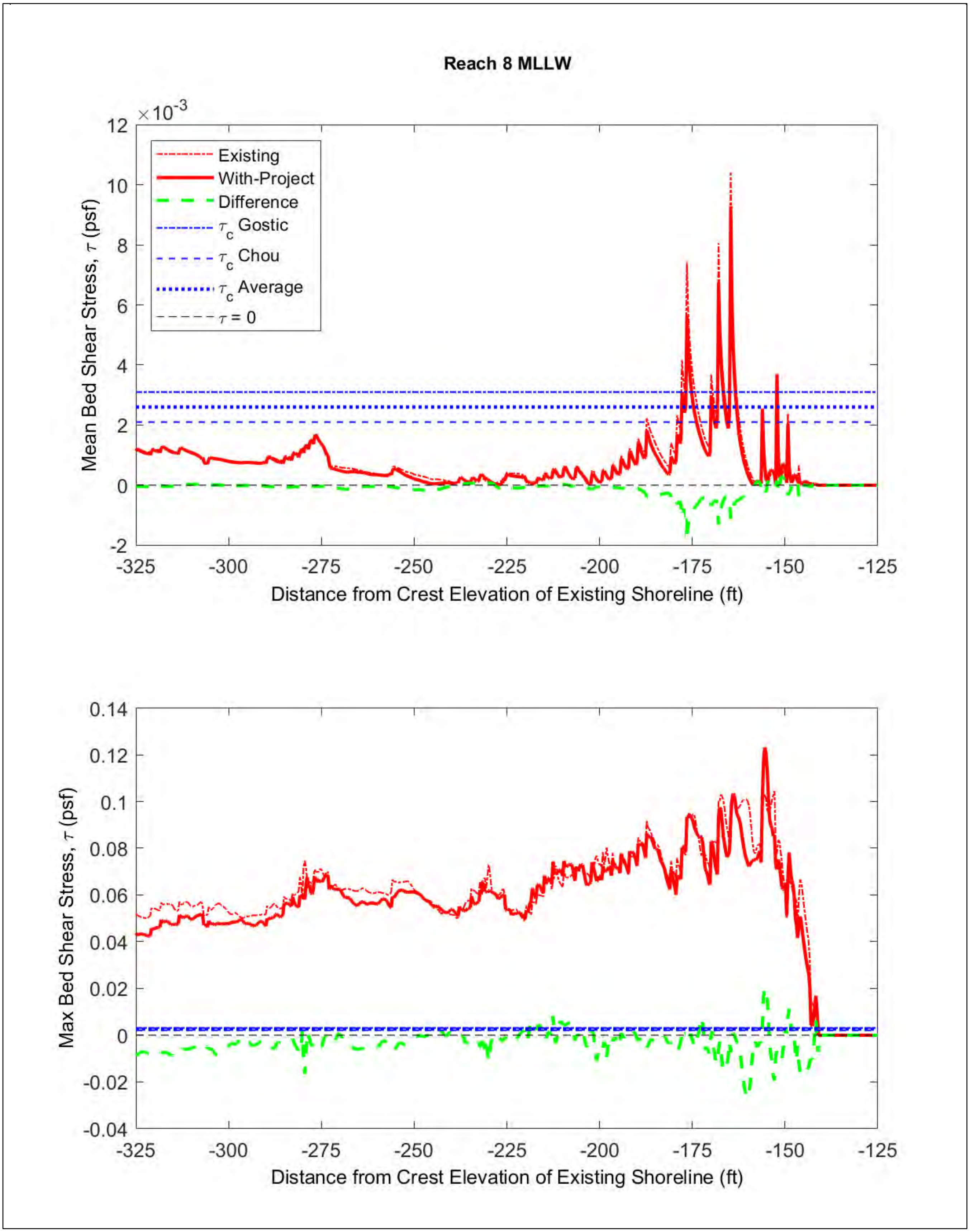
SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 7, MHHW



SOURCE: ESA XBeach modeling results, 2021

FIGURE A-34

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 7, 100-YEAR SWL

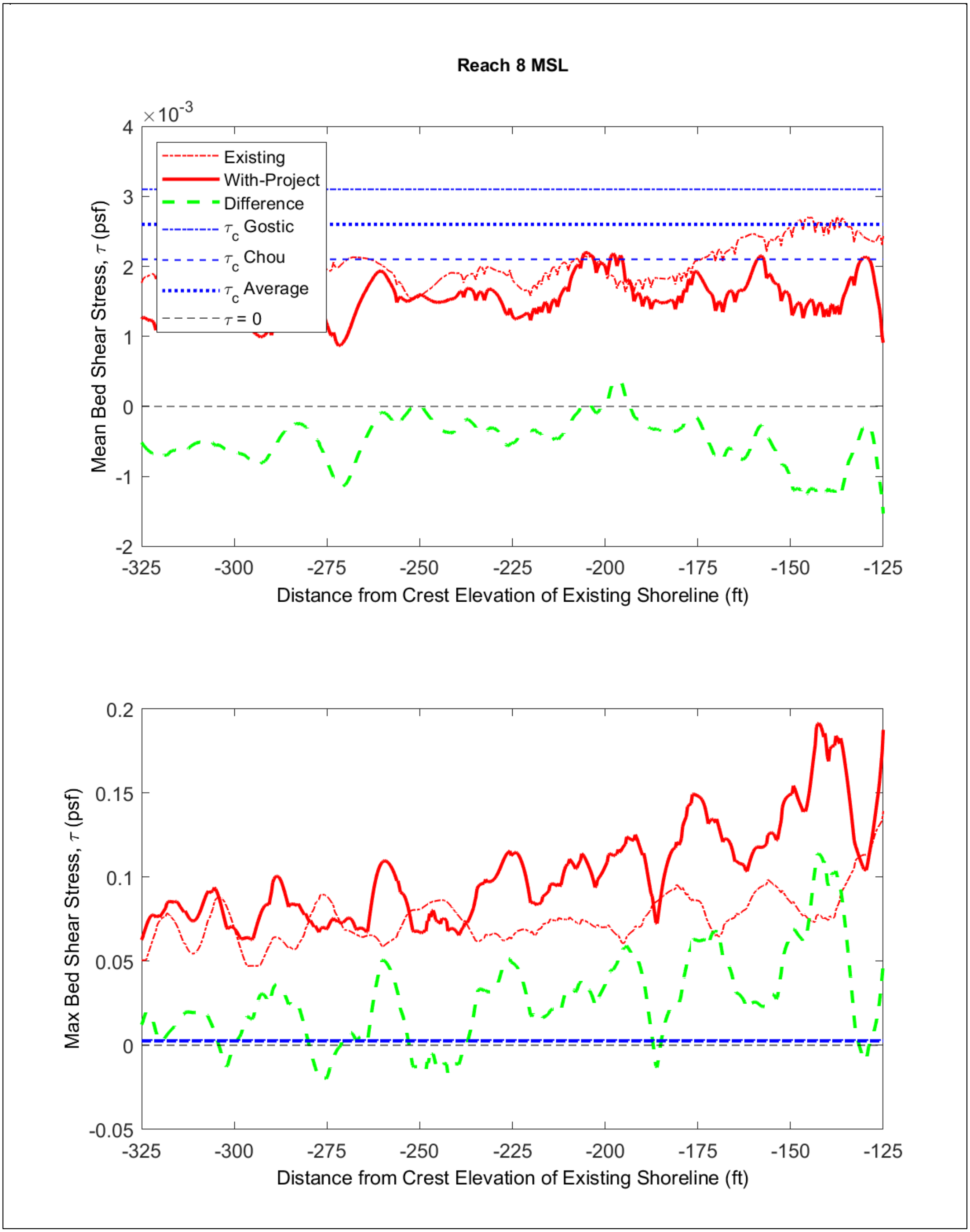


SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE A-35

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 8, MLLW

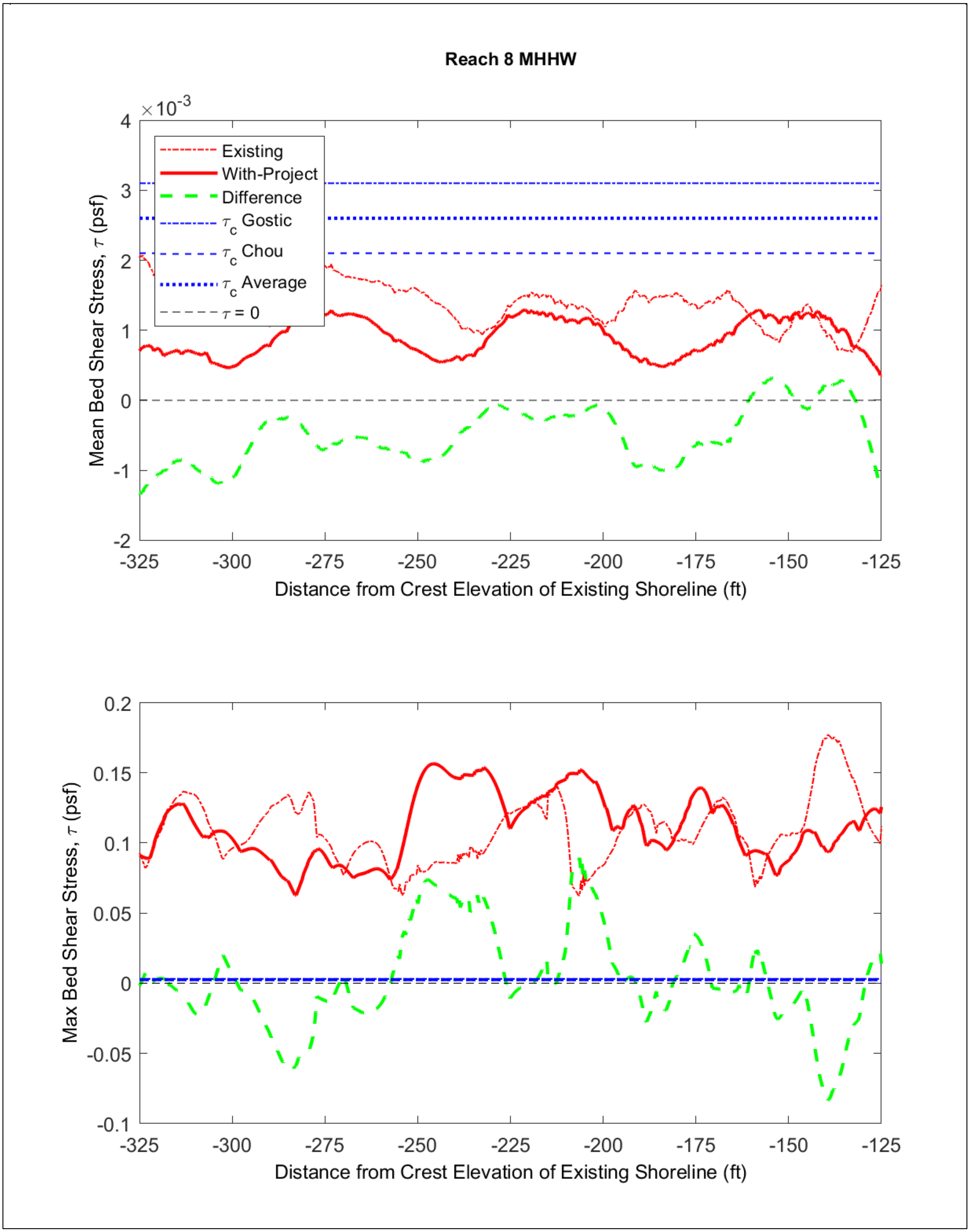


SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE A-36

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 8, MSL

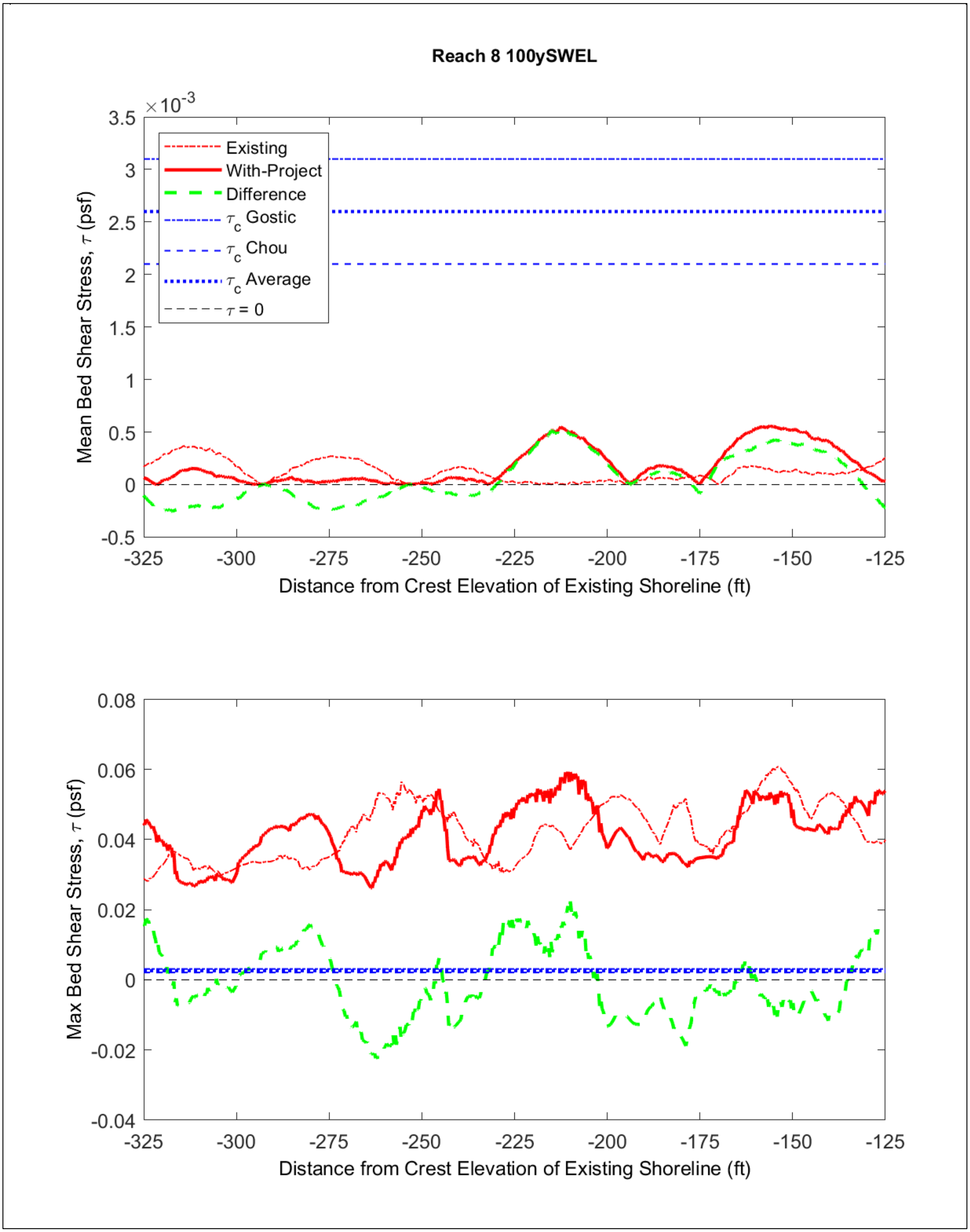


SOURCE: ESA XBeach modeling results, 2021

SFO Shoreline Protection Program

FIGURE A-37

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 8, MHHW



SOURCE: ESA XBeach modeling results, 2021

FIGURE A-38

SHORELINE WAVES—COMPARISON OF PREDICTED MEAN (TOP) AND MAXIMUM (BOTTOM) BED SHEAR STRESS TO CRITICAL VALUES FOR NEARSHORE REACH 8, 100-YEAR SWL

SOURCE: Background Image from Google Earth

FIGURE A-39
OUTPUT POINTS FOR COMPARING MODELED AND OBSERVED TIDAL CURRENTS FROM THE COUPLED HYDRODYNAMIC & WAVE MODELING

Appendix B1

Anchor QEA: Technical Review of SFO Shoreline Protection Program Coastal Hydrology Technical Report (July 2021) and ESA: Responses to Comments (October 2021)

130 Battery Street, Suite 400
San Francisco, California 94111
415.230.0862

ANCHOR QEA

Memorandum

July 21, 2021

To: David Kim, PhD, San Francisco International Airport

From: Michael L. MacWilliams, PhD, PE

cc: Matt Brennan, PhD (ESA), Eryn Brennan (ESA)

Re: Technical Review of SFO Shoreline Protection Program Coastal Hydrology Technical Report

Overview

As part of the San Francisco International Airport (SFO or Airport) Shoreline Protection Program (SPP), Environmental Science Associates, Inc., (ESA) has prepared a Coastal Hydrology Technical Report (CHTR; ESA 2021). The purpose of the CHTR is to analyze various coastal process-related issues and support the California Environmental Quality Act (CEQA) environmental review and regulatory permitting process for the SFO SPP. Anchor QEA is acting in an advisory capacity to SFO to provide an independent peer review of the CHTR. Anchor QEA previously reviewed ESA's scope of work for the CHTR (ESA 2020) to identify key questions that the CHTR should address to support the CEQA and regulatory permitting process (Anchor QEA 2021). This memorandum documents Anchor QEA's technical review of the CHTR prepared by ESA (2021).

Project Understanding

As summarized in the CHTR, the SPP proposes to remove most of the existing shoreline protection structures and construct a new shoreline protection system using a combination of concrete walls and steel king and sheet pile walls, some with armor rock revetments and/or soil fill. The 8-mile Airport shoreline is divided into 15 reaches. In Reach 7, at the end of runways 19L and 19R, the SPP would extend the shoreline protection system approximately 75 to 200 feet beyond the existing shoreline. Reach 8 will be extended approximately 100 feet beyond the existing shoreline along its entire length to meet Federal Aviation Administration regulations for a vehicle service road. The shoreline extensions in Reach 7 and Reach 8 will result in a combined total of approximately 8 to 9 acres of fill in San Francisco Bay (Bay). Other than minor amounts of sediment fill intended to stabilize the shoreline and create a necessary slope for the shoreline protection system, the overall footprint of the Airport facilities in the remaining reaches is not expected to change. Thus, the primary area of focus of the CHTR is on the effects of the changes to the shoreline in Reach 7 and Reach 8.

Key Technical Questions

The primary components of the SPP that could potentially affect currents, waves, and sediment transport are the placement of Bay fill that changes the footprint of the Airport facilities (Reach 7 and Reach 8) and the vertical extension of flood protection barriers along the Bay shoreline in the remaining reaches. The primary questions that need to be addressed by the CHTR to support CEQA and permitting are related to potential impacts to Bay currents, waves, and sediment transport.

The primary technical questions for Reach 7 are whether the placement of Bay fill that expands the footprint of the Airport facilities affects currents, waves, and shear stresses resulting from the combined effects of waves and currents, and whether these changes are expected to affect sediment transport. The primary technical questions for the remaining reaches (where a combination of concrete walls and steel king and sheet pile walls, some with armor rock, are planned to be constructed) are whether the planned changes to the shoreline or slope protection affect the dynamics of bed shear stresses, which occur when waves collide with the shoreline structure.

In areas where there will be changes to the footprint of the Airport facilities, changes to substrate due to armoring of constructed structures, or significant predicted changes to tidal currents or waves, potential impacts to wildlife and plants as a result of changes to coastal hydrology would need to be evaluated. Impacts to wildlife and plants are not directly addressed in the CHTR. However, the analysis conducted for the CHTR can inform these impact assessments.

Technical Review of the CHTR

The CHTR summarizes the modeling of tidal currents and wind waves to assess potential hydraulic impacts of the SPP. Hydrodynamic modeling was conducted using a two-dimensional (2D) version of the Delft3D-FM model developed by the U.S. Geological Survey and Deltares (Deltares 2019). ESA refined the model grid in the vicinity of the Airport by incorporating a finer grid with a cell resolution of 32 feet by 32 feet and incorporated newer site-specific bathymetric data. ESA applied the Simulating WAves Nearshore (SWAN) wave model (TU Delft 2019) to predict wave conditions in the Bay and XBEACH (Roelvink et al. 2009) to translate wave heights from the SWAN model to the shoreline along representative profiles.

The review comments listed below provide some suggestions to improve the analysis and presentation of results to that should be considered in the CHTR to better provide the information needed to make a determination of the significance of impacts of the SPP as part of the CEQA assessment. The primary review comments are grouped under five main topics; however, some comments span multiple topics. This is followed by minor review comments for suggested editorial or grammatical changes. Page, section, and figure numbers in the following review comments refer to numbering in the CHTR (ESA 2021) unless otherwise noted.

Primary Review Comments

Setting and Methods

1. The coastal hydraulics assessment approach as described in Section 1.2 of the CHTR is technically sound and sufficient for answering the key technical questions in sufficient detail to support the CEQA and regulatory permitting process. The application of hydrodynamic and wave models and the subsequent comparison of the predicted waves, tidal currents, and shear stresses between existing and with-project conditions, for a set of present and future conditions, should be sufficient to provide the comparisons needed to make a determination of the significance of impacts of the SPP as part of the CEQA assessment. The comments below provide some suggestions to improve the analysis and presentation of the results to support this CEQA assessment.

ESA RESPONSE

Thank you for this high-level assessment of the coastal hydraulics assessment as sufficient to assess potential SPP impacts. See below for responses to comments to further enhance the report.

2. The CHTR indicates that the assumed completion date for the project is 2032, with an assumed functional lifespan of 60 years (until 2092); however, sea level rise (SLR) effects were only evaluated through 2085 (Page 17). Please explain why the SLR analysis does not span the full expected functional lifespan of the project and why 3.5 feet of SLR was selected.

ESA RESPONSE

The 60-year lifespan is referenced to the 2025 project construction start date. The report has been revised to clarify the assumed start date for the beginning of the project's lifespan. The selection of 3.5 feet of sea level rise is based on OPC (2020) and CCSF (2020) planning guidance, as already noted in 2nd to last paragraph of Section 1.1.

As noted in Section 2.7, "[i]n the conceptual design phase, the sea-level design criteria were selected based on the best-available climate change science, guidance, timeframe, flood hazard reduction, and cost (AECOM et al. 2018)." The recommended sea-level design criteria from AECOM et al. (2018) was for FEMA accreditation plus 36 inches (three feet) of sea level rise. Then, in response to the latest state strategy (OPC 2020), the amount of sea-level rise was increased by 6 inches to 3.5 feet.

Note that FEMA accreditation generally requires 2 feet of freeboard above the 100-year still water levels, so the crest elevation of the sheet pile walls is typically 5.5 feet (2 feet freeboard plus 3.5-foot sea-level rise allowance) above the current 100-year still water levels. (Two feet of freeboard above the 100-year still water level is used for illustration. The design team has conducted an analysis of wave exposure for the different reaches of the SPP. For reaches that are exposed to higher total water levels due to waves, the design crest elevations have been adjusted accordingly.)

Since 3.5 feet of sea-level rise is the project's design criteria, this amount of sea-level rise was selected for evaluating the potential coastal hydraulic impacts. There is a small probability that this amount of sea-level rise is exceeded in 2085. (According to OPC 2018, the chance of exceeding 3.5 feet of sea-level rise is between about 5% and 0.5% probability). However, since the modeling indicated that the effect of 3.5 feet of sea-level was relatively minor as compared to existing conditions, if a slightly higher amount of sea-level rise does occur by 2085, the impacts would not be substantially different than what is predicted by the modeling for 3.5 feet of sea-level rise.

3. In the bathymetric change maps (Figure 4 and Figure 5), different elevation bands are colored white, visually indicating no significant change between the two surveys of either -0.5 to +0.5 feet or -1 to +1 foot. Typically, the white color band is based on the vertical accuracy of the bathymetric surveys to indicate changes that are not significant based on the vertical uncertainty in the data; however, there is no discussion of the vertical accuracy associated with the comparisons. It would be helpful to add a discussion of the vertical uncertainty associated with the bathymetric datasets and the resulting comparisons to put these differences in context. The bin size of the white band indicating no change should be based on the vertical uncertainty of the surveys, and if feasible, it would be preferable to use the same color scale for both figures. The use of two different color ranges (-5 to 5 feet and -2.5 to 2.5 feet) makes it more difficult to compare differences between the two figures.

ESA RESPONSE

When readily available, the reported values for vertical uncertainty have been added to Table 4. The bathymetry sources for the regional bathymetric change figure have a vertical uncertainty of up to 2 feet, and are shown with change increments of ±1 foot. The bathymetry sources for the local bathymetric change figure have a vertical uncertainty of approximately 0.5 feet, and are shown with change increments of ±0.5 feet.

The range of bathymetric change (±5 feet for regional; ±2.5 feet for local) was selected to best show the qualitative context specific to each pair of data sets. Since these datasets cover different time periods and extents, the changes are not necessarily suited to displaying with the same range. While presenting identical ranges for the two figures may be appropriate for a study focused on quantitative long-term geomorphic analysis, using the two different ranges is thought to be most appropriate for the purpose of this assessment for this study, to provide qualitative context.

Hydrodynamic Modeling

4. The hydrodynamic model, which was used in the CHTR, is a depth-averaged 2D model. A 2D model is sufficient for assessing changes in water level, waves, and bed shear stress between

existing conditions and with-project conditions, but less suitable for detailed sediment transport modeling in estuarine systems.

ESA RESPONSE

We concur that a 2D model is sufficient for the current study, and also concur that a more detailed 3D model may be more appropriate for other certain estuarine sediment transport modeling applications. One of the main reasons for drivers of the need for a 3D model is vertical stratification by salinity. We reviewed salinity data in the vicinity of the Airport (Section 2.3 of the report) and concluded that vertical salinity differences were relatively minor and short-lived, thereby supporting the assumption of vertically well-mixed conditions which are represented in a 2D model.

5. The model calibration, as presented in Table 6 and Figures 7 through 12, provides results for 2005 and 2018. However, no calibration results are provided for the 100-year event, which was based on January 1983. Because the design water levels were shifted up 0.7 feet to match the 100-year Federal Emergency Management Agency (FEMA) water level (Page 23), calibration or validation of the design event to historical data for 1983 is infeasible. However, calibration of the peak water levels for the 1983 period without the 0.7-foot shift is an important element of demonstrating that the model accurately predicts these peak tidal water levels. Data available from the National Oceanic and Atmospheric Administration at the San Francisco (9414290), Alameda (9414750), and San Mateo Bridge (9414458) stations for this period in 1983 can be used to validate these predicted water levels for the period simulated, which includes 4 of the 6 highest tidal levels recorded at San Francisco. These comparisons should be made and compared in Table 6 and Section 3.2.

ESA RESPONSE

Comparison of water levels predicted by the model are compared to observational data for the January 1983 event. Details of this comparison have been added in Table 6, Table A-1, and with new figures comparing model and observations as time series and 1:1 relationships. These comparisons show similar level of agreement of within a few tenths of a foot, which has been noted in with added text added in Section 3.2.7.1.

6. While the coefficient of determination is high for these comparisons, it would be helpful to add another model accuracy metric to Table 6 for the absolute error for predicting the maximum water level(s) for each simulation period. This would be particularly relevant for each of the four peak water level events in 1983, but also could be relevant for the 2005 comparisons where the peak spring tide water levels are over predicted by around 0.5 feet.

ESA RESPONSE

The absolute error between for the predicted and observed water level was already noted in Section 3.2.7.1. In addition, a table reporting absolute error for all three simulation periods at two or more peak water levels has been added as Table A-1 in Appendix A for all three events.

As shown in Table A-1, the only difference that is substantially greater than 0.5 feet is a difference of -0.89 feet at the Presidio on 1/27/83 at 10:00. The cause of this larger discrepancy is not clear; it may be an artifact of the interaction with somewhat noisy Point Reyes boundary condition with this part of the model domain or it may be an under-accounting for wind setup. However, the other two stations, Alameda and San Mateo Bridge, which bracket the Airport, have errors of about 0.5 feet on this day and all three stations have errors less than 0.5 feet on the adjacent days' peak water levels. This model accuracy is sufficient for this study, which is not used for design of the proposed floodwalls and only uses the comparison of the adjusted 1983 event to inform its findings.

7. The main body of the text needs to include discussion of the figures and analysis related to storm surge conditions (2005), the 100-year coastal flood (1983), and SLR conditions. The figures included in Section 4 that show velocity and shear stress from the coupled hydrodynamic and wave modeling include only representative tidal conditions in 2018 (Figure 15 through Figure 20). The corresponding figures for storm surge conditions, the 100-year coastal flood, and SLR conditions are included in Appendix A but are not discussed in the CHTR. As a result, the discussion in the CHTR focuses only on with-project effects during representative tidal conditions, and does not include any meaningful discussion of SLR effects.

ESA RESPONSE

The effects of SLR on the summer 2018 conditions is noted in Section 4.1 as being not substantially different than current summer 2018 conditions. Hence, the figures are provided in the appendix and only minimal discussion is warranted. A similar note that SLR has limited effects on January 2005 and adjusted January 1983 (100-year) conditions has been added.

8. The figures that show velocity and shear stress for representative storm surge in 2005 (Figure A-7 through Figure A-18) are included in Appendix A, but there is no discussion of these 2005 figures in the CHTR other than a statement that the changes in velocity and bed shear stress are “similar” to 2018 conditions (page 48). However, the predicted changes in velocity and shear stress during the storm surge period in 2005 appear to be larger in magnitude than the predicted changes under typical conditions in 2018, which are discussed in the CHTR (e.g., Figures A-8 and A-10). For example, Figure A-10 appears to show predicted increases in bed shear stress of close to 0.03 pound per square foot (psf) in Reach 8, an increase more than three times greater than the critical shear stress for the consolidated sediment (0.0084 psf). The much higher predicted changes in shear stress shown in Figures A-8 and A-10 should not be characterized as similar to those shown in Figures 16 and 18.

ESA RESPONSE

Bed shear stress figures for 2005 (Figures A-9, A-10, A-15, A-16) have been revised so the range of their color scales matches that of 2018 shown in Figures 16 & 18 [Figures 19 and Figure 21 in the revised report]. With the color scales now identical, the similarity between the 2018 and the 2005 differences is more apparent, e.g. Figure 16 [19] versus Figure A-9, Figure 18 [21] versus Figure A-10.

The one area of difference is along Reach 8, where immediately along the with-project shoreline there are higher predicted bed shear stresses. This occurs because waves that would propagate across open water for existing conditions instead break on the side slope of the proposed open water fill. This breaking occurs within a narrow strip, typically only one cell wide, that overlap with the outboard shoulder of the proposed open water fill. The outboard shoulder of the proposed open water fill would be designed to include rock armor revetment sufficient to resist erosion from these higher bed shear stresses (COWI 2021) and therefore cause erosion impacts to the bed. Text noting and explaining the increase along Reach 8 has been added to the text in Section 4.1.

When comparing velocity (e.g. Figure 17 [20] to Figure A-8, Figure 16 [18] to Figure A-7), there is no increase in velocity along Reach 8 as occurs for bed shear stress. This is because Reach 8's narrow band of bed shear stress increase is due solely to wave breaking on the fill's outboard shoulder. Tidally-driven velocities do not rapidly increase due to shallowing, as breaking waves do.

9. It should also be noted that the color scales for Figures A-9 and A-10 (2005) and Figures A-21 and A-22 (1983) range from -0.03 to +0.03 psf, while the equivalent color scale for the similar figures for 2018 (Figures 16 and 18) ranges from about -0.012 to +0.012 psf. Using a different color range for different figures masks the fact that the predicted differences in Figure A-9, Figure A-10, Figure A-21, and Figure A-22 are almost three times larger than the difference shown in Figures 16 and 18.

ESA RESPONSE

The color scales for the scenarios modeled in Figures A-9, A-10, A-15, A-16, A-21, A-22, A-27, and A-28 were revised to match the narrower-ranged color scales used in Figure 16 [19] and Figure 18 [21]. This allows for more direct comparison with the 2018 scenario results and also shows the range of changes in higher resolution.

For interpretation of these revised figures, see response to comment #8 for January 2005 and comment #10 for January 1983.

10. The figures that show velocity and shear stress for a 100-year coastal flood (Figure A-19 through Figure A-30) are included in Appendix A, but there is no discussion of these 1983 figures in the CHTR other than a statement that the changes in velocity and bed shear stress are “similar” to

2018 conditions (Page 48). However, the predicted changes in velocity and shear stress during the 100-year coastal flood appear to be larger in magnitude than the predicted changes under the typical conditions in 2018, which are discussed in the CHTR (e.g., Figure 22). Similar to the results for 2005, Figure A-22 appears to show predicted increases in bed shear stress close to 0.03 psf in Reach 8 during the 100-year coastal flood (1983), which is much higher than the predicted changes in bed shear stress during 2018, which are discussed in the CHTR.

ESA RESPONSE

Figures A-21, A-22, A-27, and A-28 have been revised so the range of color scales is consistent with the 2018 bed shear stress figures. With this change, the similarity between 2018 and adjusted 1983 conditions is more apparent. As discussed in response to comment #8, the increase in predicted bed shear stress along a narrow strip of Reach 8 is due to wave breaking on the shoulder of the proposed open water fill. Text noting and explaining the increase along Reach 8 has been added to the text in Section 4.1.

11. The modeling results section concludes that "the potential extent and magnitude of change to the bay's coastal hydraulics are limited" (Page 41). These conclusions appear to be based primarily on the results from 2018 for "representative tidal conditions" (Page 37), with no discussion of either the storm surge (2005) or 100-year coastal flood (1983) conditions other than a statement that the results are similar to 2018 (Page 48). The figures included in Appendix A indicate some larger changes in the storm surge and coastal flood conditions that are not discussed in the CHTR. After the discussion of these results are added to the CHTR, as suggested in Comments 8 and 10, these conclusions should be revisited based on the results of all three conditions simulated. In particular, some of the results for the storm surge (2005) and 100-year coastal flood conditions (1983) appear to show larger differences in bed shear stress than are predicted for 2018 (e.g., Figures A-10 and A-22). The overall conclusion may not change significantly, but it is important that the text of the CHTR discusses the full range of conditions evaluated, not just representative tidal conditions.

ESA RESPONSE

As discussed in response to comments #8 and #10, the increase in bed shear stress for the January 2005 and adjusted 1983 conditions is limited to a narrow strip of the shoreline immediately above proposed rock armor revetment. Based on this, no changes to the overall conclusions are deemed necessary.

12. The explanation of velocity changes in Figure 17 is attributed to "local effects of the shallower depths and drag of the shoreline" (Page 42). However, in the description of bathymetry (Section 3.3.3), the text states "No changes were applied to bathymetry seaward of the flood walls and fill" (Page 28). However, even if no changes to the bathymetry were made the extended Reach 7 shoreline would be adjacent to deeper water along the edge of Reach 7 under with-project conditions since the existing bathymetry is generally deeper with increasing distance from the

existing Reach 7 shoreline (Figure 3). Because this area with higher predicted velocity is seaward of the flood walls and presumably has the same depth under both the existing and with-project conditions, please explain what you mean by “local effects of shallower depths.”

ESA RESPONSE

The phrase ‘local effects of shallower depths’ refers to the area where bed elevations were raised to represent the outboard shoulder of the open water fill. In response to Comment #13, Figure [7] has been added to show these changes in bed elevations.

For further clarity, in the preceding sentence, “cause flow acceleration to slightly higher velocities” has been changed to “cause both flow deceleration and acceleration” to better introduce the following sentences, which describe both flow decreases and increases.

13. As with the previous comment, it is unclear how bed elevations were changed in the model for the with-project conditions and whether the fill being described includes any design slope from the fill to the existing bed. This makes interpreting the velocity and shear stress difference maps more difficult. It would be helpful to see a figure that demonstrates the detailed bathymetric difference between existing conditions and with-project conditions in the vicinity of Reach 7 and Reach 8. Is there a new subtidal slope associated with the shoreline that is affecting the depths, as implied by the interpretation of Figure 17 in Comment 12?

ESA RESPONSE

A figure showing the change in bed elevation due to the proposed open water fill has been added as Figure [7] in Section 3.2.3.

14. Alternatively, Section 4.2 explains that “the extension of the shoreline results in deeper water at the shoreline toe, which tends to reduce bed shear stresses” (Page 50). This statement suggests that the extended shoreline may be treated as a vertical wall in the model with no slope at the toe. Is this assumption realistic? If not, does modeling the shoreline toe as a vertical wall result in an underestimate of the changes in shear stress relative to including some new subtidal slope? The shoreline profiles (e.g., Figure 31) suggest there is a change in slope that is not vertical. If this is the case in the hydrodynamic model, it should show up in the detailed bathymetry difference figure between the existing conditions and with-project conditions requested in Comment 13. If the model bathymetry does not include this slope, some discussion of how this potentially affects predicted shear stresses immediately adjacent to the shoreline should be included. The inclusion of this figure—or a more detailed description of the bathymetry differences between existing conditions and with-project conditions in Section 3.3.3—would help with understanding this and interpreting the velocity differences.

ESA RESPONSE

In the coupled hydrodynamic and wave modeling, the extended shoreline is represented as both bathymetric change (e.g., added Figure [7] in response to Comment #13) and as a vertical wall, for the floodwall at the crest of the open water fill.

For clarification, the phrase "deeper water at the shoreline toe" refers to the depth at the bottom the shoreline, e.g.:

- For Reach 7: the difference in depth at x = -110 feet along the horizontal axis in Figure 24 [30] upper panel 'a') as compared to the depth at x = -250 feet in Figure 24 [30] lower panel 'b')
- For Reach 8: the difference in depth at x = -50 feet in Figure 28 [34] upper panel 'a') as compared to the depth at x = -120 feet in Figure 28 [34] lower panel 'b')

15. The previous redline draft of the CHTR included a table at the end of Section 4.1 that compared velocity and shear stress values at discreet points along the shoreline. Given how difficult it is to visually determine the magnitude of the differences from the maps at the scale they are shown, it would be helpful to retain similar table—in addition to the maps—that features well-selected points to help with the interpretation of the differences shown on the maps.

ESA RESPONSE

Tables showing the change in velocity and bed shear stress at ten selected locations near Reach 7 and Reach 8 have been added to the appendix and referenced in Section 4.1.

Wave Modeling

16. Wind-wave modeling used a separate structured rectangular grid for the application of the SWAN model based on the San Francisco Bay Basic Tidal Model (Elias et al. 2013). A series of three nested grids were used to simulate the wave-generating fetches across the Bay. The nested grids varied in cell size from a large grid (330 feet by 330 feet) covering the central and south bay to a small grid near the Airport shoreline. The small grid was essentially the same grid configuration as the hydrodynamic model.

ESA RESPONSE

We concur with this summary of the wave modeling approach. The source of the model was not the San Francisco Bay Basic Tidal Model (Elias et al. 2013). Reference removed for clarity.

17. The SWAN model was applied for a range of combined depth and wind direction to evaluate storm conditions. As detailed in Sections 3.3.7 and 4.2 of the CHTR (Page 34 and Page 42), wind-wave conditions were modeled using the 100-year wind speed with a combination of three wind directions (northeast at 45 degrees, southeast at 135 degrees, and north-northwest at 335 degrees) and three water levels (mean higher high water, mean sea level, and mean lower low water). Model results for wave heights were not included in the CHTR. The inclusion of some

figures showing predicted wave heights would be useful for characterizing the wind-wave exposure and interpreting the bed shear stress results.

ESA RESPONSE

Figures [24], [26], and [28] have been added to the report, showing predicted wave heights for winds from three directions, for existing and with-project conditions.

18. The 100-year event(s) selected for the CHTR analysis were not compared to the 100-year event(s) being used by the SFO SPP design team. The CHTR indicates coordination with the design team on SLR assumptions (Page 17). Please state whether the assumptions for the storm surge and 100-year coastal flood are also consistent with the assumptions being used by the SFO SPP design team.

ESA RESPONSE

Text added to Section 3.3.7 and Section 3.4 noting that these 100-year events yield similar coastal flood conditions to the response-based approach used by the design team (COWI 2020a).

The response-based approach relies upon a multi-decadal hindcast to characterize event frequency. For this assessment of potential coastal hydraulic impacts, using a range of individual events is sufficient.

19. One significant concern relating to the wave analysis included in the CHTR is the choice of only three principal wind directions used in the Bay Wave Modeling (Section 3.3). Only north-northwest, northeast, and southeast winds were modeled (Page 34) and no discussion was provided in the CHTR for the rationale of selecting only three principal wind directions. Earlier in the CHTR, the text states that the dominant wind direction is from the west and west-northwest (Page 9). The CHTR also states that "peak winds at the airport occur in winter and tend to blow from the south" (Page 11). However, winds from the south were not included in the wave analysis. Given that the Airport experiences relatively high wind speeds from more than three directions (Figure 2), it would be appropriate to expand this analysis with several additional directions, including at least one which, although less common, is significantly less fetch limited (e.g., east-southeast). The inclusion of a figuring showing the fetch exposure for each wind direction would also be helpful for evaluating the set of scenarios selected.

ESA RESPONSE

Additional text has been added to Section 3.3.7 to clarify that winds from all directions were considered and the rationale for selecting the three directions with the largest waves that were then selected to represent extreme conditions.

The reference to the predominant wind direction in Section 2.4 (prior p. 9) is in relation to frequency of all winds, not the magnitude of extreme winds.

The text about peak winds in Section 2.4 (prior p. 11) has been revised from 'the south' to 'south of the Airport'. The largest fetch from south of the Airport occurs from approximately 135 degrees, which was included in the extreme wave modeling.

Waves become larger as they travel the full length of the bay and refract around shoreline bends such that these primary axes generate larger waves than smaller local fetches. So we do not have reason to believe that modeling additional directions, such as from the east-southeast, would substantially alter the findings of the wave analysis.

As seen in Figure [24], Figure [26], Figure [28], Table A-2, and Table A-3, the variation in wave height for the three selected wind directions is relatively small, indicating that extreme wave height is not that dependent on direction.

Also note that while only these three directions were used for the extreme wave analysis, the observed wind directions were used for the coupled hydrodynamic and wave modeling, and include other directions besides these three.

20. If additional wind directions are included, it may also be worth considering using different peak wind speeds for each direction rather than the same wind speed for all directions. The wind rose (Figure 2) suggests different peak velocities associated with each direction.

ESA RESPONSE

We used the 100-year wind magnitude independent of direction, which provides a conservative upper bound for wind speeds and resultant waves. As per response to comment #19, the three modeled wind directions are considered sufficient for purposes of this study.

21. The wave model calibration (Section 3.3.8) indicates that the “calibration” was interpolated between the stationary model runs made at “discrete intervals of wind speed, direction, and water level” (Page 36) rather than actually simulating the wind conditions during the period when the deployments took place. Ideally, the wave model should be run using the actual wind directions, speeds, and water levels that span the deployment rather than interpolating from stationary runs that do not include the full range of wind directions experienced during the deployment (Page 36). This should be done with the coupled hydrodynamic and wave model described in Section 3.4. If this is not possible, at a minimum, please provide a detailed description of how this interpolation was done and justify why you think this is an appropriate way to calibrate the wave model.

ESA RESPONSE

Text and Figure 14 [17] have been revised to show wave model results for coupled model scenario from Summer 2018.

22. For the extreme wave modeling (Figures 21 to 23), please also include figures showing significant wave height for these three extreme wind scenarios (Page 50). These could be added

to Appendix A. It is surprising that the shear stress for the winds from the southeast is generally lower than for the winds from the northwest.

ESA RESPONSE

Figures [24], [26], and [28] showing significant wave height have been added to the report. As shown in these figures, the lower bed shear stress for winds from the southeast (Figure 21 [27]) as compared to the northwest (Figure 23 [29]) is consistent with the lower predicted wave heights for wind from the southeast (Figure [26]) as compared to wind from the northwest (Figure [28]).

Bed Shear Stress and Erosion

23. The choice of units on the plotting of shear stress (psf) makes the changes in shear stress shown numerically small since the predicted changes in 2018 are generally small and on the order of 0.005 psf (e.g., Figure 18). However, Figure A-10 and Figure A-21 show predicted increases in shear stress on the order of 0.03 psf or higher along Reach 8, which is a large increase in predicted shear stress (on the order of 1.5 N/m^2). These predicted changes in bed shear stress that are much larger than the critical shear stress. As a result, there should be a meaningful discussion of whether these predicted changes in shear stress are likely to result in local scour.

ESA RESPONSE

As discussed in response to comments #8 and #9 above, the color scales have been revised to increase the resolution of plotted changes in bed shear stress. These revised plots confirm that the increases for January 2005 and adjusted January 1983 are similar to summer 2018. The exception is increased bed shear stress along a narrow strip of the shoulder of the proposed open water fill. Since the shoulder's proposed design includes rock armor revetment sufficient to prevent scour, no local scour is anticipated where the larger bed shear stress increases are predicted.

24. The critical shear stress used in this analysis was 0.0021 psf for unconsolidated mud and 0.0084 psf for consolidated mud. The predicted changes in shear stress for the storm surge and 100-year coastal flood are approximately three times higher than the critical shear stress in Reach 8. These differences appear inconsistent with the conclusion in the CHTR that changes in shear stress "are not substantial enough to affect the lower consolidated bed layer" (Page 48). Please discuss these predicted changes in bed shear stress that are greater than 0.03 psf. Are these differences significant in terms of critical shear stress?

ESA RESPONSE

As discussed in response to comments #8 and #10 above, the larger increases in bed shear stress are limited to the shoulder of the proposed open water fill. Since the shoulder's proposed design includes rock armor revetment with much higher critical shear stress than those quoted for bay mud, the larger increases in bed shear stress are not significant with regards to erosion.

25. In Figure 22, it appears that the predicted with-project shear stress (center panel) may be higher than under existing conditions along Reach 8 and that these differences may not be plotted in the right panel. Please confirm that you are not trimming out effects immediately along the with-project shoreline in the difference panels.

ESA RESPONSE

Yes, immediately along the with-project Reach 8 shoreline there is higher predicted bed shear stress along a narrow strip of the shoulder of the proposed open water fill (see comment #8 for more discussion as to reason and implications). Figure 19 [22], as well as the similar Figures 18 [21] and 20 [23], have been revised to improve visibility of the narrow strip with higher predicted bed shear stress.

26. The SPP indicates that the lighting trestles at the end of Runway 19 will be reconstructed, however there is no indication of the changes in size, location, or spacing under with-project conditions. Inclusion of these in-water structures in the hydrodynamic and wave modeling was mentioned in Sections 3.2.4 and 3.3.4, respectively. In the hydrodynamic model, lighting trestles were modeled as pillar structures. In the SWAN model, lighting trestles were specified as obstacles based on alignment and transmission coefficient. While the CHTR indicated that the lighting trestles would have a minimal impact on wave heights (Section 3.3.4), it did not discuss whether any impacts would occur based on tidal currents or shear stress. The coupled hydrodynamic and wave modeling results showed increases in bed shear stress offshore of Reach 7 in the vicinity of the lighting trestles. The trestles are not mentioned or discussed in any of the interpretation of the shear stress figures in Section 4. Please include an interpretation of the effect of the lighting trestles on shear stress for figures where there are predicted changes in shear stress in the vicinity of the trestles.

ESA RESPONSE

Along the main axis of the 19L trestle, the piling spacing will increase from about every 17 feet (existing) to every 100 feet (with-project). Description of the piling spacing for existing and proposed conditions has been added to Section 3.2.4 and Section 3.3.4.

This decrease in spacing would manifest in the hydrodynamic predictions as slightly less drag on tidal currents. Less drag would cause tidal currents to increase in velocity. However, along the 19L trestle alignment, the predicted change in velocity due to the entirety of with-project conditions (open water fill and new trestle) is to decrease tidal currents (see image below). As already explained in Section 4.1, the decrease in velocity is due to the proposed open water fill, and this effect surpasses any slight increase due to less drag from the proposed trestle. The small region of increasing velocity occurs upstream of the trestle alignment, and is thought to be caused by the slight flow constriction of the open water fill, not the decrease in trestle pile density.

Text has been added to Section 4.1 noting the lack of influence of the proposed trestle on tidal current and bed shear stress.

27. The local bathymetric changes discussed in Section 2.6.3 focuses on changes within Seaplane Harbor and does not discuss bathymetric changes along Reaches 7 and 8. Figure 5 appears to show recent shoreline erosion along Reaches 7 and 8 between 2010 and 2014; however, the modeling conclusions do not predict this. Please explain the apparent inconsistency and why the model may not be capturing this process.

ESA RESPONSE

Text added to Section 2.6.3 to discuss the bathymetric changes shown in Figure 5 along Reach 7 and Reach 8.

Figure 5 [5] shows multi-year near-shore bathymetric changes between the 2010/2014 combined data set and the 2020 data set. This type of multi-year change comparison is different than the modeling comparisons conducted for this study. Modeling for this study compares bed shear stress between existing and with-project conditions. The intent of showing the data in Figure 5 is to provide setting and context for the modeling results, not to serve as a calibration dataset for the modeling. Modeling that would provide results directly comparable to Figure 5 [5] would entail a hindcast of 2010/2014 to 2020 conditions (wind, water level and other conditions), with detailed consideration of sediment transport and erosion processes. Such modeling would require additional effort beyond what was conducted for this study.

Shoreline Wave Modeling

28. In the CHTR, XBEACH (Roelvink et al. 2009) was used to translate wave heights from the SWAN model to the shoreline along representative profiles (i.e., cross sections) at the shoreline to evaluate the effect of the proposed Bay fill on elevated bed shear stresses along the shoreline. As discussed in Section 3.5.2, two representative profiles were used for Reaches 7 and 8 based on the most recent topography and bathymetry data. For Reach 7, the representative profile was derived from a transect perpendicular to the existing shoreline, northwest of the lighting trestles. The bathymetry profile along Reach 7 varies with a gentler slope to the northwest and steeper slope to the southeast of the lighting trestles (Figure 3). The coupled hydrodynamic and wave modeling results showed increases in bed shear stress offshore of Reach 7 to the southeast of the lighting trestles. Additional details should be provided on the bathymetry differences between existing and with-project conditions, the rationale for selecting the representative profile, and the implication of these assumptions on the modeling results.

ESA RESPONSE

For the XBeach modeling, the bathymetry differences between existing and with-project conditions are best visualized in Fig. 24 [30] for Reach 7 and Fig. 28 [34] for Reach 8. Figure [7] comparing project-scale bathymetry between the existing and with-project conditions has been added.

The results of the coupled modeling show that the changes in bed shear stress due to the project mostly occurs in areas dominated by water velocity rather than wind waves. Only at right along the shoreline (e.g., Reach 8, as discussed in response to comment #8) does wave breaking cause a significant increase, but this increase is limited to areas with proposed rock armor revetment.

The cross section to represent Reach 7 was selected where the proposed open water fill extends its greatest distance from the existing shoreline. Reviewing the results (Figs. 24 to 27 [30 to 33]), shows that peak stress is occurring on the armored slope, a result that would not change by selecting another location along Reach 7.

Rationale and implications of reach selection added to report text Sect. 3.5 and 4.5.

29. As with the wave modeling, only three wind directions were modeled for the shoreline wave modeling (Page 39). Using a wider range of directions and, if appropriate, different maximum wind speeds for each direction may be important because some of the wind directions modeled are more fetch limited than other wind directions that were not modeled. The shoreline wave modeling used the largest resulting wave height from the three principal wind directions (Page 39), however wave height results were not provided. It would be helpful to provide the wind and wave condition associated with each shoreline wave model scenario.

ESA RESPONSE

See response regarding selection of wind direction and speed above in response to Comments #19 and 20. The choice of maximum wind speed (see Section 3.3) was intended to provide a conservative upper bound on resulting wave heights. Tables A-2 and A-3 were added to the appendix to provide wind and wave model outputs from the SWAN bay model that were used as inputs for shoreline wave model inputs. Review of these tables demonstrates little dependency of wave height or period on wind direction.

30. In Figure 29, there are higher predicted shear stresses under with-project conditions at a distance of -200 to -125 feet from the existing crest elevation than under existing conditions. Based on the axis scale used on this figure, these increases may have the potential to cause erosion, especially if it increases above the critical bed shear stress for erosion, but it is hard to tell from the figure since the critical shear stress for erosion is relatively small compared to the maximum shear stresses. Can you add an additional panel that shows the change in bed shear stress along these transects bayward of the armored slope? Also, additional discussion should be provided for the predicted changes in bed shear stress bayward of the armored slope since this area is erosional based on bathymetric changes shown in Figure 5. If possible, please indicate the extent for the rock armor on Figures 24 through 31. These revisions would be helpful in assessing the conclusion that "for all model runs, the mean bed shear stress for the with-project case was small and equal to the existing conditions at distances greater than approximately 25 feet from the intersection of the still water level with the shoreline structures" (Page 54).

ESA RESPONSE

In Figure 29 [35], the reviewers are referring to a relative increase in the maximum shear stress for the with-project case (lower panel 'b'). Over the region noted by reviewers, the maximum shear stress value exceeds critical shear stress for both unconsolidated and consolidated mud, as it does for a similar section of the bed that is just outboard of the existing shoreline toe (upper panel 'a', x = -50 to x = -125).

Additional figures added to the appendix (Figures A-31 to A-38) present existing, with-project, and difference (with-project minus existing) bed shear stresses for a region that covers the section noted in the comment and that extends 200 feet bayward of the armored slope. Mean and maximum bed shear stresses are plotted in two separate panels so the vertical axes can be set appropriate to the mean or maximum.

Figure A-36 provides additional detail for the model results from Figure 29 [35]. As shown in the top panel of Figure A-36, the mean bed shear stress decreases slightly over the distance x = -200 to -125. Mean shear is generally just below for the critical bed shear stress for unconsolidated mud. While there is an increase in the maximum bed shear stress for the with-project condition in this same region (Figure A-36, bottom panel), this is likely due to the particular dynamics of just the single largest wave modeled during this scenario. Somewhat higher bed shear stress due to just a single wave within an extreme event is not thought to cause substantial bed changes. And, since other indicators, such as the mean bed shear stress decreasing for this water level, and the lack of change in maximum bed shear stress for other water levels (Figure A-35, Figure A-37, and Figure A-38), do not indicate substantial erosion potential, then any small bathymetric changes by a single wave are not likely to be substantial.

While Figure 5 shows net erosion (up to one foot) in certain locations, it is not clear if this single difference represents an existing and ongoing erosional trend. Consideration of a longer period of record could indicate that the bathymetric changes in Figure 5 are consistent with a longer term trend or that they reflect seasonal and inter-annual changes in sedimentation and depositional processes. Sediment supply, predominant wind direction, and storminess vary by season and from year to year. As such, those same qualifications discussed in response to comment #27 also apply to the shoreline wave modeling presented in Figure 29 [35], with the additional caveat that the extreme conditions of the 100-year wind speed that are represented in Figure 29 [35] would only occur very infrequently and last for a short period of time.

As modeled, the extent of rock armor for Reach 7 was x = -195 feet (landward) to x = -240 feet (bayward), while for Reach 8 was x = -88 feet (landward) to x = -121 feet (bayward). These quantitative details needed to be specified in the model to account for the rock armor's roughness, but since the design is still being refined by the design team, this level of specificity is not provided directly in the modeling report text or figures. Text was added to Section 3.5.3 to describe where bed roughness changes were made in the shoreline model setup to reflect the approximate location of the rock armor and adjoining bed materials.

Minor Review Comments

1. The CHTR (Page 12) states that South bay “extends south from the San Francisco-Oakland Bay Bridge […]” There are multiple different definitions of South Bay, some of which define South Bay as starting along a line between San Leandro and Hunters Point (such that the deeper region between this line and the Bay Bridge is considered part of Central Bay). Please revise this statement to begin with “In this report, South Bay is referred to as the portion of San Francisco Bay that extends south […]”

ESA RESPONSE

The text in Section 2.6.1 is revised to define South Bay in this report.

2. Please either label the Seaplane Harbor (Page 14) and any other geographic features discussed in the figures (e.g., Figure 3 through Figure 5), or include a reference in the text of Section 2.6.2 or 2.6.3 to Figure 1 where these features are labeled.

ESA RESPONSE

Reference to Figure 1 added in Sections 2.6.2 and 2.6.3.

3. Capitalization of North Bay, south bay, and central bay is not internally consistent (Page 22). North Bay and San Pablo Bay are typically capitalized, whereas south bay and central bay are not.

ESA RESPONSE

All uncapitalized subembayment names were capitalized.

4. The sentence "Because of tidal amplification within the bay, the highest water levels predicted by the model at the Airport are 10.3 feet NAVD88." (Page 23) is a statement of the model results and does not belong in the Modeling Methods section. As explained in Comment 5 of the Hydrodynamic Modeling section, there is currently no presentation of the model calibration results for the 100-year coastal flood event or the results of the 100-year coastal flood event in the main body of the CHTR where this statement can be moved. This sentence should be included in the discussion of either the calibration results for the 100-year coastal flood event or the results of the 100-year coastal flood event when they are added to the CHTR.

ESA RESPONSE

This sentence has been moved to Section 3.2.7.1 where the results of the 100-year scenario are discussed.

5. Figures 10 through 12 appear in Section 3.3 though they belong in Section 3.2. Please move these figures back to immediately follow Figures 7 through 9 in Section 3.2.

ESA RESPONSE

The order of the figures has been revised to best accommodate page breaks and section breaks.

6. In Section 3.2.7.2, the first line uses "compares" when the term should be "compare" (Page 24).

ESA RESPONSE

Text revised as suggested.

7. In 2005, the model tends to overpredict both high and low water at all locations shown (Figure 10), while in 2018 (Figure 7) the model tends to underpredict high water. Is there an explanation for this difference?

ESA RESPONSE

In general, the model and observed water levels agree to within a half foot or less, but the model sometimes overpredicts relative to observations and sometimes underpredicted relative to observations. The reason for these differences may be due to a combination of unresolved wind setup, tidal boundary conditions, hydraulic connectivity to muted tidal or leveed-off areas, and/or bed roughness. Although a small amount of uncertainty remains in the model's predictions relative to observations, the model still provides sufficient accuracy for purposes of comparing existing and with-project bed shear stress.

8. Invalid reference to Table 7 (Page 37).

ESA RESPONSE

The hyperlink in the text properly links to Table 7 despite the error message. Error message was deleted, link tested and proved functional.

9. Table 7 (Page 38) appears in Section 3.5.1 though it belongs in Section 3.4.

ESA RESPONSE

The order of Table 7 has been revised to best accommodate page breaks and section breaks.

10. In the caption for Figure 15, "Coupied" needs to be corrected to "Coupled."

ESA RESPONSE

The misspelling in the caption of Figure 15 [18] has been corrected.

11. Please move the legend in Figure 29 and Figure 31 to the upper left-hand side so that it does not cover the lines that are plotted on these figures.

ESA RESPONSE

The legend location has been revised for Figures 28 [34], 29 [35], and 31 [37].

References

Anchor QEA, LLC, 2021. Key Questions for SFO Shoreline Protection Program Coastal Hydrology Study, Memorandum, February 15, 2021.

Deltares NL, 2019. San Francisco Bay-Delta Community Model website. Modeling files for Bay-Delta 2D Model. Accessed: August 9, 2019. Available at: www.d3d-baydelta.org.

Elias, E., J. Hansen, and L.H. Erikson, 2013. San Francisco Bay Basic Tide Model. Modeling files for Bay-Delta 2D model. Accessed: August 9, 2019. Available at: https://www.usgs.gov/media/files/san-francisco-bay-basic-tide-model.

ESA (Environmental Sciences Associates, Inc.), 2020. SFO Shoreline Protection Program Coastal Hydrology Technical Report Scope of Work. July 2020.

ESA, 2021. *San Francisco International Airport Shoreline Protection Program Coastal Hydraulics Technical Report*. July 2021.

Roelvink, D, A. Reniers, A. van Dongeren, J. van Thiel de Vries, R. McCall, and J. Lescinski, 2009. "Modelling storm impacts on beaches, dunes and barrier islands." *Coastal Engineering* 56(11-12):1133–1152. DOI: http://dx.doi.org/10.1016/j.coastaleng.2009.08.006.

TU Delft, 2019. Swan Scientific and Technical Documentation. SWAN Cycle III Version 41.31. Delft University of Technology, Technical Documentation, Delft, Netherlands. Available at: http://swanmodel.sourceforge.net/.

Intentionally blank

Appendix B2

Anchor QEA: Final Review of SFO Shoreline Protection Program Coastal Hydrology Technical Report (November 2021)

130 Battery Street, Suite 400
San Francisco, California 94111
415.230.0862

ANCHOR QEA

Memorandum

November 30, 2021

To: David Kim, PhD, San Francisco International Airport

From: Michael L. MacWilliams, PhD, PE

cc: Matt Brennan, PhD (ESA), Eryn Brennan (ESA)

Re: Final Review of SFO Shoreline Protection Program Coastal Hydrology Technical Report

Overview

As part of the San Francisco International Airport (SFO or Airport) Shoreline Protection Program (SPP), Environmental Science Associates, Inc., (ESA) prepared the Draft 2 Coastal Hydrology Technical Report (CHTR; ESA 2021a) in July 2021. The purpose of the CHTR is to analyze various coastal process-related issues and support the California Environmental Quality Act (CEQA) environmental review and regulatory permitting process for the SFO SPP. Anchor QEA, LLC, is acting in an advisory capacity to SFO to provide an independent peer review of the CHTR. Anchor QEA previously reviewed ESA's scope of work for the CHTR (ESA 2020) to identify key questions that the CHTR should address to support the CEQA and regulatory permitting process (Anchor QEA 2021a).

In July 2021, Anchor QEA provided a technical review of the Draft 2 CHTR (Anchor QEA 2021b). That technical review included a description of our understanding of the project and purpose of the CHTR, so those elements are not included in this final review. In November2021, ESA provided a revised version of the CHTR (ESA 2021b), as well as responses to Anchor QEA's technical review comments in Appendix B1 to the CHTR). This memorandum documents Anchor QEA's final review of ESA's revised CHTR (2021b).

Technical Review of the CHTR

The technical review (Anchor QEA 2021b) provided suggestions to improve the analysis and presentation of results in the CHTR to better provide the information needed to make a determination of the significance of impacts of the SPP as part of the CEQA assessment. The technical review comments addressed the following topics:

- Setting and Methods
- Hydrodynamic Modeling
- Wave Modeling
- Bed Shear Stress and Erosion
- Shoreline Wave Modeling
- Minor Review Comments

ESA's responses to these comments were provided in Appendix B1 of the revised CHTR (ESA 2021b).

Final Review of the CHTR

This final review focuses on revisions made to the CHTR (ESA 2021b) based on the technical review comments provided by Anchor QEA (Anchor QEA 2021b). The following subsections summarize the changes made to address technical review comments. Page, section, and figure numbers in the following review comments correspond to numbering in the revised CHTR (ESA 2021b) unless otherwise noted.

Setting and Methods

The primary concern of technical review comments related to setting and methods (Comments 1 to 3) pertained to the rationale for selecting 3.5 feet of sea level rise (SLR) for the functional lifespan of the project. Based on the SLR planning guidance cited in the CHTR from the Ocean Protection Council (OPC; 2020) and the City and County of San Francisco (2020), 3.5 feet of SLR is less than is recommended to be used for 2085 for a medium-high risk aversion scenario (OPC 2018). In response, additional explanation was added to Section 2.7 of the CHTR to provide a more detailed rationale that includes the basis for the selection for the 3.5 feet of SLR based on the FEMA accreditation criteria and puts this value in context relative to the OPC (2018) recommendations. This revision to Section 2.7 addresses the technical review comment related to providing additional rationale for the basis of the SLR analysis. The other minor revisions made to this section were sufficient to address the other technical review comments related to the setting and methods section of the CHTR.

Hydrodynamic Modeling

Coupled hydrodynamic and wave modeling was conducted to evaluate velocities and bed shear stresses during representative tidal conditions (summer 2018), storm surge conditions (January 2005), the 100-year coastal flood condition (January 1983), and SLR conditions. The primary issues from the technical review of the hydrodynamic modeling (Comments 4 to 15) pertained to the lack of results or discussion for the January 1983 model calibration, January 2005 storm surge conditions, 100-year coastal flood condition, and SLR conditions. For the hydrodynamic modeling, revisions to the CHTR and Appendix A included the following:

- Additional water-level calibration results for the January 1983 event (Tables 6 and A-1; Figures 13 and 14)
- Revised color scales for bed shear stress to allow easier comparisons among the modeled conditions (Figures A-9, A-10, A-15, A-16, A-21, A-22, A-27, and A-28)
- New discussion on increases in bed shear stress along Reach 8 (page 52)
- New with-project bathymetry change figure (Figure 7)
- New velocity and bed shear stress comparisons (Tables A-4 and A-5)

These revisions substantially address the hydrodynamic modeling technical review comments.

Wave Modeling

The wave modeling was conducted to determine the extreme wind-wave heights and wave-induced bed shear stresses. The main concern from the technical review of the wave modeling (Comments 16 to 22) was the choice of only three principal wave directions (northeast at 45 degrees, southeast at 135 degrees, and north-northwest at 335 degrees) that did not include winds from the south, which occur less frequently during winter storms but have the highest wind speeds (Section 2.4). In response, revisions to the CHTR and Appendix A included model wave height results (Section 4.2; Figures 24, 26, and 28; Tables A-2 and A-3) as suggested. Additionally, the wave model calibration was updated using the coupled wave and hydrodynamic model. These revisions address most of the technical review comments on the wave modeling. Further justification for the selection of the three wind directions used in the analysis was added to Section 3.3.7. Although no other wind directions or fetch analyses were included in the revised CHTR as suggested by Anchor QEA (2021b), this additional analysis is unlikely to result in material impacts to the conclusions of the wave analysis.

Bed Shear Stress and Erosion

The technical review comments for bed shear stress and erosion (Comments 23 to 27) pertained to the presentation of modeling results to allow easier interpretation of the importance of the with-project changes in bed shear stress. Most of the technical review comments about bed shear stress and erosion were addressed by revisions to the hydrodynamic modeling results. Additional revisions were made to address comments related to the proposed lighting trestle (Sections 3.2.4 and 3.3.4) and bathymetry changes (Section 2.6.3). Lastly, the shear stress figures were revised, and additional discussion of changes in shear stress immediately adjacent to the shoreline was added in Section 4.1. To summarize these changes, a sentence was inserted in Section 1.3 to outline the areas where rock armor revetment will be included in the design. These revisions substantially address the technical review comments related to bed shear stress and erosion.

Shoreline Wave Modeling

The main concern from the technical review of the shoreline wave modeling (Comments 28 to 30) was the uncertain spatial extents of the rock armor revetment in front of the proposed fill in relation to the region with predicted increases in shear stress. In response, revisions were made to Sections 3.5 and 4.3 of the CHTR, and new figures were added to Appendix A that show model results focusing on the bed shear stresses in front of the proposed fill (Figures A-31 to A-38).

ESA's response regarding the extent of the rock armor included a general description of the modeled rock armor extents "from the floodwall crest to toe of fill" in Section 3.5.3 and the horizontal distances of the modeled rock armor extents in Appendix B1 (Comment 30). However, the higher-stress region in the with-project case based on Figures A-31 to A-38 is located bayward of the rock armor extent described in ESA's response to Comment 30. While the assumptions used for the modeled rock armor extents affect the shoreline wave modeling results, Section 1.4, Report Limitations, states that "Construction method and long-term stability of the open water fill are assumed to be addressed by the proposed project's construction specification and engineering design plans." Hence, these analyses are sufficient for the purposes of the CHTR, but the extent of rock armoring should be further evaluated as part of the final design.

Minor Review Comments

All minor review comments were addressed in the revised CHTR.

References

Anchor QEA (Anchor QEA, LLC), 2021a. Memorandum to Key Questions for SFO Shoreline Protection Program Coastal Hydrology Study, Memorandum, February 15, 2021.

Anchor QEA, 2021b. Technical Review of SFO Shoreline Protection Program Coastal Hydrology Technical Report, Memorandum, July 21, 2021.

CCSF (City and County of San Francisco), 2020. *Sea-Level Rise Vulnerability and Consequence Assessment*.

ESA (Environmental Sciences Associates, Inc.), 2020. SFO Shoreline Protection Program Coastal Hydrology Technical Report Scope of Work. July 2020.

ESA, 2021a. *Draft 2 San Francisco International Airport Shoreline Protection Program Coastal Hydraulics Technical Report*. July 2021.

ESA, 2021b. *Screencheck 3 San Francisco International Airport Shoreline Protection Program Coastal Hydraulics Technical Report*. November 2021.

OPC (Ocean Protection Council), 2018. *State of California Sea-Level Rise Guidance, 2018 Update*. Approved by Ocean Protection Council on March 14, 2018. Available at: https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf.

OPC, 2020. *Strategic Plan to Protect California's Coast and Ocean 2020–2025*. February 2020. Available at: https://www.opc.ca.gov/webmaster/ftp/pdf/2020-2025-strategic-plan/OPC-2020-2025-Strategic-Plan-FINAL-20200228.pdf.

APPENDIX H
Air Quality Analysis for EIR Alternatives

ESA

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900 phone
415.896.0332 fax

esassoc.com

memorandum

date	March 2, 2022
to	Michael Li, Senior Environmental Planner, San Francisco Environmental Planning Division
from	Brian Schuster, Cheri Velzy, and Sarah Patterson, ESA
subject	SFO Shoreline Protection Program – Air Quality Analysis for EIR Alternatives

Introduction

This memorandum provides supplementary technical information for the evaluation of air quality impacts in the San Francisco International Airport (SFO) Shoreline Protection Program Draft EIR alternatives analysis. California Environmental Quality Act (CEQA) Guidelines section 15126.6(a) states that an EIR must describe and evaluate a reasonable range of alternatives to a proposed project that would feasibly attain most of the project's basic objectives but avoid or substantially lessen any identified significant adverse environmental effects of the project. CEQA Guidelines section 15126.6(e)(1) further specifies that the specific alternative of "no project" shall also be evaluated along with its impact. Accordingly, SFO Shoreline Protection Program Draft EIR Chapter 6, *Alternatives*, examines a reasonable range of alternatives to the proposed project, including the No Project Alternative. The Draft EIR determines that the proposed project would result in either no impacts, less-than-significant impacts, or impacts that can be reduced to a level of less than significant with mitigation related to all but one environmental impact category. Draft EIR Section 4.C, *Air Quality*, identifies that Impact AQ-3 would be significant and unavoidable even after implementation of mitigation measures:

- Impact AQ-3: Construction of the proposed project would generate ozone precursors and would result in a cumulatively considerable net increase in criteria air pollutants for which the proposed project area is in non-attainment under an applicable federal or state ambient air quality standard.

Specifically, Draft EIR Section 4.C, *Air Quality*, finds that the proposed project would result in significant NO_X emissions. Emissions from all other criteria air pollutants were found to be less than significant. Therefore, this memorandum focuses solely on the NO_X emissions from the EIR alternatives and does not discuss other criteria air pollutant emissions.

The following alternatives were selected for detailed analysis in the Draft EIR:

- Alternative A: No Project
- Alternative B: Reaches 7 and 8 Extended Construction Duration
- Alternative C: No Vehicle Service Road Relocation for Reaches 7, 8, 11, 13, and 14
- Alternative D: Less-Barge/More-Truck Construction Scenario

- Alternative E: Reach 7 Lower Wall Height
- Alternative F: Minimize Wetland Fill

Detailed descriptions of each alternative are presented in the *Analysis* section below, including the assumptions used in analyzing the impacts of each alternative as it relates to air quality. While certain alternatives, such as Alternative B and Alternative D, were developed to reduce the significant impact related to NO_X emissions during construction of the project identified in the Draft EIR, the development of the alternatives was also informed by additional environmental considerations, including but not limited to reducing less-than-significant and less-than-significant-with-mitigation impacts related to biological resources and hydrology and water quality identified in the Draft EIR. Nonetheless, each of the selected alternatives would result in air quality effects that would differ from (e.g., reduce) those of the proposed project. This memo does not evaluate the feasibility of the alternatives or their ability to attain the objectives of the proposed project. These topics are addressed in Draft EIR Chapter 6, *Alternatives*.

Analysis

Alternative A: No Project

As required by CEQA, the Draft EIR evaluates a No Project Alternative to allow decision-makers to compare the environmental effects of approving the project with the effects of not approving the project. Alternative A, the No Project Alternative, represents what would reasonably be expected to occur in the foreseeable future if the project was not implemented.

Under this alternative, SFO would not install a new shoreline protection system around the Airport that would comply with current Federal Emergency Management Administration (FEMA) requirements for flood protection against a 100-year flood. Under this alternative, the existing shoreline protection features on the perimeter of the Airport, which include a combination of concrete walls, sheet pile walls, concrete debris, armor rocks, sandbags, K-rails, tidal flats, embankment walls/dikes, and earthen and vegetated berms, which FEMA determined are not adequate to prevent inundation during a 100-year flood, would remain.

Under Alternative A, SFO would continue to monitor shoreline conditions and the performance of existing shoreline protection features on the perimeter of the Airport. If required to protect public safety and/or aircraft operations from a sudden risk of exposure (e.g., from an unusually strong storm season resulting in accelerated shoreline erosion), SFO would implement temporary emergency shoreline protection measures, which could include placement of sandbags, rock, and/or longer-term measures if authorized by the agencies with environmental regulatory jurisdiction for the project.

Criteria air pollutant emissions, including NO_X, would result from these temporary emergency shoreline protection measures. These emissions would result from any fuel-burning activity, including maintenance and construction worker commute vehicle trips, on-road truck activity (such as trucks delivering sandbags, rocks, or other material and equipment), off-road equipment activity (such as forklifts or cranes placing material), and marine equipment activity if needed (such as for crew boat surveys or in-water maintenance support). Although the No Project Alternative would likely result in more temporary emergency shoreline protection measures than the proposed project over time, it is anticipated that criteria air pollutant emissions associated with these activities would be minor compared with the emissions associated with construction of the proposed project, and they would also be spread out over a much longer timeframe (i.e., decades) than the proposed project’s 7-year construction period. This would result in much lower average daily emissions than those estimated for construction activities associated with the proposed project.

Alternative B: Reaches 7 and 8 Extended Construction Duration

The purpose of Alternative B is to reduce the average daily NO_X emissions resulting from project construction by extending the length of construction activities for Reaches 7 and 8. Under this alternative, construction of Reach 7 would be extended from a duration of approximately three years (from June 2025 to March 2028) to approximately six years (from June 2025 to March 2031), and construction of Reach 8 would be extended from a duration of approximately one year and six months (from November 2027 to June 2029) to approximately two years and six months (from November 2027 to June 2030). The length of construction for all other reaches would remain the same as for the proposed project under this alternative.

NO_X emissions for this alternative were calculated by evenly distributing emissions for Reaches 7 and 8 over their entire new construction durations. This assumes that the same total construction activity would occur for both Reaches 7 and 8, just over a longer timeframe, thereby reducing the intensity (i.e., average daily) of emissions. Total NO_X emissions for both reaches do not change under Alternative B. For example, under the proposed project, construction of Reach 7 would result in a total of 496 tons of NO_X emissions from 2025 to 2028; under Alternative B, construction of Reach 7 would result in the same total of 496 tons of NO_X emissions, but emissions would occur from 2025 to 2031. This has the effect of lowering average daily emissions for Reach 7 from 2025 to 2028 as compared to the proposed project, even while the total emissions remain the same. The same approach was taken for Reach 8. It was assumed that emission factors associated with off-road construction equipment and on-road trucks would not change in the future years when construction activities would be extended; this represents a conservative assumption because emission factors are likely to decline due to increasing fuel efficiency and incorporation of more stringent engine emissions standards.

Alternative C: No Vehicle Service Road Relocation

A vehicle service road is a designated roadway on an airfield for use by ground vehicles. The existing vehicle service road for Reaches 7–11, 13, and 14 does not meet existing Federal Aviation Administration (FAA) taxiway and taxilane object-free area standards. To meet FAA airport design standards, under the proposed project, the existing vehicle service road would be relocated for Reaches 7–11, 13, and 14 outside of the primary object free zone, a critical airspace surface, and would follow the proposed shoreline protection system along Reach 7. The relocation of the vehicle service road would require the placement of approximately 11.24 acres of bay fill for Reaches 7, 8, 11, 13, and 14.

Under Alternative C, the vehicle service road for Reaches 7, 8, 11, 13, and 14 would not be relocated. This alternative is intended to reduce the amount of open water fill in the bay required to construct the proposed project. As presented in Draft EIR Chapter 2, *Project Description*, the proposed shoreline protection system for Reaches 1–16 would require the placement of approximately 26 acres of open water fill in the bay along various reaches. By not relocating the vehicle service road, the amount of open water fill in the bay would be reduced by approximately 11.24 acres (43 percent) compared to the proposed project.

Without the vehicle service road relocation, the construction equipment and intensity required for construction of Reaches 11 and 13 would be similar to that required for Reach 6, per linear foot. Construction activities for Reach 6 include site prep, berm/soil/riprap removal, demolition of the vinyl wall, sheet pile installation on land, cap beam installation on land, placement of riprap, pipe outlet removal and reattachment, road resurfacing, and general ongoing site services. NO_X emissions associated with construction of Reaches 11 and 13 were scaled to those of Reach 6 by calculating the emissions per linear foot of Reach 6, and then multiplying that value by the length in feet of Reaches 11 and 13, respectively, to obtain a total emissions value for Reaches 11 and 13 under this alternative. This was done for all NO_X emissions sources, including on-road trucks and off-road equipment. For example, NO_X emissions for Reach 6 total 11.3 pounds per day. This value divided by the 3,000-foot length of Reach 6 results in 0.0038 pounds of NO_X per foot, on a daily basis. The value of 0.0038 pounds/foot/day of NO_X was then multiplied by the 4,300-foot length of Reach 13, resulting in a value of 16.2 pounds per day of NO_X for Reach 13 under this alternative. These equations are shown below:

- 11.3 pounds/day NO_X ÷ 3,000 feet Reach 6 length = 0.0038 pounds/foot/day NO_X
- 0.0038 pounds/foot/day NO_X * 4,300 feet Reach 13 length = 16.2 pounds/day NO_X

Table 1 shows the lengths of the reaches affected by this alternative.

TABLE 1
WALL LENGTHS OF AFFECTED REACHES (ALTERNATIVE C)

Reach No.	Reach Name	Length of Wall (feet)
6	Superbay	3,000
11	Runway 28R	3,300
13	Runway 28L	4,300

Reaches 7 and 8 involve marine equipment, some of which would be used in for placement of fill. To account for the decrease in marine equipment activity associated with the decrease in fill that would be needed to relocate the vehicle service road, marine emissions were estimated by applying the ratio of fill required without vehicle service road relocation to the fill required for the proposed project, as shown below:

- Reach 7 fill required for the proposed project = 11.28 acres
- Reach 7 fill required without vehicle service road relocation = 9.68 acres
- 9.68 ÷ 11.28 = 86 percent (a 14 percent reduction)
- Reach 8 fill required for the proposed project = 4.44 acres
- Reach 8 fill required without vehicle service road relocation = 1.41 acres
- 1.41 ÷ 4.44 = 32 percent (a 68 percent reduction)

Alternative D: Less-Barge/More-Truck Construction Scenario

The purpose of Alternative D is to reduce average daily NO_X emissions resulting from marine equipment used during project construction by reducing the amount of barge activity for construction of Reaches 7–9. Under Alternative D, some materials that would be transported by barge during work at Reaches 7, 8, and 9 under the proposed project would be transported by truck. Materials assumed to travel by truck instead of by barge in this alternative include sand fill, soil grouting material, and sheet piles. Alternative D does not eliminate all barge movement of material; barging of material would still be required for dredging disposal and for materials brought to the vendor prior to trucking it to the project site.

To estimate NO_X emissions associated with trucking these materials instead of transporting them by barge, an inventory of trucking emissions associated with material movement for the proposed project was used. Sand fill, soil grout, and sheet piles are transported by land (via trucks) as part of the proposed project. For these materials, the total quantity of material trucked, and the associated total emissions from trucking, were used to develop an "emission factor" for each material type in the form of emissions per unit material transported by truck (e.g., *x* pounds of NO_X per cubic yard of soil grout trucked). These "emission factors" were applied to the corresponding quantity of each material type that would be transported by truck instead of by barge under Alternative D in order to estimate new trucking-related emissions for this alternative. To estimate total NO_X emissions for Alternative D, these new trucking emissions were added to all off-road and on-road construction emissions for the proposed project, as well as the marine/barge emissions that could not be eliminated under this alternative.

Alternative E: Reach 7 Lower Wall Height

Under Alternative E, the shoreline protection system for Reach 7 would be built at the existing berm, resulting in a reduced wall height as compared to the proposed project. This alternative would substantially reduce the amount of fill in the bay compared to the proposed project. If the shoreline protection system for Reach 7 was built at the existing berm, the height of the wall would be limited to 6.5 feet, as opposed to 13.5 feet for the proposed project. Hence, the shoreline protection system would be 7 feet lower than under the proposed project. As presented in Draft EIR Chapter 2, *Project Description*, the proposed shoreline protection system for Reaches 1–16 would require the placement of approximately 26 acres of open water fill in the bay along various reaches. By building the shoreline protection system for Reach 7 at the existing berm, the amount of open water fill in the bay would be reduced by approximately 11.28 acres (43 percent) compared to the proposed project.

The construction equipment and intensity of Reach 7 under Alternative E would be similar to Reach 6, per linear foot. As discussed above, construction activities for Reach 6 include site prep, berm/soil/riprap removal, demolition of the vinyl wall, sheet pile installation on land, cap beam installation on land, placement of riprap, pipe outlet removal and reattachment, road resurfacing, and general ongoing site services. Reach 7 NO_X emissions were scaled by multiplying the Reach 6 emissions per foot by the length of Reach 7 to represent the construction emissions from that reach with the reduced wall height.

Table 2 shows the lengths of the reaches affected by this alternative.

TABLE 2
WALL LENGTHS OF AFFECTED REACHES (ALTERNATIVE E)

Reach No.	Reach Name	Length of Wall (feet)
6	Superbay	3,000
7	Runway 19 End	3,900

Alternative F: Minimize Wetland Fill

As described in Draft EIR Chapter 2, *Project Description*, Reach 2 begins at the intersection of North Access Road and North Field Road and wraps around the northeastern boundary of the Airport's Mel Leong Treatment Plant before terminating along the south-facing shoreline of Seaplane Harbor. Due to its varying water levels and different shoreline orientations, Reach 2 is divided into three sub-reaches (Sub-reaches 2A, 2B, and 2C). The proposed project would remove the existing shoreline protection features at Reach 2 and construct a new shoreline protection system consisting primarily of steel sheet pile walls. Under the proposed project, a new 26-

foot-wide roadway, not accessible by the public, also would be constructed along the perimeter of Reach 2 to allow construction access for installation of the steel sheet pile walls. The roadway also would support fire safety access for the Mel Leong Treatment Plant and would improve internal roadway connectivity in this area of the Airport.

Construction of Sub-Reach 2B would require the placement of approximately 1.68 acres of fill in seasonal (approximately 1.66 acres) and tidal (approximately 0.02 acre) wetlands located north of the treatment plant for the new 26-foot-wide roadway and a newly graded ground surface that would be used as a construction staging area for the proposed project, which would remain after project construction, as noted above. The proposed roadway would require 0.49 acre of fill in the seasonal wetlands, and the newly graded ground surface would require 1.19 acres of fill in the seasonal and tidal wetlands.

Under Alternative F, the new 26-foot-wide roadway would be constructed along the perimeter of Reach 2, but the newly graded ground surface would not be implemented. Consequently, the volume of wetland fill under this alternative would be reduced by approximately 1.19 acres (70 percent) compared to the proposed project. For the proposed project, this fill activity occurs during the Reach 2 Fill subphase of Reach 2 construction. This subphase consists of filling the low spots of the reach to create a more level ground. The fill material would be sand, which would be shipped in from a barge and placed by conveyor on the Seaplane Lagoon end of Reach 2. Once placed, the fill will be moved locally by loaders, dozers, or excavators to the appropriate area. To estimate criteria pollutant emissions associated with Reach 2 under Alternative F, NO_X emissions associated with construction of the Reach 2 Site Prep, Reach 2 Grading, Reach 2 Fill, Reach 2 Gravel, and Reach 2 Clear and Grub subphases of Reach 2 were reduced by 70 percent from the proposed project. The 70 percent reduction represents the reduction in the amount of fill acres under this alternative (0.49 acre) versus the amount of fill under the proposed project (1.68 acres). This was done for emissions from both on-road truck trips and off-road construction equipment activity. There are no marine emissions for the five Reach 2 subphases affected by this alternative, so marine emissions remain the same as those for the proposed project.

In addition, by not creating the newly graded ground surface, this alternative would not allow for implementation of the construction staging area, thus diverting more trucks to the northern staging areas, particularly Plot 16D (see Figure 2-50, Construction Staging Areas, in Chapter 2, *Project Description*). However, the air quality analysis for the proposed project did not model truck travel to the Reach 2 staging area, only to the Aviador Lot and to Plot 16D. Therefore, Alternative F would not change emissions associated with on-road truck travel as modeled for the proposed project.

Results

Tables 3 through 6 present NO_X emissions for the proposed project and each of the five alternatives listed above, in addition to two control scenarios: the Best-Case Mitigated Scenario, and Likely Mitigated Scenario. The analysis represents construction activities occurring without any emissions controls (such as Tier 4 construction equipment engines) and relies on model default values for emission rates. Given the uncertainties in the availability of specific emissions control technologies during the project's construction from 2025 to 2031, two control scenarios were evaluated. The Best-Case Mitigated Scenario represents the maximum potential emission reductions given current and anticipated future emissions control technologies and assumes 100 percent compliance with Tier 4 Final off-road emissions standards, electric equipment for certain small pieces of construction equipment, 100 percent Tier 4 Final marine vessel engines, 100 percent model year 2018 or newer heavy-duty trucks, 30 percent electric heavy-duty trucks and 20 percent natural gas heavy-duty trucks, a 2-minute idling limit for all vehicles, and 100 percent electric worker shuttles. The Likely Mitigated Scenario accounts for uncertainties in the ability to meet the mitigation measure (e.g., the feasibility of obtaining equipment) and assumes 90 percent compliance with Tier 4 Final off-road emissions standards, 100 percent Tier 3 marine vessel engines, 100 percent model year 2018 or newer heavy-duty trucks, default fleet electric and natural gas heavy-duty trucks from the California Air Resources Board's 2021 EMission FACtor (EMFAC2021) model, a 2-minute idling limit for all vehicles, and 100 percent electric worker shuttles.

The tables presented below include:

- **Table 3:** Average daily construction NO_X emissions for the proposed project and each alternative by year.
- **Table 4:** Average daily controlled construction NO_X emissions under the Best-Case Mitigated Scenario for the proposed project and each alternative by year.
- **Table 5:** Average daily controlled construction NO_X emissions under the Likely Mitigated Scenario for the proposed project and each alternative by year.
- **Table 6:** Maximum Average Daily Construction NO_X Emissions for the Proposed Project and Alternatives

TABLE 3
AVERAGE DAILY CONSTRUCTION NO_X EMISSIONS FOR THE PROPOSED PROJECT AND ALTERNATIVES BY YEAR

	Average Daily NO_X Emissions (pounds/day)					
Year	**Proposed Project**	**Alternative B: Reaches 7 and 8 Extended Construction Duration**	**Alternative C: No Vehicle Service Road Relocation for Reaches 7, 8, 11, 13, and 14**	**Alternative D: Less-Barge/ More-Truck Construction Scenario**	**Alternative E: Reach 7 Lower Wall Height**	**Alternative F: Minimize Wetland Fill**
2025	**216.7**	129.3	**197.2**	**207.1**	57.6	**210.1**
2026	168.8	130.1	155.0	160.5	57.4	168.8
2027	186.0	107.1	158.8	176.4	58.8	186.0
2028	141.0	107.5	106.6	132.5	**101.3**	141.0
2029	51.8	**148.2**	35.4	50.5	51.8	51.8
2030	46.0	133.7	32.0	46.0	46.0	46.0
2031	27.8	82.1	31.2	27.8	27.8	27.8
Percent Reduction in Maximum Year Emissions compared to Proposed Project's Maximum Year NO_X Emissions (2025)	=	-32%	-9%	-4%	-53%	-3%

ABBREVIATIONS:

NO_X = oxides of nitrogen; vs. = versus; VSR = vehicle service road

NOTE:

Bold values are the maximum year of NO_X emissions for the proposed project and each alternative.

TABLE 4
AVERAGE DAILY CONTROLLED CONSTRUCTION NO_X EMISSIONS FOR THE PROPOSED PROJECT AND ALTERNATIVES BY YEAR – BEST-CASE MITIGATED SCENARIO

	Average Daily NO_X Emissions (pounds/day)					
Year	**Proposed Project**	**Alternative B: Reaches 7 and 8 Extended Construction Duration**	**Alternative C: No Vehicle Service Road Relocation for Reaches 7, 8, 11, 13, and 14**	**Alternative D: Less-Barge/ More-Truck Construction Scenario**	**Alternative E: Reach 7 Lower Wall Height**	**Alternative F: Minimize Wetland Fill**
2025	**63.6**	38.3	**58.2**	**59.8**	18.2	**61.5**
2026	49.2	38.9	45.4	46.1	18.5	49.2
2027	51.8	30.0	45.0	48.3	17.1	51.8
2028	40.1	30.7	31.5	36.8	**30.2**	40.1
2029	19.1	**47.1**	11.2	18.6	19.1	19.1
2030	17.0	40.9	10.9	17.0	17.0	17.0
2031	9.9	24.8	10.7	9.9	9.9	9.9
Percent Reduction in Maximum Year Emissions compared to Proposed Project's Maximum Year NO_X Emissions (2025)	—	-26%	-8%	-6%	-53%	-3%

ABBREVIATIONS:

NO_X = oxides of nitrogen; vs. = versus; VSR = vehicle service road

NOTE:

Bold values are the maximum year of NO_X emissions for the proposed project and each alternative.

TABLE 5
AVERAGE DAILY CONTROLLED CONSTRUCTION NO_X EMISSIONS FOR THE PROPOSED PROJECT AND ALTERNATIVES BY YEAR – LIKELY MITIGATED SCENARIO

	Average Daily NO_X Emissions (pounds/day)					
Year	Proposed Project	Alternative B: Reaches 7 and 8 Extended Construction Duration	Alternative C: No Vehicle Service Road Relocation for Reaches 7, 8, 11, 13, and 14	Alternative D: Less-Barge/ More-Truck Construction Scenario	Alternative E: Reach 7 Lower Wall Height	Alternative F: Minimize Wetland Fill
2025	**182.3**	102.2	**162.8**	**167.2**	30.8	**178.9**
2026	136.4	103.3	122.7	123.9	31.2	136.4
2027	157.3	85.7	131.5	143.5	37.1	157.3
2028	123.3	96.6	82.0	110.1	**86.8**	123.3
2029	39.3	**129.5**	22.1	37.5	39.3	39.3
2030	35.4	112.1	18.2	35.4	35.4	35.4
2031	21.6	66.1	17.6	21.6	21.6	21.6
Percent Reduction in Maximum Year Emissions compared to Proposed Project's Maximum Year NO_X Emissions (2025)	–	-29%	-11%	-8%	-52%	-2%

ABBREVIATIONS:

NO_X = oxides of nitrogen; vs. = versus; VSR = vehicle service road

NOTE:

Bold values are the maximum year of NO_X emissions for the proposed project and each alternative.

TABLE 6
MAXIMUM DAILY CONSTRUCTION NO_X EMISSIONS FOR THE PROPOSED PROJECT AND ALTERNATIVES

	Average Daily NO_X Emissions (pounds/day)[a]					
Scenario	Proposed Project	Alternative B: Reaches 7 and 8 Extended Construction Duration	Alternative C: No Vehicle Service Road Relocation for Reaches 7, 8, 11, 13, and 14	Alternative D: Less-Barge/ More-Truck Construction Scenario	Alternative E: Reach 7 Lower Wall Height	Alternative F: Minimize Wetland Fill
Unmitigated Scenario	216.7	148.2	197.2	207.1	101.3	210.1
Percent Decrease from Proposed Project	—	**32%**	**9%**	**4%**	**53%**	**3%**
Best-Case Mitigated Scenario	63.6	47.1	58.2	59.8	30.2	61.5
Percent Decrease from Proposed Project	—	**26%**	**8%**	**6%**	**53%**	**3%**
Likely Mitigated Scenario	182.3	129.5	162.8	167.2	86.8	178.9
Percent Decrease from Proposed Project	—	**29%**	**11%**	**8%**	**52%**	**2%**

ABBREVIATIONS:

NO_X = oxides of nitrogen; vs. = versus; VSR = vehicle service road

[a] The values shown are for the year in which the maximum emissions would occur. For example, Alternative B's maximum unmitigated emissions occur in 2029, while the proposed project's maximum unmitigated emissions occur in 2025.

INTENTIONALLY BLANK

APPENDIX I

CEQA Analysis – Estimation of Project Travel Demand during Construction Activities

MEMORANDUM

Date: November 22, 2021

To: Michael Li, San Francisco Planning Department
Jenny Delumo, San Francisco Planning Department

From: Luba Wyznyckyj, LCW Consulting

Subject: SFO Shoreline Protection Program CEQA Analysis – Estimation of Project Travel Demand during Construction Activities (Planning Case Number 2020-004398ENV)

This memorandum summarizes the methodology and the vehicular traffic volume information used in the quantitative and qualitative construction impact analysis for the proposed project. The traffic volumes are based on information provided by San Francisco International Airport (SFO)/COWI in the spreadsheets titled "EIR Data Requested Information Rev 4" and "Construction Sequencing for Reaches Rev 1-3_10_2021", and the EIR Data Request Summary Report dated December 16, 2020 (see attachment 1).

Travel demand for construction of the proposed project was based on preliminary construction information provided by the project sponsor, including average daily and total trucks and workers by work phase for Reaches 1 through 15, which are being analyzed at a project level. Information for Reach 16, which is being analyzed at a program level, has not been developed; therefore, travel demand for Reach 16 is not included in this memorandum.

The construction information was provided by SFO/COWI for each of the 15 reaches comprising the proposed project, of which seven would be constructed during the daytime (Reaches 1 through 6 and Reach 15) and eight would be constructed during the nighttime hours (Reaches 7 through 14). Construction of the reaches would occur over an approximately 78-month period between June 2025 and November 2031, and construction of the reaches would overlap (see attachment 1). Figures A-1 and A-2 in attachment 7 present the project location and reach locations, respectively.

Eight staging areas for construction materials (e.g., steel sheet piles, riprap, base rock, forms, templates, sand) and sorting of demolition debris were identified for construction of the proposed project. Six of the eight construction staging areas are located on Airport property adjacent to the project site and range between 0.26 to 5.28 acres. The Aviador Lot is a 2.5-acre construction staging area located on Airport property west of U.S. 101 in the City of Millbrae. Plot 16D is a 4-acre construction staging area located on Airport property north of the U.S. 101/I-380 Interchange in the City of South San Francisco. For purposes of this analysis, the Plot 16D construction staging area was determined to be the primary staging area for construction materials and demolition debris generated during construction of Reaches 1–8, while the Aviador Lot construction staging area was determined to be the primary staging area for construction materials and demolition debris generated during construction of Reaches 9–15.

The 15 shoreline reaches and six of the eight construction staging areas are located on Airport property east of U.S. 101. Vehicle access to Reaches 1–8 and six construction staging areas (including Plot 16D) is available via North Access Road and the ramps connecting U.S. 101 and I-380 with North Access Road, as well as local streets via South Airport Boulevard.

Vehicle access to Reaches 9–15 and the St. Francis Lot construction staging area is available via South McDonnell Road and the ramps connecting U.S. 101 with Millbrae Avenue. Vehicle access to Reach 16, which runs along the western edge of the Airport property east of U.S. 101, is available via South Airport Boulevard and North McDonnell and South McDonnell roads, connecting to the U.S. 101 ramps at South Airport Boulevard, San Bruno Avenue, and Millbrae Avenue.

The steps involved in determining project construction vehicle trips for use in the environmental analyses are described below and include the following:

1. Summarize average daily construction trucks and workers by reach
2. Determine maximum overlap in construction vehicle activities and maximum number of average daily construction vehicles
3. Determine project hourly vehicles during analysis periods
4. Determine travel paths and study locations
5. Assign construction truck and worker trips to roadway network

In addition, this memorandum presents existing traffic volumes at or in the vicinity of the study locations.

Step 1: Summarize average daily construction trucks and workers by reach

Each of the project construction activities would generate various types of vehicle trips: haul trucks associated with the transfer and disposal of demolition materials, haul trucks importing fill and riprap materials, trucks delivering materials and equipment, and construction workers traveling to and from the construction worker parking lots.

The construction data spreadsheet provided by SFO/COWI includes information by reach for the total construction duration and on an average daily basis for various construction truck trip types[1] and average daily construction workers by work phase. Construction workers would park within existing SFO parking facilities, and a construction worker shuttle would transport workers between the parking lots and the reaches before and after the work shifts. Construction worker shuttles are included in the construction vehicle summary.

The construction truck trip types were aggregated into three groups:

- Trucks A include trucks making concrete deliveries. These would be the only type of trucks that would travel directly between an off-site location and the reaches.
- Trucks B include deliveries of materials (import) and removal of demolition materials (export) between the larger staging areas (i.e., the Aviador Lot and Plot 16D) and off-site locations. These trucks would primarily travel to and from the staging areas during the day for the both the daytime and nighttime reaches.

---

1 Project construction truck types include demolition off-haul, riprap off-haul, riprap import, other materials import and concrete deliveries. See attachments 1 and 2.

- Trucks C include trucks transferring materials (export and import) between the Aviador Lot or Plot 16D staging areas and the reaches. These trucks would travel between the reaches and the staging areas during the daytime for reaches constructed during the day (i.e., Reaches 1 through 6 and Reach 15) and during the overnight hours for reaches constructed at night (i.e., Reaches 7 through 14).

Attachment 2 summarizes the average daily construction trucks by truck type and construction workers by step (i.e., phase) of the work.

Table 1 presents for each reach the total construction trucks for the entirety of the construction period, as well as the average daily trucks and workers for the phase of construction with the greatest number of construction trucks and workers (referred to as the maximum average daily trucks and workers). The maximum work phase selected for each reach is highlighted in attachment 2 and summarized for each reach in attachment 3.

Trucks that would travel to and from the sites throughout the duration of the reach's construction period and trucks associated with tasks that could occur any time during the construction period were added to the trucks during the phase with the greatest activity.

TABLE 1
PROJECT CONSTRUCTION TRUCKS, WORKERS, AND WORKER SHUTTLES SUMMARY BY REACH[a]

Reach (Approximate Construction Duration)	Total Trucks	Average Daily Trucks, Workers, and Worker Shuttles for Reach Phase with the Greatest Number of Trucks[d]			
		Construction Trucks	Workers	Worker Shuttles	Total
Reach 1 (102 days)[b]	2,350	76	34	6	116
Reach 2 (159 days)[b]	5,070	124	46	6	176
Reach 3 (71 days)[b]	2,021	176	54	6	236
Reach 4 (67 days)[b]	2,097	114	43	6	163
Reach 5 (111 days)[b]	3,750	176	54	6	236
Reach 6 (97 days)[b]	2,351	118	44	6	168
Reach 7 (800 days)[c]	35,831	154	68	6	228
Reach 8 (401 days)[c]	10,022	163	61	6	230
Reach 9 (22 days)[c]	792	125	54	6	185
Reach 10 (30 days)[c]	884	150	45	6	201
Reach 11 (339 days)[c]	23,155	131	35	6	172
Reach 12 (72 days)[c]	3,259	88	28	6	122
Reach 13 (375 days)[c]	29,212	131	35	6	172
Reach 14 (112 days)[c]	6,042	134	49	6	189
Reach 15 (69 days)[b]	1,283	58	39	6	103
Total trucks	**128,118**				

NOTES:
a Due to rounding, numbers in columns may not add to totals.
b Construction would occur during the daytime shift.
c Construction would occur during the nighttime shift.
d Trucks that would travel to and from the reaches and the Aviador Lot and Plot 16D staging areas throughout the duration of the reach's construction period and trucks for tasks that could occur anytime during the construction period were added to the number of trucks during the phase with the greatest number of trucks.

SOURCES: San Francisco International Airport (SFO), spreadsheets entitled "EIR Data Requested Information Rev 4" and "Construction Sequencing for Reaches Rev 1-3_10_2021", March 2021; LCW Consulting analysis.

Step 2: Determine overlap in construction vehicle activities and maximum number of average daily construction vehicles

Project construction of the 15 reaches would be sequenced but would partially or completely overlap (see attachment 1 for additional details): construction would begin at Reach 2 and move east towards Reach 6. Construction would then commence on Reach 1, followed by Reach 15, and then followed by Reaches 14 through 9 (in reverse numerical order). Construction of Reaches 7 and 8 is anticipated to overlap with other reaches, with work on Reach 7 starting at the same time as Reach 2 work, and work on Reach 8 starting after completion of work on Reaches 1 through 6, 14 and 15. The preliminary schedule and overlap information was used to determine the maximum average daily construction vehicle activity that would result from the overlapping construction of the reaches. This represents the greatest number of vehicles generated by construction activities on a daily basis.

The maximum average daily trucks and workers for each reach for its construction duration, as identified in **Table 1** above, were plotted to determine the overlap periods and to identify the periods with the maximum number of average daily trucks. **See Attachment 4.** The peak number of construction trucks traveling to and from the reaches and staging areas per day would occur between December 2025 and June 2028 when either daytime or nighttime construction of reaches would overlap with construction of Reach 7.

Table 2 presents information on the maximum average daily numbers of construction trucks, workers, and worker shuttles for the construction overlap periods where the combined number of daily construction trucks would exceed 400 trucks per day. For the remainder of the construction period, the average daily number of construction trucks and workers would be less, and during the maximum phase of construction, would generally range from 130 to 300 trucks per day. Other work phases would generate fewer trucks per day.

TABLE 2
PROJECT CONSTRUCTION PEAK OVERLAP PERIODS [a]

Reach	Overlap Period	Average Daily Trucks, Workers and Worker Shuttles for Combined Reach Phases with the Greatest Number of Trucks			
		Construction Trucks	Workers	Worker Shuttles	Total
Reaches 2, 3 and 7 (overlap scenario 1)	December 2025	454	168	9	631
Reaches 3, 4 and 7	February – March 2026	444	165	9	618
Reaches 4, 5 and 7	April – May 2026	444	165	9	618
Reaches 5, 6 and 7	August – Sept 2026	448	166	9	623
Reaches 7, 8 and 14 (overlap scenario 2)	Dec 2027 – Jan 2028	450	178	12	640
Reaches 10, 11 and 13	Nov - Dec 2030	411	115	6	532

NOTES:
[a] Overlap periods with more than an average of 400 construction trucks per day during the peak construction phase for each reach.
[b] Trucks that would travel to and from the reaches and the Aviador Lot and Plot 16D staging areas throughout the duration of the reach's construction period and trucks that would travel during tasks that could occur anytime during the construction period were added to the number of trucks during the phase with the greatest number of trucks.
[c] Estimation of worker shuttles assumes three shuttle roundtrips per hour (one every 20 minutes) before and after each shift for a total of six shuttles per shift (3 shuttles per hour x 2 hours [one hour before and one hour after shift] = 6 shuttles per shift). Separate routes would be required for reaches accessed via North Access Road (reaches 1 through 8) versus South McDonnell/Millbrae Avenue (reaches 9 though 15).
Construction of daytime reaches 1 through 6 and nighttime reaches 7 and 8 would all be accessed via North Access Road. Because workers leaving the nighttime shift and workers arriving for the daytime shift would overlap during 6 to 7 a.m. only one route and three runs (i.e., one hour before daytime shift/after nighttime shift, one hour after daytime shift, and one hour before nighttime shift) would be required (3 shuttles per hour x 3 hours).

SOURCES: San Francisco International Airport (SFO), spreadsheets entitled "EIR Data Requested Information Rev 4l" and ""Construction Sequencing for Reaches Rev 1-3_10_2021", May 2021; LCW Consulting analysis.

The overlap of Reaches 2, 3 and 7 (two daytime construction reaches and one nighttime construction reach, referred to as overlap scenario 1) and Reaches 7, 8 and 14 (three nighttime construction reaches, referred to as overlap scenario 2) shown in Table 2 were selected as the representative maximum number of construction vehicles generated during the peak phases of project construction.

- Scenario One: The maximum number of construction vehicles (454 trucks and 168 construction workers) would travel during simultaneous construction of the daytime reaches 2 and 3 and the nighttime reach 7 for a one-month period.

- Scenario Two: The maximum number of construction vehicles during nighttime construction would occur during simultaneous construction of reaches 7, 8 and 14 for a two-month period. During the overlap of reaches 7, 8 and 14 there would be about 450 trucks and 178 construction workers traveling to and from the project site on a daily basis.

Table 3 summarizes the number of maximum average daily trucks per day throughout the project construction period between June 2025 and November 2031. For about 77 percent of the 6.5-year construction period (78 months), there would be fewer than 300 trucks per day traveling to and from the project site, and for 40 percent of the period there would be fewer than 200 trucks per day.

TABLE 3
DISTRIBUTION OF AVERAGE DAILY TRUCKS PER DAY THROUGHOUT THE PROJECT CONSTRUCTION DURATION

Maximum Average Daily Trucks per Day [a]	Months [b]	% of Construction Duration
100 to 199	32	40 %
200 to 299	29	37 %
300 to 399	10	13 %
400 to 455	7	10 %
Total	78	100 %

NOTES:
[a] Trucks making a round trip to and from the project site (multiply by two for one-way vehicle trips).
[b] Total construction period of 78 months between 6-1-2025 and 11-18-2031

SOURCES: San Francisco International Airport (SFO), spreadsheets entitled "EIR Data Requested Information Rev 4" and ""Construction Sequencing for Reaches Rev 1-3_10_2021", March 2021; LCW Consulting analysis.

Step 3: Determine project hourly vehicles for analysis periods

Based on review of the expected travel characteristics of import and export trucks and construction workers provided by SFO/COWI (see attachment 1), the project traffic volumes were determined for two analysis periods: the a.m. peak hour and for an average hour during the overnight construction period. The hourly volumes assume the following:

- Materials import or export between off-site locations and the Plot 16D and Aviador Lot staging areas for both the daytime and nighttime reaches would occur 24 hours a day, but 70 percent of truck trips would likely occur between 6 a.m. and 11 a.m. The analysis assumed that 70 percent of trucks would travel to and from the staging areas over a five-hour period.
- Materials transfer between the Plot 16D and Aviador Lot staging areas and daytime reaches would occur between 6 a.m. and 4:30 p.m. The analysis assumed that trucks would travel to and from the reaches over a ten-and-a-half -hour period.
- Materials Transfer between the Plot 16D and Aviador Lot staging areas and the nighttime reaches would occur between 11 p.m. and 6 a.m. The analysis assumed that trucks would be travel to and from the reaches over a seven-hour period (average overnight hour).
- Construction Workers Daytime Reaches: Worker shift between 7 a.m. and 4 p.m., workers would arrive one hour before the shift starts. The analysis assumed that all workers would arrive to the project site between 6 a.m. and 7 a.m.
- Construction Workers Nighttime Reaches: Worker shift between 11 p.m. and 6 a.m., workers would leave one hour after the shift ends. The analysis assumed that all workers would leave the project site between 6 a.m. and 7 a.m.
- Construction worker shuttles would travel between the construction worker parking lot(s) and the reaches one hour before the worker shift starts and one hour after the worker shift ends. The start of the daytime shift and the end of the nighttime shift would overlap (i.e., includes travel during the a.m. peak hour).

The p.m. peak hour was not analyzed because the construction shifts for daytime (7 a.m. and 4 p.m.) and nighttime (11 p.m. to 6 a.m.) construction at the reaches would not substantially overlap with the weekday p.m. peak period (4:30 p.m. to 6:30 p.m.). During the typical p.m. peak hour, project vehicles would be limited to construction workers from the daytime reaches leaving the project site and the number of project vehicles would be substantially less than during the a.m. peak hour.

Before determining the number of vehicle trips during the analysis hours and assigning the construction vehicle trips to the roadway network, the numbers of daily construction trucks, workers, and worker shuttles presented in Table 2 were multiplied by two to reflect one inbound and one outbound trip for each vehicle. **Table 4** presents the daily, a.m. peak hour and overnight average hour construction vehicle trips for the two overlap scenarios.

TABLE 4
PROJECT CONSTRUCTION VEHICLE TRIPS[a]
DURING REACH OVERLAP SCENARIOS

Reach Overlap Analysis Scenario/Construction Vehicle Type	Daily	Weekday A.M. Peak Hour	Overnight Average Hour
Scenario One: Reaches 2, 3 and 7 [b]			
Trucks A – Between Off-site and reaches [d]	0	0	0
Trucks B – Between Off-site and Plot 16D [e]	563	79	0
Trucks B – Between Off-site and Aviador Lot [e]	0	0	0
Trucks C – Between Plot 16D and reaches [f]	344	33	16
Trucks C – Between Aviador Lot and reaches [f]	0	0	0
Construction Workers [g]	336	168	0
Construction Worker Shuttles [g]	18	6	0
Total	1,261	286	16
Scenario Two: Reaches 7, 8 and 14 [c]			
Trucks A – Between Off-site and reaches [d]	2	0	2
Trucks B – Between Off-site and Plot 16D [e]	389	54	0
Trucks B – Between Off-site and Aviador Lot [e]	136	20	0
Trucks C – Between Plot 16D and reaches [f]	244	0	35
Trucks C – Between Aviador Lot and reaches [f]	130	0	19
Construction Workers [g]	356	178	0
Construction Worker Shuttles [g]	24	12	0
Total	1,281	264	55

NOTES:
[a] Includes inbound and outbound vehicle trips by construction trucks, workers, and worker shuttles (i.e., one-way trips).
[b] Overlap of daytime construction Reaches 2 and 3 and nighttime construction Reach 7.
[c] Overlap of nighttime construction Reaches 7, 8 and 14.
[d] Trucks A include trucks making concrete deliveries.
[e] Trucks B include deliveries of materials and removal of demolition materials between the Aviador Lot and Plot 16D staging areas and the off-site locations. Plot 16D staging area for Reaches 1 through 8, and Aviador Lot staging area for Reaches 9 through 15.
[f] Trucks C include trucks transferring materials between the Aviador Lot and Plot 16D staging areas and the reaches.
[g] Construction worker shuttle trips include trips between the construction worker parking lots and the reaches. The construction worker shuttle would serve all reaches under construction at the same time.

SOURCES: San Francisco International Airport (SFO), spreadsheets entitled "EIR Data Requested Information Rev 4" and ""Construction Sequencing for Reaches Rev 1-3_10_2021", March 2021; LCW Consulting analysis.

Step 4: Determine travel paths and study locations

Figure A-3 in attachment 7 presents a schematic of the type of travel associated with the project construction activities. These types of travel include:

- Travel between off-site locations and the reaches for trucks delivering concrete (Trucks A).
- Truck travel between off-site locations and the Plot 16D and Aviador Lot staging areas for deliveries of construction materials and disposal of demolition materials (Trucks B).

- Truck travel between the Plot 16D and Aviador Lot staging areas and the reaches and their nearby staging/laydown area (Trucks C).
- Construction worker travel between the off-site locations and SFO parking lots D and DD.
- Shuttles to transport construction workers from SFO parking lots D and DD and the reaches

Based on the travel paths described above, eight study locations were identified for assignment of construction truck and worker trips. Figure A-4 in attachment 7 presents the study locations.

- Three locations on U.S. 101 to identify trips north and south of the project site and to capture the trips between the Aviador Lot and the reaches to the north (Locations A, B, and C).
- Millbrae Avenue east of U.S. 101 which would serve as the access road to the south Reaches 9 through 15 via South McDonnell Road and the Millbrae Gate Location D).
- North Access Road east of U.S. 101 which would serve as the access road to the north Reaches 1 through 8 (Location E).
- Millbrae Avenue west of U.S. 101 which would identify the trips traveling to and from the Aviador Lot (Location F) either from off-site locations or the reaches.
- San Bruno Avenue east of U.S. 101 which would identify the construction worker trips traveling between the construction worker parking areas and off-site locations via U.S. 101 (Location G).
- South Airport Boulevard south of North Access Road which would identify the construction worker trips traveling between the construction worker parking areas and off-site locations via I-380/I-280 (Location H).

Figures A-5 through A-8 in attachment 7 present the travel paths assumed for project construction vehicles.

- **Figure A-5** presents the concrete truck travel paths between the off-site locations in San Francisco and the reaches.
- **Figure A-6A** presents the truck travel paths between the off-site locations (i.e., sources of materials or locations of disposal of demolition materials) and the Plot 16D staging area.
- **Figure A-6B** presents the truck travel paths between the off-site locations and the Aviador Lot staging area.
- **Figure A-7A** presents the truck travel paths between the Plot 16D staging area and the reaches via North Access Road for Reaches 1 through 8.
- **Figure A-7B** presents the truck travel paths between the Aviador Lot and the reaches via Millbrae Avenue/South McDonnell Road for Reaches 9 through 15.
- **Figure A-8** presents the construction worker travel paths between the off-site origins or destinations (i.e., location of residence) and the construction worker parking lots (i.e., SFO Lot D or Lot DD).

Construction worker shuttles would travel between the parking lots and Reaches 1 through 8 via South Airport Boulevard and North Access Road, while construction worker shuttles would travel between the construction worker parking lots and Reaches 9 though 15 via South Airport Boulevard, North McDonnell Road, and South McDonnell Road. Construction worker shuttles traveling between the construction worker parking lots and Reaches 1 through 8 would travel across study locations on North Access Road (Location E) and South Airport Boulevard (Location H), while worker shuttle trips between the construction worker parking lots and Reaches 9 through 15 would not travel across any study locations. For these reasons construction worker shuttle travel paths are not presented in separate figures.

Step 5: Assign construction vehicles to the roadway network

The daily and hourly construction trucks, workers, and worker shuttles were assigned to the roadway network based on information provided by SFO on the origin or destination of the type of export or import materials, vendor location, and anticipated residence of construction workers.

Construction trucks were distributed to the roadway network based on the paths identified in **Figure A-5** through **A-7** in attachment 7 based on the type of truck identified in the construction data spreadsheet. **Table 5** presents the access routes for the various truck types (also see attachment 7). In general, the North Bay and East Bay would be the primary destination of export trucks (e.g., Dutra Materials in Richmond, Altamont Landfill in Livermore), San Francisco would be the primary origin of import trucks for concrete and backfill soil, the North Bay would be the origin of rip rap, rock and asphalt (e.g., Dutra Materials in Richmond and Dutra Quarry in San Rafael), and various sources in the South Bay and East Bay would be the origin of other vendor trucks.

TABLE 5
PROJECT CONSTRUCTION TRUCK ORIGIN/DESTINATION ASSUMPTIONS

Construction Truck Type	Access Route
Trucks A: Between Off-Site Locations and Reach Directly (Figure A-5)	
7. Concrete	North U.S. 101/I-80
Trucks B: Between Off-Site Locations and the Plot 16D and Aviador Lot Staging Areas (Figures A-6A and A-6B)	
1A. Demo Off-Haul – Concrete, Clay/Mud	North U.S. 101/I-80
1B. Demo Off-Haul – Vinyl, Asphalt, Other Landfill	South U.S. 101
3. Riprap Off-Haul	North U.S. 101/I-80
5. Riprap/Soil Import from San Francisco [a]	North U.S. 101/I-80
5. Riprap/Soil Import from San Rafael [a]	North I-380/I280
8. Other Truck Imports	South U.S. 101
Trucks C: Between the Plot 16D and Aviador Lot Staging Areas and Reaches (Figures A-7A and A-7B)	
2. Demo Off-Haul	North Access Rd for Reaches 1 through 8 and Millbrae Avenue/So. McDonnell Road for Reaches 9 through 15
4. Riprap Off-Haul	
5. Riprap/Soil Import	
9. Other Truck Imports	

NOTES:
[a] Distribution of trucks between the Plot 16D and Aviador Lot staging areas and off-site locations based on activity occurring during the overlap phase for affected reaches (i.e., percent split determined from details provided in "quantities" tab for riprap/soil imports - riprap from Dutra Quarry in Marin versus backfill soil from Pier 92 in San Francisco).

SOURCES: San Francisco International Airport (SFO), EIR Data Request Summary Report, 12-16-2020 pp. 30-33" (see attachment 1); LCW Consulting analysis.

Construction workers would all drive to the project site and would travel from San Francisco, the South Bay, the East Bay and the North Bay generally in the proportions and via the associated access routes presented in **Table 6.** Construction workers would be primarily drawn from the East Bay and the South Bay, with somewhat fewer workers from San Francisco and the North Bay.

TABLE 6
PROJECT CONSTRUCTION WORKER ORIGIN/DESTINATION AND ACCESS ROUTE ASSUMPTIONS

Origin or Destination (place of residence)	Percentage	Access Road
San Francisco	10%	North U.S. 101/I-80
South Bay Close (Santa Clara, San Mateo)	15%	South U.S. 101
South Bay Far (Monterey, Santa Cruz, Salinas) [a]	10%	North I-380/I280
South Bay Far (Monterey, Santa Cruz, Salinas) [a]	10%	South U.S. 101
East Bay Close (Alameda, Contra Costa) [b]	10%	North U.S. 101/I-80
East Bay Close (Alameda, Contra Costa) [b]	10%	South U.S. 101
East Bay Far (San Joaquin)	20%	South U.S. 101
North Bay (Napa, Marin, Sonoma)	15%	North I-380/I280
Total	100%	

NOTES:
[a] Vehicle access routes to and from South Bay Far split between south U.S. 101 and I-280/I-380.
[b] Vehicle access routes to and from East Bay Near split between north U.S. 101 /I-80 and south U.S. 101 and the San Mateo Bridge.

SOURCES: San Francisco International Airport (SFO), spreadsheet entitled "SFO SPP Hours Workers 1-6-21", January 2021 (see attachment 1); LCW Consulting analysis.

Construction workers traveling to and from the construction worker parking lots located off of South Airport Boulevard were assigned to U.S. 101 and the northbound and southbound ramps at San Bruno Avenue. In addition, construction workers traveling from the north via I-280/I-380 were assigned to the I-380 North Access Road ramps and South Airport Boulevard to access the parking lots. Construction worker shuttles traveling between the parking lots and the reaches were assigned to South Airport Boulevard, North Access Road, North McDonnell Road and South McDonnell Road. The construction worker travel paths are presented in **Figure A-8** in attachment 7.

Table 7 presents the daily, a.m. peak hour and the average overnight hour project construction vehicles by type at the study locations for the two overlap scenarios. **Attachment 5** presents the vehicle assignment detail for the study locations and nearby U.S. 101 and I-380 ramps by individual reach and for the two overlap scenarios (Reaches 2, 3 and 7 and Reaches 7, 8 and 14).

These volumes are presented on the attached **Figure A-9** for the overlap of Reaches 2, 3 and 7, and on **Figure A-10** for the overlap of Reaches 7, 8 and 14. **Figures A-9** and **A-10** in attachment 7 also present information for the ramps to and from U.S. 101 and I-380.

Based on information provided by SFO, approximately 75 percent of project construction vehicles traveling to and from the Aviador Lot would travel via Garden Lane, and 25 percent would be routed via the northernmost BART parking lot aisle that will connect Rollins Road with Aviador Avenue. **Figure A-11** in attachment 7 presents the construction truck volumes in the vicinity of the Aviador Lot staging area.

TABLE 7
PROJECT VEHICLE TRIPS DURING CONSTRUCTION PERIOD[a]
OVERLAP SCENARIOS

Roadway Segment/Construction Vehicle Type	Overlap of Reaches 2, 3 and 7 (Scenario 1)						Overlap of Reaches 7, 8 and 14 (Scenario 2)					
	Daily		A.M. Peak Hour		Average Overnight Hour		Daily		A.M. Peak Hour		Average Overnight Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A. U.S. 101 North of North Access Road												
Trucks between off-site and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between off-site and staging areas	37	37	5	5	0	0	40	40	6	6	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	0	0	0	0	0	0
Construction workers	34	34	14	20	0	0	36	36	36	0	0	0
Total	***71***	***71***	***19***	***25***	***0***	***0***	***77***	***77***	***41***	***6***	***1***	***1***
B. U.S. 101 Between N. Access Rd and Millbrae Avenue												
Trucks between off-site and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between off-site and staging areas	217	217	30	30	0	0	158	158	22	22	0	0
Trucks between staging areas and reaches	0	0	0	0	0	0	0	0	0	0	0	0
Construction workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	***309***	***309***	***85***	***68***	***8***	***8***	***257***	***257***	***22***	***120***	***1***	***1***
C. U.S. 101 South of Millbrae Avenue												
Trucks between off-site and staging areas	217	217	30	30	0	0	181	181	25	25	0	0
Construction workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	***309***	***309***	***85***	***68***	***0***	***0***	***278***	***278***	***25***	***123***	***0***	***0***
***D.* Millbrae Avenue East of U.S. 101**												
Trucks between off-site and reaches	0	0	0	0	0	0	1	1	0	0	1	1
Trucks between staging areas and reaches	0	0	0	0	0	0	65	65	0	0	9	9
Total	***0***	***0***	***0***	***0***	***0***	***0***	***66***	***66***	***0***	***0***	***10***	***10***
***E.* North Access Road West of North Field Road**												
Trucks between staging areas and reaches	172	172	16	16	8	8	122	122	0	0	17	17
Construction worker shuttles	9	9	3	3	0	0	12	12	6	6	0	0

Roadway Segment/Construction Vehicle Type	Overlap of Reaches 2, 3 and 7 (Scenario 1)						Overlap of Reaches 7, 8 and 14 (Scenario 2)					
	Daily		A.M. Peak Hour		Average Overnight Hour		Daily		A.M. Peak Hour		Average Overnight Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
Total	***181***	***181***	***19***	***19***	***8***	***8***	***134***	***134***	***6***	***6***	***17***	***17***
***F.* Millbrae Avenue West of U.S. 101**												
Trucks between off-site and staging areas	0	0	0	0	0	0	68	68	10	10	0	0
Trucks between staging areas and reaches	0	0	0	0	8	8	65	65	0	0	9	9
Total	***0***	***0***	***0***	***0***	***8***	***8***	***133***	***133***	***10***	***10***	***9***	***9***
***G.* San Bruno Avenue East of U.S. 101**												
Construction workers	126	126	75	51	0	0	134	134	0	134	0	0
Total	***126***	***126***	***75***	***51***	***0***	***0***	***134***	***134***	***0***	***134***	***0***	***0***
***H.* So. Airport Blvd South of North Access Road**												
Construction workers	42	42	17	25	0	0	45	45	45	0	0	0
Total	***42***	***42***	***17***	***25***	***0***	***0***	***45***	***45***	***45***	***0***	***0***	***0***

NOTES:
[a] Due to rounding, numbers in columns may not add to totals.
[b] **Figures A-9** and **A-10** and attachment 5 present project construction vehicles for the study locations and associated U.S. 101 and I-380 ramps.

SOURCES: San Francisco International Airport (SFO), spreadsheets entitled "EIR Data Requested Information Rev 4", "Construction Sequencing for Reaches Rev 1-3_10_2021" and "SFO SPP Hours Workers 1-6-21", January and March 2021, and EIR Data Request Summary Report, 12-16-2020; LCW Consulting analysis.

Existing traffic volumes at or in the vicinity of the study locations

Table 8 presents the existing daily and a.m. peak hour traffic volumes for the study locations based on intersection and roadway segment counts conducted in 2018 and 2019 and Caltrans data for U.S. 101 from 2018 and 2019 (see attachment 6). These volumes reflect conditions prior to the onset of changes resulting from the COVID-19 pandemic (e.g., prior to reduction in airport flight activity and reduction in peak period travel by all modes).[2]

TABLE 8
EXISTING DAILY AND A.M. PEAK HOUR TRAFFIC VOLUMES AT STUDY LOCATIONS

Roadway Segment [h]	Daily		A.M. Peak Hour	
	NB/EB	SB/WB	NB/EB	SB/WB
A. U.S. 101 North of North Access Road [a]	142,000	142,000	8,500	8,500
B. U.S. 101 Between N. Access Rd and Millbrae Ave [a]				
C. U.S. 101 South of Millbrae Avenue [a]				
D1. Millbrae Avenue West of S. McDonnell Rd/Old Bayshore Hwy [b]	17,388	19,335	1,143	546
D2. S. McDonnell Rd north of Millbrae Avenue [c]	7,112	7,740	226	189
E1. North Access Rd East of U.S. 101/I-380 Ramps [d]	4,676	4,977	359	327
E2. North Access Rd West of N. Field Road [e]	3,253	3,008	282	148
F. Millbrae Avenue West of U.S. 101 ramps [f]	32,469	34,572	1,766	1,724
G. San Bruno Avenue East of U.S. 101 ramps [g]	14,725	12,800	839	320

NOTES:
[a] Locations A, B and C – Approximate based on published Caltrans 2018 AADT and 2019 Peak Hour data.
[b] Location D1 – IDAX Intersection Counts, AM Peak Period (7 to 9 AM), Old Bayshore Hwy/S. McDonnell Rd/Millbrae, 4-24-2018. IDAX 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, 10/22/2019 – 10/28/2019
[c] Location D2 – IDAX 24-hour/Vehicle Classification Counts, S McDonnell Rd N of Millbrae Ave/Site Code 1, 4-24-2018 to 4-30. 2018.
[d] Location E1 – IDAX 24-hour/Vehicle Classification Counts, N Access Rd E of I-380 Off-ramp/Site Code 13, 4-24-2018 to 4-30-2018.
[e] Location E2 – IDAX 24-hour/Vehicle Classification Counts, N Access Rd W of N Field Rd/Site Code 15, 4-24-2018 to 4-30-2018.
[f] Location F – IDAX Intersection Counts, AM Peak Period (7 to 9 AM), SB 101 On-ramp/Millbrae Avenue, 4-24-2018. Daily estimated based on 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, 10/22/2019 – 10/28/2019.
[g] Location G – IDAX Intersection Counts, AM Peak Period (7 to 9 AM), NB 101 On-ramp/San Bruno Avenue, 4-24-2018. Daily estimated based on 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, 10/22/2019 – 10/28/2019.
[h] Roadway segment locations differ slightly from those presented in Table 7 for project travel demand to provide additional information on variation in traffic volumes on adjacent segments where data is available.

SOURCES: IDAX traffic volume counts conducted in 2018 and 2019, Caltrans published traffic volume data 2018/2019 (see attachment 6), LCW Consulting 2021.

Hourly traffic volumes during the 11 p.m. to 6 a.m. overnight construction period are not available at all study locations. In general, hourly traffic volumes on Bay Area roadways during the overnight hours are substantially lower than during the daytime hours, including during the a.m. peak hour. However, in the project vicinity overnight hourly traffic volumes do not decrease as much as on other Bay Area roadways. During the overnight hours, generally between 11 p.m. and 6 a.m., hourly traffic volumes on roadways in the project vicinity are generally lower than during the a.m. peak hour but reflect different peaking of travel

[2] The long-term effects of the ongoing COVID-19 pandemic on the transportation system are unknown at this time. It would be unreasonable to speculate how the transportation system and travel behavior could change in the future. For these reasons, the analysis in this memo relies on transportation data and conditions prior to COVID-19 to establish existing conditions.

associated with Airport operations (e.g., employee shift changes and late night/early morning passenger arrivals or departures by auto when transit options don't exist, overnight freight cargo operations). For example, on North Access Road east of U.S. 101, traffic volumes during the overnight hours are about 14 to 37 percent of the a.m. peak hour volumes, but with higher hourly volumes between 5 a.m. and 7 a.m., while on South McDonnell Road overnight traffic volumes are about 21 to 60 percent of the a.m. peak hour, but with higher hourly volumes between 11 p.m. and 2 a.m.

ATTACHMENTS

Attachment 1
SFO/COWI CONSTRUCTION QUANTITIES AND ANALYSIS ASSUMPTIONS

Figure 23 - Reach Numbering

Table 1

Reach 1	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes							
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	3121	300	10	6
	Countinuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)			Reach Duration	99	4
Excavation for concrete wall, Assume 6ftx3ft	2.1	Berm or Soil Removal	[cy]	2081	200	10	6
	3	Concrete Wall (Land)	[LF]	3121	40	78	6
Based on approximate locat	3.1	Passive Flood Gate	[LF]	50	4	13	6
	3.2	SDPS 17, 18, North Slough	[LS]	-	1	1	10
	Continuous	Traffic Coordination	Continuous	Cont.	Reach Duration	99	4
	Continuous	Laydown Area Management	Continuous	Cont.	Reach Duration	99	3
	Continuous	Management, Inspection, Support Staff	Continuous	Cont.	Reach Duration	99	8
	Anytime	Deployable Floodwall	[LS]	1	Place in Storage	1	0
This is assuming resurfacin	Anytime	Resurface Road	[sf]	144909	13500	11	9
					-	-	-
					-		-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.1, 3	
Total						99	62

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
4994	0	0	0	0	0	0	0	0	0
31626	0	0	0	0	0	0	0	0	0
4994	0	0	0	0	0	0	12	125	9738
37452	0	0	0	0	0	0	0	0	0
6000	0	0	0	0	0	0	0	0	0
800	0	0	0	0	0	0	0	0	0
31626	0	0	0	0	0	0	0	0	0
23720	0	0	0	0	0	0	0	0	0
63252	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
7728	12	129	9145	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
212192	12	129	9145	0	0	0	12	125	9738

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	21	250	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
25	260	3121	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	6	429
0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
27	281	3371	0	0	0	0	0	0	6	432

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	42	499	0	0	0
0	0	0	0	10	988	11860	0	0	0
0	0	0	0	0	0	0	0	0	0
10611	0	0	0	0	0	0	0	0	0
200	0	1	878	0	3	30	0	0	0
0	1	1	80	1	1	12	0	0	0
0	0	0	0	2	198	1581	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	1	1400	0	0	0	0	0	0
0	14	150	11722	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
10811	16	153	14080	17	1231	13982	0	0	0

Table 2

Reach 2	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	4422	300	15	6
5 concrete blocks, total area of 302 sf, assume 4ft thick between floor slab, rough slab, and walls.	2.1	Concrete Block/Ramp Demo	[cy]	45	45	1	6
Assumed 11 sq ft per LF of existing concrete wall with 660 LF of existing concrete wall.	2.2	Concrete Demolition (Land)	[cy]	269	75	4	6
	2.3	Berm or Soil Removal	[cy]	1474	200	7	6
	3.3	Drainpipe Removal and Reconnection	[Pipe(s)]	1	1	2	2
	3.1	Sheet Pile (Land)	[LF]	4422	75	59	6
	3.2	Capbeam (Land)	[LF]	4422	75	59	6
	4.1	Riprap Placement (Land)	[cy]	632	200	3	6
	4.2	Back Fill Sand (Land)	[cy]	565	200	3	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	155	4
	Continuous	Laydown Area Management	-	-	Reach Duration	155	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	155	8
Based on full area from fence to new wall.	5.2	Reach 2 Grading	[sf]	490000	20000	25	6
71710 sq ft of mapped wetlands. Assumed 1-ft of fill over the wetland area.	6.1	Reach 2 Fill	[cy]	2656	200	13	7
	6.2	Reach 2 Gravel	[cy]	13704	475	29	7
Assumed a road following the alignment of Reach 2 for the fire road and 26-ft wide, including the spur coming between the treatment plant and the college.	6.3	Compacted Base Rock for Asphalt (12")	[sf]	89336	6000	15	8
	7.1	Asphalt Paving includes 6" HMA	[sf]	89336	13500	7	9
	7.2	Reach 2 Clear and Grub	[sf]	490000	100000	5	6
	Anytime	Resurface Road	[sf]	135939	13500	10	9
Total Description						Steps 1, 2.1, 2.2, 2.3, 3.1, 4.1, 4.2, 6.1, 6.2, 6.3, 6.4, 7.1	
Total						155	118

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
7075	0	0	0	0	0	0	0	0	0
477	6	6	477	9	9	107	0	0	0
1721	5	18	1434	8	29	344	0	0	0
3538	0	0	0	0	0	0	12	88	6898
320	0	0	0	0	0	0	0	0	0
28301	0	0	0	0	0	0	0	0	0
28301	0	0	0	0	0	0	0	0	0
1517	0	0	0	0	0	0	0	0	0
1582	0	0	0	0	0	0	0	0	0
49687	0	0	0	0	0	0	0	0	0
37265	0	0	0	0	0	0	0	0	0
99373	0	0	0	0	0	0	0	0	0
11760	0	0	0	0	0	0	0	0	0
7437	0	0	0	0	0	0	0	0	0
16156	0	0	0	0	0	0	0	0	0
9529	0	0	0	0	0	0	0	0	0
4765	0	0	0	0	0	0	0	0	0
2352	5	25	1911	0	0	0	0	0	0
7250	12	121	8579	0	0	0	0	0	0
318405	28	169	12402	17	38	452	12	88	6898

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	29	354	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
25	184	2211	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	44	3274	30	95	1138	0	0
0	0	0	9	25	1017	25	71	1130	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	186	5577	0	0	0	0	0
0	0	0	0	0	0	40	1154	46160	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
27	214	2565	37	256	9868	95	1319	48427	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	59	708	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	2	160	1	2	24	0	0	0
0	3	147	36850	5	295	3538	0	0	0
0	0	12	2123	1	59	708	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	1553	18632	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	34	506	37462	0	0	0	0	0	0
0	28	185	14453	0	0	0	0	0	0
0	5	25	1911	0	0	0	0	0	0
0	14	141	10996	0	0	0	0	0	0
0	85	1018	103954	21	1967	23609	0	0	0

Table 3

Reach 3	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	1380	300	5	6
boatramp is assumed to be demolished. Measures approximately 17,700 sf.	2.1	Concrete Block/Ramp Demo	[cy]	1100	45	24	6
1020 LF of existing concrete "wall". Assume wall is 5x1 + 3x2 enlarged footing or 11 sq ft. Assuming the whole thing comes out and not just the above-grade element.	2.2	Concrete Demolition (Land)	[cy]	415	75	6	6
	2.3	Riprap Removal (Land)	[cy]	1073	200	5	6
	3.1	Sheet Pile (Land)	[LF]	1380	75	18	6
	3.2	Capbeam (Land)	[LF]	1380	75	18	6
	3.3	Pipe Outlet Removal and Reattachment	[Pipe(s)]	3	1	3	2
	4.1	Riprap Placement (Land)	[cy]	613	200	3	6
5 ft x 3 ft of wall plus that if we demo the entire existing conc wall footing.	4.2	Back Fill Sand (Land)	[cy]	1181	200	6	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	67	4
	Continuous	Laydown Area Management	-	-	Reach Duration	67	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	67	8
Assume existing road is 40ft wid	Anytime	Resurface Road		55200	13500	4	9
Assume 5ft gap between existin	4.3	Compacted Base Rock for Asphalt (12")	[sf]	6900	6000	1	8
	4.4	Asphalt Paving includes 6" HMA	[sf]	6900	13500	1	9
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.1, 2.2, 2.3, 3.1, 4.1, 4.2	
Total						67	92

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
2208	0	0	0	0	0	0	0	0	0
11731	6	147	11731	9	220	2639	0	0	0
2654	5	28	2212	8	44	531	0	0	0
2576	0	0	0	0	0	0	13	70	5442
8832	0	0	0	0	0	0	0	0	0
8832	0	0	0	0	0	0	0	0	0
480	0	0	0	0	0	0	0	0	0
1472	0	0	0	0	0	0	0	0	0
3308	0	0	0	0	0	0	0	0	0
21539	0	0	0	0	0	0	0	0	0
16154	0	0	0	0	0	0	0	0	0
43078	0	0	0	0	0	0	0	0	0
2944	12	49	3484	0	0	0	0	0	0
736	0	0	0	0	0	0	0	0	0
368	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
126913	23	223	17427	17	264	3170	13	70	5442

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	9	110	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	150	2404	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	43	3177	30	92	1104	0	0
0	0	0	9	53	2127	25	148	2363	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
30	159	2515	23	96	5304	55	240	3467	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	18	221	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	46	11500	5	92	1104	0	0	0
0	0	4	662	1	18	221	0	0	0
0	1	3	240	1	3	36	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	673	8077	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	14	57	4465	0	0	0	0	0	0
0	34	39	2893	0	0	0	0	0	0
0	28	14	1116	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	80	163	20877	21	805	9659	0	0	0

Table 4

Reach 4	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers	Total Commute Distance For Completion of Task
Units								[mi]
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently.							
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	1445	300	5	6	2312
For concrete ramp, Entire boatramp is 6263 sq ft or ~50 ft wide. Assumed 1.5ft thick	2.1	Concrete Block/Ramp Demo	[cy]	348	45	8	6	3711
Assume 6ft wide x 6ft deep	2.2	Riprap Removal (Land)	[cy]	1927	200	10	6	4624
	3.1	Sheet Pile (Land)	[LF]	1445	75	19	6	9248
	3.2	Capbeam (Land)	[LF]	1445	75	19	6	9248
	3.3	Pipe Outlet Removal and Reattachment	[Pipe(s)]	10	1	10	2	1600
	Anytime	Passive Flood Gate	[LF]	20	4	5	6	2400
For passive flood gate	3.5	Concrete Wall (Land)	[LF]	80	40	2	6	960
Assume 10.5-ft x 2 ft deep per LF of wall	4.1	Riprap Placement (Land)	[cy]	1124	200	6	6	2697
Assumed 5-ft out of the 7-	4.2	Back Fill Sand (Land)	[cy]	1594	200	8	7	4462
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	[LF]	1461	Reach Duration	65	4	20812
	Continuous	Laydown Area Management	-	-	Reach Duration	65	3	15609
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	65	8	41624
	Anytime	Resurface Road	[sf]	97500	13500	7	9	5200
					-	-	-	-
					-	-	-	-
					-	-	-	-
					-	-	-	-
Total Description						Steps 1, 2.1, 2.2, 3.1, 3.3 4.1, 4.2		
Total						65	81	124507

Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage	Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)
[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]
0	0	0	0	0	0	0	0	0	2
6	46	3711	9	70	835	0	0	0	0
0	0	0	0	0	0	13	125	9768	28
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
12	87	6153	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
18	133	9865	9	70	835	13	125	9768	30

Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
10	116	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
270	4316	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	6	11
0	0	14	79	5822	30	169	2023	0	0
0	0	9	72	2869	25	199	3187	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
279	4431	23	150	8690	55	368	5210	6	12

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	19	231	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	48	12042	5	96	1156	0	0	0
0	0	4	694	1	19	231	0	0	0
0	1	10	800	1	10	120	0	0	0
80	0	0	351	0	1	12	0	0	0
272	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	650	7804	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	14	101	7887	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
352	18	163	21773	21	796	9555	0	0	0

Table 5

Reach 5	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	2760	300	9	6
wall of 5x1 + 3x2 enlarged	2.1	Concrete Demolition (Land)	[cy]	1124	75	15	6
Assume riprap is 7 ft wide :	2.2	Riprap Removal (Land)	[cy]	4293	200	21	6
	3.1	Sheet Pile (Land)	[LF]	2760	75	37	6
	3.2	Capbeam (Land)	[LF]	2760	75	37	6
	4.1	Riprap Placement (Land)	[cy]	1227	200	6	6
5-ft and 6 ft deep with a 1	4.2	Back Fill Sand (Land)	[cy]	3987	200	20	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	[LF]	2760	Reach Duration	109	4
	Continuous	Laydown Area Management	-	-	Reach Duration	109	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	109	8
	Anyitme	Resurface Road	[sf]	83000	13500	6	9
5ft band of asphalt paving	4.3	Compacted Base Rock for Asphalt (12")	[sf]	13800	6000	2	8
	4.4	Asphalt Paving includes 6" HMA	[sf]	13800	13500	1	9
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.1, 2.2, 3.1,4.1, 4.2	
Total						109	84

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
4416	0	0	0	0	0	0	0	0	0
7196	5	75	5997	8	120	1439	0	0	0
10304	0	0	0	0	0	0	13	279	21767
17664	0	0	0	0	0	0	0	0	0
17664	0	0	0	0	0	0	0	0	0
2944	0	0	0	0	0	0	0	0	0
11163	0	0	0	0	0	0	0	0	0
34728	0	0	0	0	0	0	0	0	0
26046	0	0	0	0	0	0	0	0	0
69457	0	0	0	0	0	0	0	0	0
4427	12	74	5238	0	0	0	0	0	0
1472	0	0	0	0	0	0	0	0	0
736	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-									
729294	17	149	11235	8	120	1439	13	279	21767

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	18	221	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	601	9617	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	86	6354	30	184	2208	0	0
0	0	0	9	179	7176	25	498	7973	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
30	619	9838	23	265	13530	55	682	10181	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	37	442	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	92	23000	5	184	2208	0	0	0
0	0	7	1325	1	37	442	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	1085	13023	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	14	86	6714	0	0	0	0	0	0
0	34	78	5787	0	0	0	0	0	0
0	28	29	2233	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	79	292	39058	20	1343	16114	0	0	0

Table 6

Reach 6	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers	Total Commute Distance For Completion of Task	Daily Demo Trips
Units								[mi]	[round trips/day
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently.								
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	2951	300	10	6	4722	0
400-ft of concrete berm (~15	2.1	Berm or Soil Removal	[cy]	2657	200	13	6	6378	0
Rip removal area is assumed	2.2	Riprap Removal (Land)	[cy]	2623	200	13	6	6295	0
	2.3	Demolition (Vinyl Wall)	[LF]	2951	200	15	6	7082	2
	3.1	Sheet Pile (Land)	[LF]	2951	75	39	6	18886	0
	3.2	Capbeam (Land)	[LF]	2951	75	39	6	18886	0
Assume 4 ft x 2 new riprap p	4.1	Riprap Placement (Land)	[cy]	874	200	4	6	2098	0
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	95	4	30308	0
	Continuous	Laydown Area Management	-	-	Reach Duration	95	3	22731	0
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	95	8	60616	0
	Anytime	Pipe Outlet Removal and Reattachment	[Pipe(s)]	4	1	4	2	640	0
	Anytime	Resurface Road	[sf]	70824	13500	5	9	3777	12
					-	-	-	-	-
					-	-	-	-	-
					-	-	-	-	-
					-	-	-	-	-
					-	-	-	-	-
					-	-	-	-	-
Total Description						Steps 1, 2.1, 2.2, 2.3, 3.1,4.1,			
Total						95	68	182421	14

Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage	Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)
[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]
0	0	0	0	0	0	0	0	2
0	0	0	0	0	12	159	12437	25
0	0	0	0	0	13	171	13299	28
30	2095	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
63	4470	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
92	6565	0	0	0	25	330	25736	55

truck milage 95278 222446 -127168

Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
20	236	0	0	0	0	0	0	0	0
332	3986	0	0	0	0	0	0	0	0
367	5876	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	14	61	4529	30	131	1574	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
719	10098	14	61	4529	30	131	1574	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	39	472	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	98	24592	5	197	2361	0	0	0
0	0	8	1416	1	39	472	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	947	11366	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	4	320	1	4	48	0	0	0
0	14	73	5729	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	18	184	32057	21	1227	14719	0	0	0

Table 7

Reach 7	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes							
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	4244	300	14	6
	Continuous	Reach 7 and 8 Support Staff	Continuous		-	720	11
	6	Sheet Pile (Land)	[LF]	429	75	6	6
	2	Dredging	[cy]	147156	3000	49	7
Est from Dike Shapes over L	2	Dike Fill (Double Crew)	[cy]	266,832	3000	89	14
	3	Double Sheet Pile Wall (Double Crew)	[LF]	8561	60	143	14
8-ft spacing of tie-rods	3	Tierods	[LS]	622	60	10	5
	3	Temporary Platform and Waler	[LF]	8561	100	86	7
	3	Dewater and Water Processing	[cy]	164204	100000	2	4
Varying treatment depths c	4	Soil Grout Ground Improvement (Triple Crew)	[cy]	302,000	1200	252	21
Assume 429 ft with 6x2 ft c	4	Back Fill Sand (Barge)	[cy]	112316	1500	75	11
Approximate area of riprap i	2	Riprap Removal (Land)	[cy]	20524	200	103	6
4013 ft of berm to remove.	4	Berm or Soil Removal	[cy]	12427	200	62	6
Assume 45-ft of riprap x 3 f	4	Riprap Placement (Land)	[cy]	24875	200	124	6
	5	Wick Drain	[sf]	66750	1200	56	3
	5	Surcharge Fill and Spreading	[cy]	22250	400	56	7
	6	Surcharge Removal	[cy]	22250	400	56	7
	6	Compacted Base Rock for Asphalt (12")	[sf]	148000	6000	25	8
	6	Asphalt Paving includes 6" HMA	[sf]	148000	13500	11	9
For Demo quantity assume	Anytime	Trestle Demo and Rebuild	[LF]	922	25	37	13
Total Description							
Total						720	158

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
6790	0	0	0	0	0	0	0	0	0
633600	0	0	0	0	0	0	0	0	0
2746	0	0	0	0	0	0	0	0	0
27469	0	0	0	0	0	0	0	0	0
99617	0	0	0	0	0	0	0	0	0
159805	0	0	0	0	0	0	0	0	0
4146	0	0	0	0	0	0	0	0	0
47942	0	0	0	0	0	0	0	0	0
525	0	0	0	0	0	0	0	0	0
422800	0	0	0	0	0	0	0	0	0
65892	0	0	0	0	0	0	0	0	0
49258	0	0	0	0	0	0	13	1334	104058
29824	0	0	0	0	0	0	12	746	58157
59700	0	0	0	0	0	0	0	0	0
13350	0	0	0	0	0	0	0	0	0
31150	0	0	0	0	0	0	0	0	0
31150	0	0	0	0	0	0	22	1224	95453
15787	0	0	0	0	0	0	0	0	0
7893	0	0	0	0	0	0	0	0	0
38355	2	74	5237	0	0	0	0	0	0
1709445	2	74	5237	0	0	0	47	3303	257667

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	28	340	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	2873	45974	0	0	0	0	0	0	0	0
25	1553	18640	0	0	0	0	0	0	0	0
0	0	0	14	1741	128853	30	3731	44775	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
50	2781	33375	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
105	7236	98329	14	1741	128853	30	3731	44775	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	57	679	0	0	0
0	0	0	0	2	1440	17280	0	0	0
0	3	14	3575	5	29	343	0	0	0
0	0	0	0	0	0	0	2	98	5886
0	0	0	0	0	0	0	2	178	12452
0	0	0	0	0	0	0	6	856	21688
0	0	0	0	1	10	622	1	10	83
0	0	0	0	1	86	5137	2	171	1370
0	0	0	0	1	2	99	0	0	0
0	67	16778	520111	0	0	0	2	503	10067
0	0	0	0	0	0	0	1	75	5241
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	56	10013	1	56	668	0	0	0
0	0	0	0	0	0	0	1	78	2003
0	0	0	0	0	0	0	0	0	0
0	34	839	62061	0	0	0	0	0	0
0	28	307	23943	0	0	0	0	0	0
0	2	74	6638	0	0	0	2	74	885
0	134	18067	626341	15	1678	24827	19	2044	59675

Table 8

Reach 8	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes							
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	1521	300	5	6
	2	Dredging	[cy]	33800	3000	11	7
Assume 30% more fill requ	2	Dike Fill (Double Crew)	[cy]	79238	3000	26	14
	3	Double Sheet Pile Wall (Double Crew)	[LF]	2964	60	49	14
	3	Tierods	[LS]	190	60	3	5
	3	Temporary Platform and Waler	[LF]	1521	100	15	7
	3	Capbeam (Land)	[LF]	1521	75	20	6
	3	Dewater and Water Processing	[cy]	79238	100000	1	4
	4	Soil Grout Ground Improvement (Triple Crew)	[cy]	92950	1200	77	21
	4	Back Fill Sand (Barge)	[cy]	6957	1500	5	11
	2	Riprap Removal (Land)	[cy]	8856	200	44	6
	4	Concrete Demolition (Land)	[cy]	620	75	8	6
	4	Riprap Placement (Land)	[cy]	3943	200	20	6
	5	Compacted Base Rock for Asphalt (12")	[sf]	57798	6000	10	8
	5	Asphalt Paving includes 6" HMA	[sf]	57798	13500	4	9
	Continuous	Reach 7 and 8 Support Staff	Continuous		-	400	11
Assume Berm is 15ft wide x	4	Berm or Soil Removal	[cy]	3169	200	16	6
					-	-	-
Total Description							
Total						400	147

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
2434	0	0	0	0	0	0	0	0	0
6309	0	0	0	0	0	0	0	0	0
29582	0	0	0	0	0	0	0	0	0
55328	0	0	0	0	0	0	0	0	0
1268	0	0	0	0	0	0	0	0	0
8518	0	0	0	0	0	0	0	0	0
9734	0	0	0	0	0	0	0	0	0
254	0	0	0	0	0	0	0	0	0
130130	0	0	0	0	0	0	0	0	0
4082	0	0	0	0	0	0	0	0	0
21253	0	0	0	0	0	0	13	576	44898
3966	5	41	3305	8	66	793	0	0	0
9464	0	0	0	0	0	0	0	0	0
6165	0	0	0	0	0	0	0	0	0
3083	0	0	0	0	0	0	0	0	0
352000	0	0	0	0	0	0	0	0	0
7605	0	0	0	0	0	0	12	190	14830
-	-	-	-	-	-	-	-	-	-
651174	5	41	3305	8	66	793	25	766	59728

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	10	122	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	1240	19837	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	276	20426	30	592	7098	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
25	396	4753	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
55	1646	24711	14	276	20426	30	592	7098	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	20	243	0	0	0
0	0	0	0	0	0	0	2	23	1352
0	0	0	0	0	0	0	2	53	3698
0	0	0	0	0	0	0	6	296	7509
0	0	0	0	1	3	190	1	3	25
0	0	0	0	1	15	913	2	30	243
0	0	4	730	1	20	243	0	0	0
0	0	0	0	1	1	48	0	0	0
0	67	5164	160081	0	0	0	2	155	3098
0	0	0	0	0	0	0	1	5	325
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	34	328	24237	0	0	0	0	0	0
0	28	120	9350	0	0	0	0	0	0
0	0	0	0	2	800	9600	0	0	0
0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
0	129	5615	194398	10	860	11237	16	565	16250

Table 8

Reach 9	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	806	300	3	6
	2.1	Demolition (Vinyl Wall)	[LF]	806	200	4	6
	2.2	Riprap Removal (Land)	[cy]	537	200	3	6
	2.3	Sheet Pile (Land)	[LF]	806	75	11	6
	3.1	Riprap Placement (Land)	[cy]	537	200	3	6
	3.2	Back Fill Sand (Barge)	[cy]	485	1500	1	11
	Anytime	Navigation Aid Relocation	[LS]	1	0	10	4
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	20	8
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	20	4
	Continuous	Laydown Area Management	-	-	Reach Duration	20	3
	Anytime	Compacted Base Rock for Asphalt (12")	[sf]	30628	6000	5	8
	Anytime	Asphalt Paving includes 6" HMA	[sf]	30628	13500	2	9
					-		-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.1, 2.3, 3.1,	
Total						20	77

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
1290	0	0	0	0	0	0	0	0	0
1934	2	8	572	0	0	0	0	0	0
1290	0	0	0	0	0	0	13	35	2724
5158	0	0	0	0	0	0	0	0	0
1290	0	0	0	0	0	0	0	0	0
880	0	0	0	0	0	0	0	0	0
3200	0	0	0	0	0	0	0	0	0
12896	0	0	0	0	0	0	0	0	0
6448	0	0	0	0	0	0	0	0	0
4836	0	0	0	0	0	0	0	0	0
3267	0	0	0	0	0	0	0	0	0
1633	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
44122	2	8	572	0	0	0	13	35	2724

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	5	64	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	75	1204	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	38	2783	30	81	967	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
30	81	1268	14	38	2783	30	81	967	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	11	129	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	27	6717	5	54	645	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1	70
0	1	10	600	1	10	120	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	202	2418	0	0	0
0	0	0	0	0	0	0	0	0	0
0	34	174	12843	0	0	0	0	0	0
0	28	64	4955	0	0	0	0		0
-	-	-	-	-	-	-	-		-
-	-	-	-	-	-	-	-		-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	66	274	25115	20	276	3312	1	1	70

Table 10

Reach 10	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	920	300	3	6
	2.1	Demolition (Vinyl Wall)	[LF]	920	200	5	6
	2.3	Sheet Pile (Land)	[LF]	920	75	12	6
	2.4	Capbeam (Land)	[LF]	920	75	12	6
Assume 8 ft * 4.5 ft (triangular shape) per LF	3.1	Riprap Placement (Land)	[cy]	613	200	3	6
	3.2	Back Fill Sand (Land)	[cy]	681	200	3	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	26	4
	Continuous	Laydown Area Management	-	-	Reach Duration	26	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	26	8
	Anytime	Compacted Base Rock for Asphalt (12")	[sf]	30400	6000	5	8
	Anytime	Asphalt Paving includes 6" HMA	[sf]	30400	13500	2	9
					-	-	-
					-		-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.1, 2.2, 3.1, 4.1, 4.2, 5.2, 6.3, 6.4	
Total						26	69

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
1472	0	0	0	0	0	0	0	0	0
2208	2	9	653	0	0	0	0	0	0
5888	0	0	0	0	0	0	0	0	0
5888	0	0	0	0	0	0	0	0	0
1472	0	0	0	0	0	0	0	0	0
1908	0	0	0	0	0	0	0	0	0
8450	0	0	0	0	0	0	0	0	0
6338	0	0	0	0	0	0	0	0	0
16901	0	0	0	0	0	0	0	0	0
3243	0	0	0	0	0	0	0	0	0
1621	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
55389	2	9	653	0	0	0	0	0	0

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	6	74	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	43	3177	30	92	1104	0	0
0	0	0	9	31	1227	25	85	1363	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
2	6	74	23	74	4404	55	177	2467	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	12	147	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	31	7667	5	61	736	0	0	0
0	0	2	442	1	12	147	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	264	3169	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	34	172	12748	0	0	0	0	0	0
0	28	63	4918	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	65	268	25774	20	350	4199	0	0	0

Table 13

Reach 13	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1.1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	3238	300	11	6
	1.2	Concrete Demolition (Land)	[cy]	1319	75	18	6
110724 sf of rip rap betwe	2.2	Riprap Removal (Land)	[cy]	10252	200	51	6
3238 LF on outer sheet pile	2.3	Sheet Pile (Land)	[LF]	6345	75	85	6
	2.4	Capbeam (Land)	[LF]	6345	75	85	6
Assume 35 ft x 2 ft riprap	3.1	Riprap Placement (Land)	[cy]	8395	200	42	6
	3.2	Back Fill VSR (Land)	[cy]	17468	400	44	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	336	4
	Continuous	Laydown Area Management	-	-	Reach Duration	336	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	336	8
	2.1	Soil Grout Ground Improvement, Land (Double Crew)	[cy]	189872	800	237	14
	4.1	Compacted Base Rock for Asphalt (12")	[sf]	109903	6000	18	8
	4.2	Asphalt Paving includes 6" HMA	[sf]	109903	13500	8	9
	Anytime	Outfall Structure SDPS 2	[lf]	40	5	8	7
				-	-	-	-
				-	-	-	-
				-	-	-	-
				-	-	-	-
Total Description						Steps 1.1, 1.2, 2.1, 3.2, 4.1, 4.2	
Total						336	96

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
5181	0	0	0	0	0	0	0	0	0
8443	5	88	7036	8	141	1689	0	0	0
24605	0	0	0	0	0	0	13	666	51979
40608	0	0	0	0	0	0	0	0	0
40608	0	0	0	0	0	0	0	0	0
20148	0	0	0	0	0	0	0	0	0
24455	0	0	0	0	0	0	25	1092	32752
107472	0	0	0	0	0	0	0	0	0
80604	0	0	0	0	0	0	0	0	0
214944	0	0	0	0	0	0	0	0	0
265821	0	0	0	0	0	0	0	0	0
11723	0	0	0	0	0	0	0	0	0
5861	0	0	0	0	0	0	0	0	0
4480	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
854953	5	88	7036	8	141	1689	38	1758	84731

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	22	259	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	1435	22965	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	588	43485	30	1259	15111	0	0
50	2183	26202	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	8
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
80	3640	49426	14	588	43485	30	1259	15111	1	8

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	43	518	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	212	52875	5	423	5076	0	0	0
0	0	17	3046	1	85	1015	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	3359	40302	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	45	10680	331090	0	0	0	0	0	0
0	34	623	46086	0	0	0	0	0	0
0	28	228	17780	0	0	0	0	0	0
640	1	4	320	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
640	65	11763	451196	20	3909	46911	0	0	0

Table 12

Reach 12	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	2115	300	7	6
	2.1	Concrete Demolition (Land)	[cy]	37	75	0	6
Assume 7 x 4 ft riprap removal per LF wall	2.2	Riprap Removal (Land)	[cy]	2193	200	11	6
	2.3	Sheet Pile (Land)	[LF]	2115	75	28	6
	2.4	Capbeam (Land)	[LF]	2115	75	28	6
Assume adding 80 sf of riprap per LF	3.1	Riprap Placement (Land)	[cy]	6267	200	31	6
	3.2	Back Fill Sand (Land)	[cy]	2444	200	12	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	71	4
	Continuous	Laydown Area Management	-	-	Reach Duration	71	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	71	8
			-	-	-	-	-
			-	-	-	-	-
			-	-	-		-
			-	-	-	-	-
			-	-	-	-	-
			-	-	-	-	-
			-	-	-	-	-
			-	-	-	-	-
Total Description						Steps 2.1, 2.2, 2.3, 3.1	
Total						71	58

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
3384	0	0	0	0	0	0	0	0	0
237	5	2	198	8	4	47	0	0	0
5264	0	0	0	0	0	0	13	143	11120
13536	0	0	0	0	0	0	0	0	0
13536	0	0	0	0	0	0	0	0	0
15040	0	0	0	0	0	0	0	0	0
6843	0	0	0	0	0	0	0	0	0
22718	0	0	0	0	0	0	0	0	0
17039	0	0	0	0	0	0	0	0	0
45436	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
143033	5	2	198	8	4	47	13	143	11120

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	14	169	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	307	4913	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	439	32461	30	940	11280	0	0
0	0	0	9	110	4399	25	306	4888	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
30	321	5082	23	549	36861	55	1246	16168	0	0

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	28	338	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	71	17625	5	141	1692	0	0	0
0	0	6	1015	1	28	338	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	710	8519	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
0	3	76	18640	20	907	10888	0	0	0

Table 13

Reach 13	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1.1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	4198	300	14	6
	1.2	Concrete Demolition (Land)	[cy]	1710	75	23	6
	2.2	Riprap Removal (Land)	[cy]	18036	200	90	6
	2.3	Sheet Pile (Land)	[LF]	8171	75	109	6
	2.4	Capbeam (Land)	[LF]	4198	75	56	6
Assume 15 ft x 7.5 ft trian	3.1	Riprap Placement (Land)	[cy]	8746	200	44	6
Assume 100 sf per LF of ou	3.2	Back Fill VSR (Land)	[cy]	20213	400	51	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	426	4
	Continuous	Laydown Area Management	-	-	Reach Duration	426	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	426	8
	2.1	Soil Grout Ground Improvement, Land (Double Crew)	[cy]	242794	800	303	14
	4.1	Compacted Base Rock for Asphalt (12")	[sf]	144222	6000	24	8
	4.2	Asphalt Paving includes 6" HMA	[sf]	144222	13500	11	9
	Anytime	Outfall Structure SDPS 2	[lf]	40	5	8	7
					-	-	-
				-	-		-
					-	-	-
					-	-	-
Total Description						Steps 1.1, 1.2, 2.1, 3.2, 4.1, 4.2	
Total						426	96

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
6717	0	0	0	0	0	0	0	0	0
10946	5	114	9122	8	182	2189	0	0	0
43286	0	0	0	0	0	0	13	1172	91442
52294	0	0	0	0	0	0	0	0	0
26867	0	0	0	0	0	0	0	0	0
20990	0	0	0	0	0	0	0	0	0
28298	0	0	0	0	0	0	25	1263	37899
136173	0	0	0	0	0	0	0	0	0
102130	0	0	0	0	0	0	0	0	0
272347	0	0	0	0	0	0	0	0	0
339912	0	0	0	0	0	0	0	0	0
15384	0	0	0	0	0	0	0	0	0
7692	0	0	0	0	0	0	0	0	0
4480	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
1067516	5	114	9122	8	182	2189	38	2436	129340

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	28	336	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
28	2525	40400	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	612	45303	30	1312	15743	0	0
50	2527	30319	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	8
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
80	5080	71055	14	612	45303	30	1312	15743	1	8

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	56	672	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	272	68092	5	545	6537	0	0	0
0	0	11	2015	1	56	672	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	4255	51065	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	45	13657	423373	0	0	0	0	0	0
0	34	817	60477	0	0	0	0	0	0
0	28	299	23332	0	0	0	0	0	0
640	1	4	320	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
640	65	15061	577609	20	4912	58945	0	0	0

Table 14

Reach 14	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes	Same whole number steps happen concurrently. For example Step 2.1 and 2.2 are performed concurrently. However, the total duration is the sum of the steps listed in H24						
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	4657	300	16	6
	2.1	Demolition (Vinyl Wall)	[LF]	4657	200	23	6
Only a 160ft of double shee	2.2	Sheet Pile (Land)	[LF]	4718	75	63	6
	2.3	Capbeam (Land)	[LF]	4558	75	61	6
Assume 15ft wide, 3ft deep	3.1	Riprap Placement (Land)	[cy]	7863	200	39	6
Assume 1ft of fill is required	3.2	Back Fill Sand (Land)	[cy]	5213	200	26	7
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)	-	-	Reach Duration	133	4
	Continuous	Laydown Area Management	-	-	Reach Duration	133	3
	Continuous	Management, Inspection, Support Staff	-	-	Reach Duration	133	8
Only includes a small portio	3.3	Soil Grout Ground Improvement, Land (Double Crew)	[cy]	5333	800	7	14
	4.1	Compacted Base Rock for Asphalt (12")	[sf]	169513	6000	28	8
	4.2	Asphalt Paving includes 6" HMA	[sf]	169513	13500	13	9
	Anytime	Outfall Structure SDPS 1D, 1A, 1B	[lf]	40	5	8	7
					-	-	-
				-	-		-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2.2, 3.2, 4.1	
Total						133	90

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
7451	0	0	0	0	0	0	0	0	0
11177	2	47	3306	0	0	0	0	0	0
30195	0	0	0	0	0	0	0	0	0
29171	0	0	0	0	0	0	0	0	0
18872	0	0	0	0	0	0	0	0	0
14597	0	0	0	0	0	0	0	0	0
42480	0	0	0	0	0	0	0	0	0
31860	0	0	0	0	0	0	0	0	0
84959	0	0	0	0	0	0	0	0	0
7467	0	0	0	0	0	0	0	0	0
18081	0	0	0	0	0	0	0	0	0
9041	0	0	0	0	0	0	0	0	0
4480	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
309831	2	47	3306	0	0	0	0	0	0

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	31	373	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	14	550	40732	30	1180	14154	0	0
0	0	0	9	235	9384	25	652	10427	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	4
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
2	31	373	23	785	50116	55	1831	24581	1	4

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	62	745	0	0	0
0	0	0	0	0	0	0	0	0	0
0	3	157	39317	5	315	3774	0	0	0
0	0	12	2188	1	61	729	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	10	1327	15930	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	45	300	9300	0	0	0	0	0	0
0	34	961	71082	0	0	0	0	0	0
0	28	352	27423	0	0	0	0	0	0
124	0	2	128	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
124	65	1783	149438	20	1765	21179	0	0	0

Table 15

Reach 15	Schedule Step	Activity Items	Quantity Unit	Quantity	Production Rate [Quantity Unit/day]	Total Duration [Work Days]	Number of Workers
Units							
Notes							
	1	Site Prep (Clear Grub, Misc Excavation, Grading/Road Prep)	[LF]	2245	300	7	6
	2	Concrete Wall (Land)	[LF]	2245	40	56	6
	2.1	Berm or Soil Removal	[cy]	998	200	5	6
	Anytime	Passive Flood Gate	[LF]	78	4	20	6
	Continuous	Site Services (Temp Fence, Temp Barrier, Access/Security, Misc)			Reach Duration	69	4
	Continuous	Laydown Area Management			Reach Duration	69	3
	Continuous	Management, Inspection, Support Staff			Reach Duration	69	8
	Anytime	Utility Relocation	[LF]	1000	100	10	6
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Total Description						Steps 1, 2, 2.1	
Total						69	45

Total Commute Distance For Completion of Task	Daily Demo Trips	Demo Total Trips	Demo Total Mileage	Daily Demo Trips (On Site)	Demo Total Trips (On Site)	Demo Total Mileage (On site)	Daily Material Off-haul: Riprap/Soil Truck Trips	Material Off-haul: Riprap/Soil Total Truck Trips	Material Off-haul: Riprap/Soil Total Mileage
[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]
3592	0	0	0	0	0	0	0	0	0
26940	0	0	0	0	0	0	0	0	0
2395	0	0	0	0	0	0	12	60	4670
9360	0	0	0	0	0	0	0	0	0
21951	0	0	0	0	0	0	0	0	0
16463	0	0	0	0	0	0	0	0	0
43902	0	0	0	0	0	0	0	0	0
4800	0	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
129403	0	0	0	0	0	0	12	60	4670

Daily Material Off-haul: Riprap/Soil Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Truck Trips (On Site)	Material Off-haul: Riprap/Soil Total Mileage (On Site)	Daily Material Import: Riprap/Soil Truck Trips	Material Import: Riprap/Soil Total Truck Trips	Material Import: Riprap/Soil Total Mileage	Daily Material Import: Riprap/Soil Truck Trips (On Site)	Material Import: Riprap/Soil Total Truck Trips (On Site)	Material Import: Riprap/Soil Total Mileage (On Site)	Daily Concrete Truck Trips	Concrete Total Trips
[round trips/day]	[round trips]	[mi]	[round trips/day	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]
2	15	180	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	6	309
25	125	1497	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
4	40	480	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
31	180	2156	0	0	0	0	0	0	6	313

Concrete Truck Total Mileage	Daily Other Truck Trips	Total Other Truck Trips	Other Truck Trips Total Mileage	Daily Other Truck Trips (On Site)	Total Other Truck Trips (On Site)	Other Truck Trips Total Mileage (On Site)	Daily Barge Trips	Total Barge Trips	Barge Total Mileage
[mi]	[round trips/day]	[round trips]	[mi]	[round trips/day]	[round trips]	[mi]	[round trips/da	[round trips]	[mi]
	Sheet Pile, Asphalt, Misc			Sheet Pile, Asphalt, Misc					
0	0	0	0	4	30	359	0	-	0
7633	0	0	0	0	0	0	0	-	0
0	0	0	0	0	0	0	0	-	0
312	0	1	1370	0	4	47	0	-	0
0	0	0	0	10	686	8232	0	-	0
0	0	0	0	0	0	0	0	-	0
0	0	0	0	0	0	0	0	-	0
0	0	0	0	1	10	120	0	-	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
7945	0	1	1370	15	730	8758	0	0	0

Expedited Construction Schedule for AQ and Transportation

Table 1
Alterative Construction Schedule (Reach 2 First)

Reach #	Name of Reach	Working Days (5-Day Work Week)[a]	Start Date	End Date	Work Hours
1	San Bruno Channel	102	11/27/2026	4/19/2027	Daytime
2	Treatment Plant	159	6/1/2025	1/9/2026	Daytime
3	Sea Plane Harbor 1	71	12/5/2025	3/13/2026	Daytime
4	Coast Guard	67	2/10/2026	5/14/2026	Daytime
5	Sea Plane Harbor 2	111	4/14/2026	9/15/2026	Daytime
6	Superbay	97	8/14/2026	12/28/2026	Daytime
7	Runway 19L End	800	6/1/2025	6/25/2028	Nighttime
8	Runway 19L Edge	401	11/24/2027	6/6/2029	Nighttime
9	Intersection 1	22	12/24/2030	1/22/2031	Nighttime
10	Intersection 2	30	11/15/2030	12/26/2030	Nighttime
11	Runway 28R Edge	339	8/6/2030	11/23/2031	Nighttime
12	End of Runway 28R & 28L	73	6/7/2029	9/17/2029	Nighttime
13	Runway 28L Edge	428	6/7/2029	1/27//2031	Nighttime
14	Mudflat	135	7/21/2027	1/25/2028	Nighttime
15	Millbrae Channel	70	4/15/2027	7/21/2027	Daytime
	All Construction	**1,690**	**6/1/2025**	**11/23/31**	

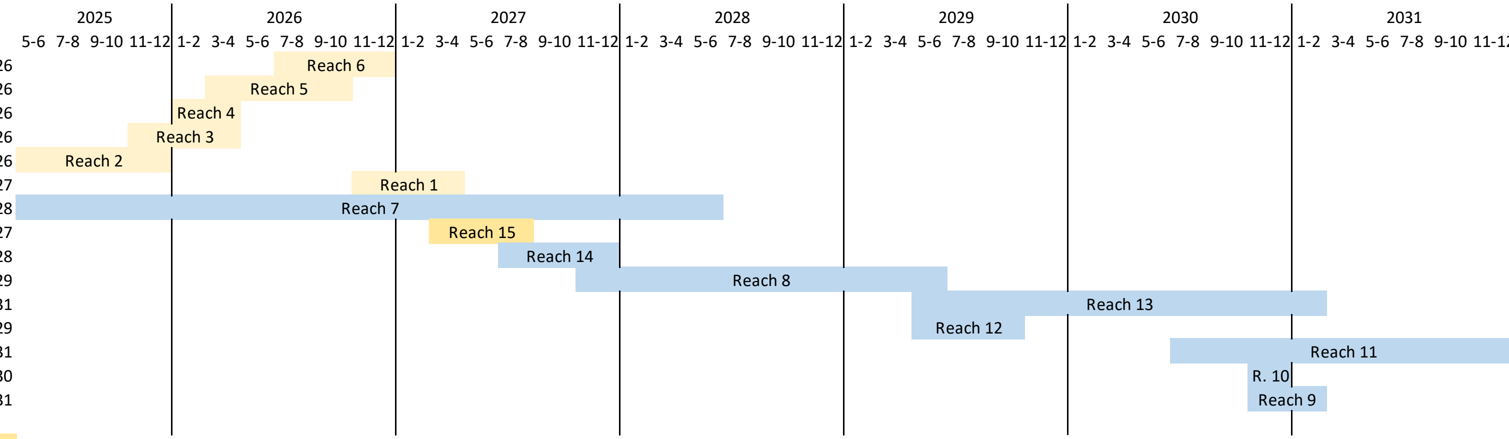
NOTES:
[a] Working days are rounded up based on whole workdays for each activity provided by the project sponsor.

SOURCE: Project sponsor.

Notes:

- Reach 2 is to be completed first to create additional laydown area for remaining reaches.
- Changes to schedule are highlighted.

Reach 6	8/14/26	12/28/26
Reach 5	4/14/26	9/15/26
Reach 4	2/10/26	5/14/26
Reach 3	12/5/25	3/13/26
Reach 2	6/1/25	1/9/26
Reach 1	11/27/26	4/19/27
Reach 7	6/1/25	6/25/28
Reach 15	4/15/27	7/21/27
Reach 14	7/21/27	1/25/28
Reach 8	11/24/27	6/6/29
Reach 13	6/7/29	1/27/31
Reach 12	6/7/29	9/17/29
Reach 11	8/6/30	11/23/31
Reach 10	11/15/30	12/26/30
Reach 9	12/24/30	1/22/31



daytime construction

nighttime construction

Trucks

Deliveries B: Between Larger Staging Areas and Final Destination		North or South
1	Demo Off-Haul	North U.S. 101/I-80
3	Riprap Off-Haul	North U.S. 101/I-80
5	Riprap/Soil Import	North U.S. 101/I-80
5	Riprap/Soil Import	North I-380/I-280
8	Other Trucks Import	South

Deliveries C: Between Reach and Larger Staging Areas (On-Site)		
2	Demo Off-Haul	
4	Riprap/Soil Off-Haul	
6	Riprap/Soil Import	
9	Other Trucks Import	

Deliveries A: Direct to Reach		
7	Concrete	North

Off-Site Origins or Destinations

Type of Trip	Off-Site Location	Roads	North or South
Disposal			
Disposal Riprap	Dutra Materials, Richmond	U.S. 101, I-80	North U.S. 101/I-80
Disposal Vinyl	Altamont Landfill	U.S. 101, SM Bridge	South
Disposal Concrete	Dutra Materials, Richmond	U.S. 101, I-80	North U.S. 101/I-80
Disposal Clay/Mud	Dutra Materials, Richmond	U.S. 101, I-80	North U.S. 101/I-80
Disposal Other Landfill	Altamont Landfill	U.S. 101, SM Bridge	South
Disposal Asphalt	Altamont Landfill	U.S. 101, SM Bridge	South

April 2021 revision due to closure of West Contra Costa Landfill, instead disposal would be to the Altamont Landfill
Due to change, location for demo trips for reaches 1 through 6 (asphalt) and 9 (vinyl wall) were revised.

Deliveries			
Concrete to Site	Pier 90, San Francisco	U.S.101, I-280	North U.S. 101/I-80
Soil Grouting Materials	Pier 92, San Francisco	U.S.101, I-280	North U.S. 101/I-80
Fill Truck Sand	Hansen, Pier 92, SF	U.S.101, I-280	North U.S. 101/I-80
Fill Truck Riprap	Dutra Quarry, San Rafael	I-380, I-280, U.S. 101	North I-380/I-280
Outside Delivery Rock	Dutra Quarry, San Rafael	I-380, I-280, U.S. 101	North I-380/I-280
Outside Delivery Asphalt	Dutra Materials, Richmond	U.S. 101, I-80	North U.S. 101/I-80
Fill Truck Clay/Mud	Various (assume East Bay)	U.S. 101, SM Bridge	South
Rebar	Stockton	U.S. 101, SM Bridge	South
Sheetpile	Stockton	U.S. 101, SM Bridge	South
Tierod	Stockton	U.S. 101, SM Bridge	South
Wick Drain Materlai	Stockton	U.S. 101, SM Bridge	South
Capbeam	Stockton	U.S. 101, SM Bridge	South

Construction Workers		North or South
San Francisco	10%	North U.S. 101/I-80
South Bay Close (Santa Clara, San Mateo)	15%	South
South Bay Far (Monterey, Santa Cruz, Salin	10%	North I-380/I-280
South Bay Far (Monterey, Santa Cruz, Salin	10%	South
East Bay Close (Alameda, Contra Costa)	10%	North U.S. 101/I-80
East Bay Close (Alameda, Contra Costa)	10%	South
East Bay Far (San Joaquin)	20%	South
North Bay (Napa, Marin, Sonoma)	15%	North I-380/I-280
	100%	
	20%	North U.S. 101/I-80
	25%	North I-380/I-280
	55%	South
	100%	

Access to Reaches Reaches	
North Access Road	Reaches 1 through 8
So. McDonnell Rd/Millbrae Gate	Reaches 9 through 15

Engineering Support Services for the Airport Shoreline Protection Program Environmental Review – Contract No. 8354A.44

Subject:	**EIR Data Request Summary Report**
Prepared by:	**Jacob Shaw, Bk Cooper**
Reviewed by:	**James Connolly and Bob Kirby**
Date:	**12-16-2020** **Rev: 1**

1.0 INTRODUCTION

The purpose of this memo is to describe the construction methodology for individual tasks and outline many assumptions used in the EIR Data Requested Information Spreadsheet.

2.0 CONSTRUCTION TASK

The following is a brief description of the various activities and task involved in the project. Each activity or task corresponds to activity items in the EIR Data Requested Information Spreadsheet. Production rates, material quantities, duration of activities, and other pertinent information can be found in the EIR Data Requested Information Spreadsheet.

2.1.1 Traffic Coordination (Excel Table 0.1)

If traffic coordination is required, the initial plan is to set up cones with a person on each end to stop and direct two-way traffic on one lane. For longer reaches or a 24/7 traffic control operation, a traffic signal may be used. The picture below is an image of traffic coordination along Reach 3. The 2-person crew would use reliable 2-way radio to direct traffic. Additional crew members may be required if driveways or side streets occur within the closure area.

5.0 HAUL ROUTES

Below is a list of the various truck trips. The methodology behind determining the routes was to find the most likely supplier. Many of the items can come from a variety of sources and the exact route will be based on contractor means-and-method. The haul routes are broken into trips to the laydown area and then from the laydown area to the reach construction site. The spread sheet counts the trips as two separate trips: one for delivery to laydown area, one for delivery to reach. The trip shown in the spread sheet are round trips.

The routes to the laydown area are shown in Figure 22.

The haul routes from the laydown area to the specific reach are noted as "On site" vehicles trips in the spread sheet. To be conservative, all trips are assumed to go to and from Aviador lot as it is on average the furthest laydown area from each reach. All trips are assumed to be 12 miles round trip. The exact laydown area will dependent on laydown area availability and contractor means-and-methods. Contractors may move from one laydown area to another as construction progresses, see Section 3.0 for laydown areas.

The general path from the laydown area is broken up into two routes, one for reaches 1-8 and the other for reaches 9-15. See Figure 23 for reach numbering. The first path is for reaches 1-8 and is shown in Figure 24 which uses 101, the road around the north-end of the airport, and gate 118 for reaches 7 and 8. While it may be shorter for trucks to go through the Millbrae gate for reaches 7-8 this would require driving past an operational runway which could be problematic. The second path is for reaches 9-15 and uses the Millbrae gate on the south end of the airport property, see Figure 25.

Table 1- Truck Barge Round Trips

Truck/Barge Round Trips	Unit	Quantity per Truck/Barge	Mileage Per Truck Per Round Trip	Location Assumption
Disposal (Riprap) Off Site	[ton]	18	78	Dutra Material, Richmond
Disposal (Concrete) Off Site Marine	[cy]	1000	20	Berth 10, Port of Oakland
Disposal (Riprap) On Site	[cy]	8	12	Onsite Relocation
Disposal (Vinyl) Off Site	[lin.ft]	10	71	West Contra Costa Landfill
Disposal (Vinyl) On Site	[lin.ft]	10	12	Onsite Relocation

Truck/Barge Round Trips	Unit	Quantity per Truck/Barge	Mileage Per Truck Per Round Trip	Location Assumption
Disposal (Concrete) Off Site	[ton]	18	78	Dutra Materiasl, Richmond
Disposal (Concrete) On Site	[cy]	10	12	Onsite Relocation
Disposal (Clay/Mud) Off Site	[ton]	18	78	Dutra Materials, Richmond
Disposal (Clay/Mud) On Site	[cy]	8	12	Onsite Relocation
Concrete Truck to Site	[cy]	11	31	Cemex Cement, Pier 90 Port of SF
Concrete Truck to Barge	[cy]	11	31	Cemex Cement, Pier 90 Port of SF
Fill Truck (Clay/Mud) From Off Site	[ton]	18	74	Various
Fill Truck (Clay/Mud) From On Site	[cy]	8	12	Onsite Relocation
Fill Truck (Sand)	[tons]	24	30	Hanson Aggregates, Peir 92 Port of SF
Fill Truck (Riprap) Off Site	[ton]	15	74	Dutra Quarry, San Rafael
Fill Truck (Riprap) On Site	[cy]	8	12	Onsite Relocation
Fill Barge (Rip Rap)	[ton or cy]	585/344	50	Dutra Quarry, San Rafael
Fill Barge (Sand)	[ton]	1500	70	Hanson Agrregates, SF Bay
Fill Barge (Rock)	[ton or cy]	585/390	50	Dutra Quarry, San Rafael
Fill Barge (Clay/Mud)	[ton or cy]	585/390	60	Various
Outside Delivery rock	[ton]	24	74	Dutra Quarry, San Rafael
Outside Delivery Asphalt	[ton]	18	78	Dutra Materials, Richmond
Rebar Delivery	[ton]	20	170	From Stockton to SFO

Truck / Barge Round Trips	Unit	Quantity per Truck / Barge	Mileage Per Truck Per Round Trip	Location Assumption
Sheet Pile Delivery To Off Site Storage	[ton]	50	146	From Stockton to Berth 10, Port of Oakland
Sheet Pile Delivery To On Site Storage	[ton]	10	170	From Stockton to SFO
Sheet Pile Delivery From Storage to Work Face or Barge	[ton]	10	12	From Berth 10 to SFO via water
Sheet Pile Delivery by Supply Barge to Work Face	[ton]	585	12	Port of Oakland or Port of SF
On Site Processed (Riprap)	[cy]	8	12	Onsite Relocation
On site Processed (Clay / Mud)	[cy]	8	12	Onsite Relocation
On Site Reallocated (Sand)	[cy]	8	12	Onsite Relocation
On Site Maintenance	[shift]	10	12	Onsite Relocation
Site Prep	[cy]	8	12	Onsite Relocation
Truck Misc	Unique	Unique	Unique	Unique
Barge Daily Movement	[shift]		8	Moored 4 miles from SFO in bay
Truck Misc (On site)	Unique	Unique	Unique	Onsite Relocation
Relocate Jet Grout Cuttings	[cy]	10	4	Onsite Relocation
Soil Grouting Material Delivery (Truck Trips)	[cy]	18	31	From Peir 92
Soil Grouting Material Delivery (Barge Trips)	[cy]	600	20	From Oakland
Tierod Delivery	[tons]	20	180	From Stockton
Dredge Disposal	[cy]	2000	130	Disposal at Mantazuma
Wick Drain Material Delivery			180	From Stockton
Capbeam Delivery	[lf]	500	180	From Stockton
Sheet Pile Delivery (Barge)	[ton]	585	160	From Stockton

Truck/Barge Round Trips	Unit	Quantity per Truck/Barge	Mileage Per Truck Per Round Trip	Location Assumption
Disposal Other, Landfill	[cy]	10	71	West Contra Costa Landfill
Disposal Asphalt	[cy]	10	71	West Contra Costa Landfill

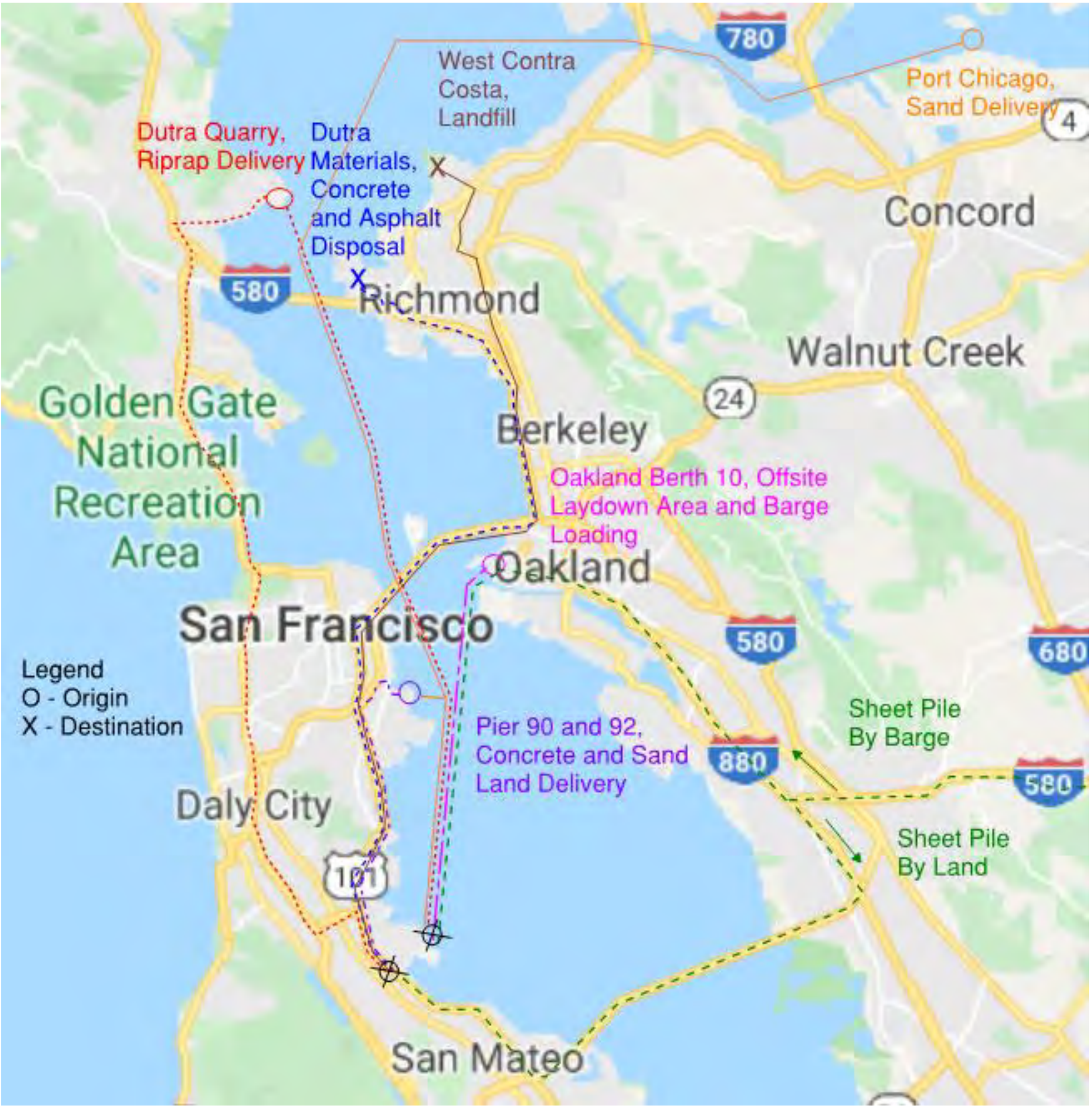


Figure 22 - Map of haul routes to laydown area

SFO Shoreline Protection Project - CEQA Analysis			
Typical Hours of Operation			
January 6, 2021			
	Daytime Shift Only	**Nigthtime Shift Only**	**Multiple Shifts**
Reaches	1 to 6	7 to 15	Not expected
Hours of work shift	7:00am - 4:00pm	11:00pm-6:00am	
Arrival of construction workers	One hour before shift starts	One hour before shift starts	
Departure of construction workers	One hour after shift ends	One hour after shift ends	
Off-site materials delivery to Aviador Lot	24/7, 70% likely to occur in morning between 6am-11am	24/7, 70% likely to occur in morning between 6am-11am	
Off-site materials delivery directly to reach (e.g., concrete)	7:00 am to 4:00 pm	11:00pm-6:00am	
Transfers between reach and staging area	6:00 am to 4:30 pm	11:00pm -6:00am	
Materials removal from Aviador Lot to other off-site locations	24/7, 70% likely to occur in morning between 6am-11am	24/7, 70% likely to occur in morning between 6am-11am	
Materials removal from reach to other locations	7:00 am to 4:00 pm	11:00pm-6:00am	
Notes:			
(1) Typical hours of operation. Discussion of hours of construction will state that reaches construction during daytime shifts			
may require some work during the evening or overnight hours, but this would not be typical.			

SFO Shoreline Protection Project - CEQA Analysis
Percentage of Construction Workers by Residence
January 6, 2021

	Residence of Construction Workers						
Reach	**San Francisco**	**South Bay Close**	**South Bay Far**	**East Bay Close**	**East Bay Far**	**North Bay**	**Total**
Additional Discription	**San Francisco County (See Note 1)**	**Santa Clara County, San Mateo County**	**Monterey, Santa Cruz, Salinas**	**Alameda, Contra Costa**	**San Joaquin County**	**Napa, Marin, Sonoma**	
All Reaches	10%	15%	20%	20%	20%	15%	100%

Notes: **1. Percentage of San Francisco workers may increase depending on local hire ordances**

Attachment 2

SUMMARY OF AVERAGE DAILY AND TOTAL CONSTRUCTION TRUCKS AND AVERAGE DAILY CONSTRUCTION WORKERS BY REACH

Attachment 2 - Average Daily Construction Trucks by Reach and Step

Reach/Step	Trucks B: Between Larger Staging Area and Final Destination								Trucks C: Between Reach and Larger Staging Area (On-Site)								A: Direct to Reach		TOTAL		Avg/Day
	1. Demo Off-Haul		3. Riprap Off-Haul		5. Riprap Import		8. Other Import		2. Demo Off-Haul		4. Riprap Off-Haul		6. Riprap Import		9. Other Import		7. Concrete		Total		Number of
	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Workers
Reach 1																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	21	0	0	4	42	0	0	6	62	6
Step 2	0	0	12	125	0	0	0	0	0	0	25	260	0	0	0	0	0	0	37	385	6
Step 3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	1	4	6	432	8	437	22
Continuous & AT	12	129	0	0	0	0	15	151	0	0	0	0	0	0	12	1186	0	0	39	1466	28
total	12	129	12	125	0	0	16	153	0	0	27	281	0	0	17	1231	6	432	90	2350	62
Reach 2																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	29	0	0	4	59	0	0	6	88	6
Step 2	11	24	12	88	0	0	0	0	17	38	25	184	0	0	0	0	0	0	65	334	18
Step 3	0	0	0	0	0	0	4	161	0	0	0	0	0	0	7	356	0	0	11	517	14
Step 4	0	0	0	0	23	70	0	0	0	0	0	0	55	165	0	0	0	0	78	235	13
Step 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Step 6	0	0	0	0	14	186	34	506	0	0	0	0	40	1154	0	0	0	0	88	1846	22
Step 7	5	25	0	0	0	0	33	210	0	0	0	0	0	0	0	0	0	0	38	234	15
Continuous & AT	12	121	0	0	0	0	14	141	0	0	0	0	0	0	10	1553	0	0	36	1815	24
total	28	169	12	88	37	256	85	1018	17	38	27	214	95	1319	21	1967	0	0	322	5070	118
Reach 3																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	9	0	0	4	18	0	0	6	28	6
Step 2	11	174	13	70	0	0	0	0	17	264	28	150	0	0	0	0	0	0	69	659	18
Step 3	0	0	0	0	0	0	4	53	0	0	0	0	0	0	7	113	0	0	11	166	14
Step 4	0	0	0	0	23	96	62	53	0	0	0	0	55	240	0	0	0	0	140	389	30
Continuous & AT	12	49	0	0	0	0	14	57	0	0	0	0	0	0	10	673	0	0	36	779	24
total	23	223	13	70	23	96	80	163	17	264	30	159	55	240	21	805	0	0	262	2021	92
Reach 4																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	10	0	0	4	19	0	0	6	29	6
Step 2	6	46	13	125	0	0	0	0	9	70	28	270	0	0	0	0	0	0	56	511	12
Step 3	0	0	0	0	0	0	4	62	0	0	0	0	0	0	7	126	6	11	16	199	20
Step 4	0	0	0	0	23	150	0	0	0	0	0	0	55	368	0	0	0	0	78	518	13
Continuous & AT	12	87	0	0	0	0	14	101	0	0	0	0	0	0	10	651	0	1	36	840	30
total	18	133	13	125	23	150	18	163	9	70	30	279	55	368	21	796	6	12	193	2097	81
Reach 5																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	18	0	0	4	37	0	0	6	55	6
Step 2	5	75	13	279	0	0	0	0	8	120	28	601	0	0	0	0	0	0	54	1075	12
Step 3	0	0	0	0	0	0	3	99	0	0	0	0	0	0	6	221	0	0	9	320	12
Step 4	0	0	0	0	23	265	62	107	0	0	0	0	55	682	0	0	0	0	140	1054	30
Continuous & AT	12	74	0	0	0	0	14	86	0	0	0	0	0	0	10	1085	0	0	36	1245	24
total	17	149	13	279	23	265	79	292	8	120	30	619	55	682	20	1343	0	0	245	3750	84
Reach 6																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	20	0	0	4	39	0	0	6	59	6
Step 2	2	30	25	330	0	0	0	0	0	0	53	699	0	0	0	0	0	0	80	1059	18
Step 3	0	0	0	0	0	0	3	106	0	0	0	0	0	0	6	236	0	0	9	342	12
Step 4	0	0	0	0	14	61	0	0	0	0	0	0	30	131	0	0	0	0	44	192	6
Continuous & AT	12	63	0	0	0	0	15	77	0	0	0	0	0	0	11	558	0	0	38	698	26
total	14	92	25	330	14	61	18	184	0	0	55	719	30	131	21	833	0	0	177	2351	68
Reach 7																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	28	0	0	4	57	0	0	6	85	6
Step 2	0	0	13	1334	0	0	0	0	0	0	28	2873	0	0	0	0	0	0	41	4207	27
Step 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	98	0	0	3	98	30
Step 4	0	0	12	746	14	1741	67	16778	0	0	25	1553	30	3731	0	0	0	0	148	24549	44
Step 5	0	0	0	0	0	0	1	56	0	0	0	0	0	0	1	56	0	0	2	111	10
Step 6	0	0	22	1224	0	0	65	1160	0	0	50	2781	0	0	5	29	0	0	142	5194	30
Continuous & AT	2	74	0	0	0	0	2	74	0	0	0	0	0	0	2	1440	0	0	6	1588	24
total	2	74	47	3303	14	1741	134	18067	0	0	105	7236	30	3731	15	1678	0	0	347	35831	171
Reach 8																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	10	0	0	4	20	0	0	6	30	6
Step 2	0	0	13	576	0	0	0	0	0	0	28	1240	0	0	0	0	0	0	41	1815	27
Step 3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4	39	0	0	4	44	36
Step 4	5	41	12	190	14	276	67	5164	8	66	25	396	30	592	0	0	0	0	161	6725	50
Step 5	0	0	0	0	0	0	62	447	0	0	0	0	0	0	0	0	0	0	62	447	17
Continuous & AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	960	0	0	2	960	11
total	5	41	25	766	14	276	129	5615	8	66	55	1646	30	592	10	1020	0	0	276	10022	147
Reach 9																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	5	0	0	4	11	0	0	6	16	6
Step 2	2	8	13	35	0	0	3	27	0	0	28	75	0	0	5	54	0	0	51	199	18
Step 3	0	0	0	0	14	38	0	0	0	0	0	0	30	81	0	0	0	0	44	118	17
Continuous & AT	0	0	0	0	0	0	63	247	0	0	0	0	0	0	11	212	0	0	74	459	36
total	2	8	13	35	14	38	66	274	0	0	30	81	30	81	20	276	0	0	175	792	77
Reach 10																					

Reach/Step	Trucks B: Between Larger Staging Area and Final Destination								Trucks C: Between Reach and Larger Staging Area (On-Site)								A: Direct to Reach		TOTAL		Avg/Day
	1. Demo Off-Haul		3. Riprap Off-Haul		5. Riprap Import		8. Other Import		2. Demo Off-Haul		4. Riprap Off-Haul		6. Riprap Import		9. Other Import		7. Concrete		Total		Number of
	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Workers
Step 1	0	0	0	0	0	0	0	0	0	0	2	6	0	0	4	12	0	0	6	18	6
Step 2	2	9	0	0	0	0	3	33	0	0	0	0	0	0	6	74	0	0	11	116	18
Step 3	0	0	0	0	23	74	0	0	0	0	0	0	55	177	0	0	0	0	78	251	13
Continuous & AT	0	0	0	0	0	0	62	235	0	0	0	0	0	0	10	264	0	0	72	499	32
total	2	9	0	0	23	74	65	268	0	0	2	6	55	177	20	350	0	0	167	884	69
Reach 11																					
Step 1	5	88	0	0	0	0	0	0	8	141	2	22	0	0	4	43	0	0	19	293	12
Step 2	0	0	13	666	0	0	48	10909	0	0	28	1435	0	0	6	508	0	0	95	13518	32
Step 3	0	0	25	1092	14	588	0	0	0	0	50	2183	30	1259	0	0	0	0	119	5122	13
Step 4	0	0	0	0	0	0	62	851	0	0	0	0	0	0	0	0	0	0	62	851	17
Continuous & AT	0	0	0	0	0	0	1	4	0	0	0	0	0	0	10	3359	1	8	12	3371	22
total	5	88	38	1758	14	588	110	11763	8	141	80	3640	30	1259	20	3909	1	8	306	23155	96
Reach 12																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	14	0	0	4	28	0	0	6	42	6
Step 2	5	5	13	143	0	0	3	76	8	8	28	307	0	0	6	169	0	0	63	708	24
Step 3	0	0	0	0	23	549	0	0	0	0	0	0	55	1246	0	0	0	0	78	1794	13
Continuous & AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	715	0	0	10	715	15
total	5	5	13	143	23	549	3	76	8	8	30	321	55	1246	20	912	0	0	157	3259	58
Reach 13																					
Step 1	5	114	0	0	0	0	0	0	8	182	2	28	0	0	4	56	0	0	19	380	12
Step 2	0	0	13	1172	0	0	48	13941	0	0	28	2525	0	0	6	601	0	0	95	18239	32
Step 3	0	0	25	1263	14	612	0	0	0	0	50	2527	30	1312	0	0	0	0	119	5714	13
Step 4	0	0	0	0	0	0	62	1116	0	0	0	0	0	0	0	0	0	0	62	1116	17
Continuous & AT	0	0	0	0	0	0	1	4	0	0	0	0	0	0	10	3750	1	8	12	3762	22
total	5	114	38	2436	14	612	110	15061	8	182	80	5080	30	1312	20	4407	1	8	306	29212	96
Reach 14																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	31	0	0	4	62	0	0	6	93	6
Step 2	2	47	0	0	0	0	3	169	0	0	0	0	0	0	6	375	0	0	11	591	18
Step 3	0	0	0	0	23	785	45	300	0	0	0	0	55	1831	0	0	0	0	123	2916	27
Step 4	0	0	0	0	0	0	62	1312	0	0	0	0	0	0	0	0	0	0	62	1312	17
Continuous & AT	0	0	0	0	0	0	0	2	0	0	0	0	0	0	10	1124	1	4	11	1129	22
total	2	47	0	0	23	785	110	1783	0	0	2	31	55	1831	20	1561	1	4	212	6042	90
Reach 15																					
Step 1	0	0	0	0	0	0	0	0	0	0	2	15	0	0	4	30	0	0	6	45	6
Step 2	0	0	12	60	0	0	0	0	0	0	25	125	0	0	0	0	6	309	43	493	12
Step 3																			0	0	
Continuous & AT	0	0	0	0	0	0	0	1	0	0	4	40	0	0	11	700	0	4	15	745	27
total	0	0	12	60	0	0	0	1	0	0	31	180	0	0	15	730	6	313	64	1283	45
Total	140	1282	274	9518	259	5491	1021	54883	83	889	614	20493	605	12969	282	21819	20	776	3297	128118	1354

AT = Any time during the construction period

Sources: EIR Data Requested Information Final.xlsx
EIR Data Requested Information Rev 1 3_7_2021.xlsx - step clarifications
EIR Data Requested Information Rev 4.xlsx - reaches 7 and 8 steps

Table 1 in Memo

Reach	Total Trucks	Daily Trucks Total	Max Step	Workers Max Step	Worker Shuttles	Total
1	2,350	90	76	34	6	116
2	5,070	322	124	46	6	176
3	2,021	262	176	54	6	236
4	2,097	193	114	43	6	163
5	3,750	245	176	54	6	236
6	2,351	177	118	44	6	168
7	35,831	347	154	68	6	228
8	10,022	276	163	61	6	230
9	792	175	125	54	6	185
10	884	167	150	45	6	201
11	23,155	306	131	35	6	172
12	3,259	157	88	28	6	122
13	29,212	306	131	35	6	172
14	6,042	212	134	49	6	189
15	1,283	64	58	39	6	103
Total	128,118	3297	1916	689	90	2695

Attachment 3
SUMMARY OF AVERAGE DAILY AND TOTAL TRUCKS AND AVERAGE DAILY CONSTRUCTION WORKERS FOR TASKS WITH GREATEST NUMBER OF CONSTRUCTION TRUCKS

Attachment 3: Summary of Construction Trucks for Overlap Reaches

	Trucks B: Between Larger Staging Area and Final Destination								Trucks C: Between Reach and Larger Staging Area (On-Site)								A: Direct to Reach		TOTAL		
Reach/Step	1. Demo Off-Haul		3. Riprap Off-Haul		5. Riprap Import		8. Other Import		2. Demo Off-Haul		4. Riprap Off-Haul		6. Riprap Import		9. Other Import		7. Concrete		Total		Reach/Step
	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	Avg/Day	Total	
Reach 1																					Reach 1
Step 2	0	0	12	125	0	0	0	0	0	0	25	260	0	0	0	0	0	0	37	385	Step 2
Cont. & AT	12	129	0	0	0	0	15	151	0	0	0	0	0	0	12	1186	0	0	39	1466	Cont. & AT
peak subtotal	*12*	*129*	*12*	*125*	*0*	*0*	*15*	*151*	*0*	*0*	*25*	*260*	*0*	*0*	*12*	*1186*	*0*	*0*	*76*	*1851*	
Reach 2																					Reach 2
Step 6	0	0	0	0	14	186	34	506	0	0	0	0	40	1154	0	0	0	0	88	1846	Step 6
Cont. & AT	12	121	0	0	0	0	14	141	0	0	0	0	0	0	10	1553	0	0	36	1815	Cont. & AT
peak subtotal	*12*	*121*	*0*	*0*	*14*	*186*	*48*	*647*	*0*	*0*	*0*	*0*	*40*	*1154*	*10*	*1553*	*0*	*0*	*124*	*3661*	
Reach 3																					Reach 3
Step 4	0	0	0	0	23	96	62	53	0	0	0	0	55	240	0	0	0	0	140	389	Step 4
Cont. & AT	12	49	0	0	0	0	14	57	0	0	0	0	0	0	10	673	0	0	36	779	Cont. & AT
peak subtotal	*12*	*49*	*0*	*0*	*23*	*96*	*76*	*111*	*0*	*0*	*0*	*0*	*55*	*240*	*10*	*673*	*0*	*0*	*176*	*1169*	
Reach 4																					Reach 4
Step 4	0	0	0	0	23	150	0	0	0	0	0	0	55	368	0	0	0	0	78	518	Step 4
Cont. & AT	12	87	0	0	0	0	14	101	0	0	0	0	0	0	10	651	0	1	36	840	Cont. & AT
peak subtotal	*12*	*87*	*0*	*0*	*23*	*150*	*14*	*101*	*0*	*0*	*0*	*0*	*55*	*368*	*10*	*651*	*0*	*1*	*114*	*1359*	
Reach 5																					Reach 5
Step 4	0	0	0	0	23	265	62	107	0	0	0	0	55	682	0	0	0	0	140	1054	Step 4
Cont. & AT	12	74	0	0	0	0	14	86	0	0	0	0	0	0	10	1085	0	0	36	1245	Cont. & AT
peak subtotal	*12*	*74*	*0*	*0*	*23*	*265*	*76*	*193*	*0*	*0*	*0*	*0*	*55*	*682*	*10*	*1085*	*0*	*0*	*176*	*2300*	
Reach 6																					Reach 6
Step 1	0	0	0	0	0	0	0	0	0	0	2	20	0	0	4	39	0	0	6	59	Step 1
Step 2	2	30	25	330	0	0	0	0	0	0	53	699	0	0	0	0	0	0	80	1059	Step 2
Step 3	0	0	0	0	0	0	3	106	0	0	0	0	0	0	6	236	0	0	9	342	Step 3
Step 4	0	0	0	0	14	61	0	0	0	0	0	0	30	131	0	0	0	0	44	192	Step 4
Cont. & AT	12	63	0	0	0	0	15	77	0	0	0	0	0	0	11	558	0	0	38	698	Cont. & AT
total	14	92	25	330	14	61	18	184	0	0	55	719	30	131	21	833	0	0	177	2351	
peak subtotal	*14*	*92*	*25*	*330*	*0*	*0*	*15*	*77*	*0*	*0*	*53*	*699*	*0*	*0*	*11*	*558*	*0*	*0*	*118*	*1757*	
Reach 7																					Reach 7
Step 4	0	0	12	746	14	1741	67	16778	0	0	25	1553	30	3731	0	0	0	0	148	24549	Step 4
Cont. & AT	2	74	0	0	0	0	2	74	0	0	0	0	0	0	2	1440	0	0	6	1588	Cont. & AT
peak subtotal	*2*	*0*	*12*	*1969*	*14*	*1741*	*69*	*17938*	*0*	*0*	*25*	*4335*	*30*	*3731*	*2*	*29*	*0*	*0*	*154*	*6781*	
Reach 8																					Reach 8
Step 4	5	41	12	190	14	276	67	5164	8	66	25	396	30	592	0	0	0	0	161	6725	Step 4
Cont. & AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	960	0	0	2	960	Cont. & AT
peak subtotal	*5*	*41*	*12*	*190*	*14*	*276*	*67*	*5164*	*8*	*66*	*25*	*396*	*30*	*592*	*2*	*960*	*0*	*0*	*163*	*7685*	
Reach 9																					Reach 9
Step 2	2	8	13	35	0	0	3	27	0	0	28	75	0	0	5	54	0	0	51	199	Step 2
Cont. & AT	0	0	0	0	0	0	63	247	0	0	0	0	0	0	11	212	0	0	74	459	Cont. & AT
peak subtotal	*2*	*8*	*13*	*35*	*0*	*0*	*66*	*274*	*0*	*0*	*28*	*75*	*0*	*0*	*16*	*265*	*0*	*0*	*125*	*657*	
Reach 10																					Reach 10
Step 3	0	0	0	0	23	74	0	0	0	0	0	0	55	177	0	0	0	0	78	251	Step 3
Cont. & AT	0	0	0	0	0	0	62	235	0	0	0	0	0	0	10	264	0	0	72	499	Cont. & AT
peak subtotal	*0*	*0*	*0*	*0*	*23*	*74*	*62*	*235*	*0*	*0*	*0*	*0*	*55*	*177*	*10*	*264*	*0*	*0*	*150*	*750*	
Reach 11																					Reach 11
Step 3	0	0	25	1092	14	588	0	0	0	0	50	2183	30	1259	0	0	0	0	119	5122	Step 3
Cont. & AT	0	0	0	0	0	0	1	4	0	0	0	0	0	0	10	3359	1	8	12	3371	Cont. & AT
peak subtotal	*0*	*0*	*25*	*1092*	*14*	*588*	*1*	*4*	*0*	*0*	*50*	*2183*	*30*	*1259*	*10*	*3359*	*1*	*8*	*131*	*8493*	
Reach 12																					Reach 12
Step 3	0	0	0	0	23	549	0	0	0	0	0	0	55	1246	0	0	0	0	78	1794	Step 3
Cont. & AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	715	0	0	10	715	Cont. & AT
peak subtotal	*0*	*0*	*0*	*0*	*23*	*549*	*0*	*0*	*0*	*0*	*0*	*0*	*55*	*1246*	*10*	*715*	*0*	*0*	*88*	*2509*	
Reach 13																					Reach 13
Step 3	0	0	25	1263	14	612	0	0	0	0	50	2527	30	1312	0	0	0	0	119	5714	Step 3
Cont. & AT	0	0	0	0	0	0	1	4	0	0	0	0	0	0	10	3750	1	8	12	3762	Cont. & AT
peak subtotal	*0*	*0*	*25*	*1263*	*14*	*612*	*1*	*4*	*0*	*0*	*50*	*2527*	*30*	*1312*	*10*	*3750*	*1*	*8*	*131*	*9476*	
Reach 14																					Reach 14
Step 3	0	0	0	0	23	785	45	300	0	0	0	0	55	1831	0	0	0	0	123	2916	Step 3
Cont. & AT	0	0	0	0	0	0	0	2	0	0	0	0	0	0	10	1124	1	4	11	1129	Cont. & AT
peak subtotal	*0*	*0*	*0*	*0*	*23*	*785*	*45*	*302*	*0*	*0*	*0*	*0*	*55*	*1831*	*10*	*1124*	*1*	*4*	*134*	*4045*	
Reach 15																					Reach 15
Step 2	0	0	12	60	0	0	0	0	0	0	25	125	0	0	0	0	6	309	43	493	Step 2
Cont. & AT	0	0	0	0	0	0	0	1	0	0	4	40	0	0	11	700	0	4	15	745	Cont. & AT
peak subtotal	*0*	*0*	*12*	*60*	*0*	*0*	*0*	*1*	*0*	*0*	*29*	*165*	*0*	*0*	*11*	*700*	*6*	*313*	*58*	*1238*	
TOTAL	140	1282	274	9518	259	5491	1021	54883	83	889	614	20493	605	12969	282	21819	20	776	3297	128118	

Attachment 3: Summary of Construction Trucks for Overlap Reaches

5. Riprap Import Distribution

	Reach 4		Reach 5		Reach 7		Reach 8		Reach 12		Reach 13	
	#	%	#	%	#	%	#	%	#	%	#	%
Riprap -- Dutra Quarry	14	61%	14	61%	14	100%	14	100%	14	61%	14	100%
Back Fill Sand -- Pier 92	9	39%	9	39%	0	0%	0	0%	9	39%	0	0%
	23	100%	23	100%	14	100%	14	100%	23	100%	14	100%

	Reach 1		Reach 2		Reach 3		Reach 6		Reach 9		Reach 10	
	#	%	#	%	#	%	#	%	#	%	#	%
Riprap -- Dutra Quarry	0	0%	0	0%	14	61%	0	0%	0	0%	14	61%
Back Fill Sand -- Pier 92	0	0%	14	100%	9	39%	0	0%	0	0%	9	39%
	0	0%	14	100%	23	100%	0	0%	0	0%	23	100%

	Reach 11		Reach 14		Reach 15	
	#	%	#	%	#	%
Riprap -- Dutra Quarry	14	100%	14	61%	0	0%
Back Fill Sand -- Pier 92	0	0%	9	39%	0	0%
	14	100%	23	100%	0	0%

Attachment 4
SCHEDULE OVERLAP OF MAXIMUM AVERAGE DAILY CONSTRUCTION TRUCKS AND WORKERS BY REACH

Attachment 4 - Schedule Overlap of Maximum Average Daily Trucks, Workers, and Worker Shuttles by Reach

Construction Trucks				June 25		July 25		Aug 25		Sept 25		Oct 25		Nov 25		Dec 25		Jan 26		Feb 26		Mar 26		Apr 26		May 26		June 26		July 26		Aug 26		Sept 26		Oct 26		Nov 26		Dec 26		Jan
																Ovrlp 1																										
				1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20
A-1	Reach 6	8/14/26	12/28/26																														118	118	118	118	118	118	118			
A-2	Reach 5	4/14/26	9/15/26																						176	176	176	176	176	176	176	176	176	176								
A-3	Reach 4	2/10/26	5/14/26																		114	114	114	114	114	114																
A-4	Reach 3	12/5/25	3/13/26													176	176	176	176	176	176	176																				
A-5	Reach 2	6/1/25	1/9/26	124	124	124	124	124	124	124	124	124	124	124	124	124	124																									
A-6	Reach 1	11/27/27	4/19/26																																					76	76	76
B-1	Reach 7	6/1/25	6/25/28	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29																																							
C-1	Reach 13	6/7/29	1/27/31																																							
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				124	124	124	124	124	124	124	124	124	124	124	124	300	300	176	176	176	290	290	114	114	290	290	176	176	176	176	176	176	294	294	118	118	118	118	118	76	76	76
Nighttime Reaches				154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154
Construction Truck Total				**278**	**278**	**278**	**278**	**278**	**278**	**278**	**278**	**278**	**278**	**278**	**278**	**454**	**454**	**330**	**330**	**330**	**444**	**444**	**268**	**268**	**444**	**444**	**330**	**330**	**330**	**330**	**330**	**330**	**448**	**448**	**272**	**272**	**272**	**272**	**272**	**230**	**230**	**230**

Construction Workers				June 26		July 26		Aug 26		Sept 26		Oct 26		Nov 26		Dec 26		Jan 27		Feb 27		Mar 27		Apr 27		May 27		June 27		July 27		Aug 27		Sept 27		Oct 27		Nov 27		Dec 27		Jan
				1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20
A-1	Reach 6	8/14/26	12/28/26																														44	44	44	44	44	44	44			
A-2	Reach 5	4/14/26	9/15/26																						54	54	54	54	54	54	54	54	54	54								
A-3	Reach 4	2/10/26	5/14/26																		43	43	43	43	43	43																
A-4	Reach 3	12/5/25	3/13/26													54	54	54	54	54	54	54																				
A-5	Reach 2	6/1/25	1/9/26	46	46	46	46	46	46	46	46	46	46	46	46	46	46																									
A-6	Reach 1	11/27/27	4/19/26																																					34	34	34
B-1	Reach 7	6/1/25	6/25/28	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29																																							
C-1	Reach 13	6/7/29	1/27/31																																							
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				46	46	46	46	46	46	46	46	46	46	46	46	100	100	54	54	54	97	97	43	43	97	97	54	54	54	54	54	54	98	98	44	44	44	44	44	34	34	34
Nighttime Reaches				68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
Construction Worker Total				**114**	**114**	**114**	**114**	**114**	**114**	**114**	**114**	**114**	**114**	**114**	**114**	**168**	**168**	**122**	**122**	**122**	**165**	**165**	**111**	**111**	**165**	**165**	**122**	**122**	**122**	**122**	**122**	**122**	**166**	**166**	**112**	**112**	**112**	**112**	**112**	**102**	**102**	**102**
Construction Worker Shuttles				**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**
Total vehicles by Month (round trip)				**401**	**401**	**401**	**401**	**401**	**401**	**401**	**401**	**401**	**401**	**401**	**401**	**631**	**631**	**461**	**461**	**461**	**618**	**618**	**388**	**388**	**618**	**618**	**461**	**461**	**461**	**461**	**461**	**461**	**623**	**623**	**393**	**393**	**393**	**393**	**393**	**341**	**341**	**341**

Attachment 4 - Schedule Overlap of Max

																										Ovrlp 2																
Construction Trucks				27	Feb 27		Mar 27		Apr 27		May 27		June 27		July 27		Aug 27		Sept 27		Oct 27		Nov 27		Dec 27		Jan 28		Feb 28		Mar 28		Apr 28		May 28		June 28		July 28		Aug 28	
				20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31	32	32	33	33	34	34	35	35	36	36	37	37	38	38	39	39
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26	76	76	76	76	76	76																																	
B-1	Reach 7	6/1/25	6/25/28	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154	154				
B-2	Reach 15	4/15/27	7/21/27							58	58	58	58	58	58																											
B-3	Reach 14	7/21/27	1/25/28													134	134	134	134	134	134	134	134	134	134	134	134	134														
B-4	Reach 8	11/24/27	6/6/29																							163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
C-1	Reach 13	6/7/29	1/27/31																																							
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				76	76	76	76	76	76	58	58	58	58	58	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				154	154	154	154	154	154	154	154	154	154	154	154	287	287	287	287	287	287	287	287	287	450	450	450	450	316	316	316	316	316	316	316	316	316	316	163	163	163	163
Construction Truck Total				**230**	**230**	**230**	**230**	**230**	**230**	**212**	**212**	**212**	**212**	**212**	**212**	**287**	**287**	**287**	**287**	**287**	**287**	**287**	**287**	**287**	**450**	**450**	**450**	**450**	**316**	**316**	**316**	**316**	**316**	**316**	**316**	**316**	**316**	**316**	**163**	**163**	**163**	**163**

Construction Workers				28	Feb 28		Mar 28		Apr 28		May 28		June 28		July 28		Aug 28		Sept 28		Oct 28		Nov 28		Dec 28		Jan 29		Feb 29		Mar 29		Apr 29		May 29		June 29		July 29		Aug 29	
				20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31	32	32	33	33	34	34	35	35	36	36	37	37	38	38	39	39
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26	34	34	34	34	34	34																																	
B-1	Reach 7	6/1/25	6/25/28	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68				
B-2	Reach 15	4/15/27	7/21/27							39	39	39	39	39	39																											
B-3	Reach 14	7/21/27	1/25/28												49	49	49	49	49	49	49	49	49	49	49	49	49	49														
B-4	Reach 8	11/24/27	6/6/29																							61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
C-1	Reach 13	6/7/29	1/27/31																																							
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				34	34	34	34	34	34	39	39	39	39	39	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				68	68	68	68	68	68	68	68	68	68	68	117	117	117	117	117	117	117	117	117	117	178	178	178	178	129	129	129	129	129	129	129	129	129	129	61	61	61	61
Construction Worker Total				**102**	**102**	**102**	**102**	**102**	**102**	**107**	**107**	**107**	**107**	**107**	**156**	**117**	**117**	**117**	**117**	**117**	**117**	**117**	**117**	**117**	**178**	**178**	**178**	**178**	**129**	**129**	**129**	**129**	**129**	**129**	**129**	**129**	**129**	**129**	**61**	**61**	**61**	**61**
Construction Worker Shuttles				**9**	**9**	**9**	**9**	**9**	**9**	**12**	**12**	**12**	**12**	**12**	**15**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Total vehicles by Month (round trip)				**341**	**341**	**341**	**341**	**341**	**341**	**331**	**331**	**331**	**331**	**331**	**383**	**416**	**416**	**416**	**416**	**416**	**416**	**416**	**416**	**416**	**640**	**640**	**640**	**640**	**451**	**451**	**451**	**451**	**451**	**451**	**451**	**451**	**451**	**451**	**230**	**230**	**230**	**230**

Attachment 4 - Schedule Overlap of Max

Construction Trucks				Sept 28		Oct 28		Nov 28		Dec 28		Jan 29		Feb 29		Mar 29		Apr 29		May 29		June 29		July 29		Aug 29		Sept 29		Oct 29		Nov 29		Dec 29		Jan 30		Feb 30		Mar 30		Apr
				40	40	41	41	42	42	43	43	44	44	45	45	46	46	47	47	48	48	49	49	50	50	51	51	52	52	53	53	54	54	55	55	56	56	57	57	58	58	59
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26																																							
B-1	Reach 7	6/1/25	6/25/28																																							
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163																					
C-1	Reach 13	6/7/29	1/27/31																			131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
C-2	Reach 12	6/7/29	9/17/29																			88	88	88	88	88	88	88														
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	219	219	219	219	219	219	219	131	131	131	131	131	131	131	131	131	131	131	131	131	131
Construction Truck Total				**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**163**	**219**	**219**	**219**	**219**	**219**	**219**	**219**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**

Construction Workers				Sept 29		Oct 29		Nov 29		Dec 29		Jan 30		Feb 30		Mar 30		Apr 30		May 30		June 30		July 30		Aug 30		Sept 30		Oct 30		Nov 30		Dec 30		Jan 31		Feb 31		Mar 31		Apr
				40	40	41	41	42	42	43	43	44	44	45	45	46	46	47	47	48	48	49	49	50	50	51	51	52	52	53	53	54	54	55	55	56	56	57	57	58	58	59
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26																																							
B-1	Reach 7	6/1/25	6/25/28																																							
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61																					
C-1	Reach 13	6/7/29	1/27/31																			35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
C-2	Reach 12	6/7/29	9/17/29																			28	28	28	28	28	28	28														
C-3	Reach 11	8/6/30	11/23/31																																							
C-4	Reach 10	11/15/30	12/26/30																																							
C-5	Reach 9	12/24/30	1/22/31																																							
Daytime Reaches				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	63	63	63	63	63	63	63	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Construction Worker Total				**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**61**	**63**	**63**	**63**	**63**	**63**	**63**	**63**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**
Construction Worker Shuttles				**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Total vehicles by Month (round trip)				**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**230**	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**

Attachment 4 - Schedule Overlap of Max

Construction Trucks				'30	May 30		June 30		July 30		Aug 30		Sept 30		Oct 30		Nov 30		Dec 30		Jan 31		Feb 31		Mar 31		Apr 31		May 31		June 31		July 31		Aug 31		Sept 31		Oct 31		Nov 31	
				59	60	60	61	61	62	62	63	63	64	64	65	65	66	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26																																							
B-1	Reach 7	6/1/25	6/25/28																																							
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29																																							
C-1	Reach 13	6/7/29	1/27/31	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131																				
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31								131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
C-4	Reach 10	11/15/30	12/26/30																	150	150	150																						
C-5	Reach 9	12/24/30	1/22/31																				125	125																				
Daytime Reaches				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				131	131	131	131	131	131	131	261	261	261	261	261	261	261	411	411	411	386	386	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
Construction Truck Total				**131**	**131**	**131**	**131**	**131**	**131**	**131**	**261**	**261**	**261**	**261**	**261**	**261**	**261**	**411**	**411**	**411**	**386**	**386**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**	**131**

Construction Workers				'31	May 31		June 31		July 31		Aug 31		Sept 31		Oct 31		Nov 31		Dec 31		Jan 32		Feb 32		Mar 32		Apr 32		May 32		June 32		July 32		Aug 32		Sept 32		Oct 32		Nov 32	
				59	60	60	61	61	62	62	63	63	64	64	65	65	66	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78
A-1	Reach 6	8/14/26	12/28/26																																							
A-2	Reach 5	4/14/26	9/15/26																																							
A-3	Reach 4	2/10/26	5/14/26																																							
A-4	Reach 3	12/5/25	3/13/26																																							
A-5	Reach 2	6/1/25	1/9/26																																							
A-6	Reach 1	11/27/27	4/19/26																																							
B-1	Reach 7	6/1/25	6/25/28																																							
B-2	Reach 15	4/15/27	7/21/27																																							
B-3	Reach 14	7/21/27	1/25/28																																							
B-4	Reach 8	11/24/27	6/6/29																																							
C-1	Reach 13	6/7/29	1/27/31	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35																				
C-2	Reach 12	6/7/29	9/17/29																																							
C-3	Reach 11	8/6/30	11/23/31								35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
C-4	Reach 10	11/15/30	12/26/30																	45	45	45																						
C-5	Reach 9	12/24/30	1/22/31																				54	54																				
Daytime Reaches				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nighttime Reaches				35	35	35	35	35	35	35	70	70	70	70	70	70	70	115	115	115	124	124	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Construction Worker Total				**35**	**35**	**35**	**35**	**35**	**35**	**35**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**115**	**115**	**115**	**124**	**124**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**
Construction Worker Shuttles				**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**66**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Total vehicles by Month (round trip)				**172**	**172**	**172**	**172**	**172**	**172**	**172**	**337**	**337**	**337**	**337**	**337**	**337**	**337**	**532**	**532**	**532**	**516**	**516**	**172**	**172**	**172**	**232**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**

Attachment 5
CONSTRUCTION VEHICLE TRIP ASSIGNMENT TO STUDY LOCATIONS BY REACH AND FOR REACH OVERLAP SCENARIOS

Attachment 5 - Construction Trip Assignment to Study Locations

Legend

Trucks

A Concrete between off-site and reach
B Import/Export between off-site and Aviador Lot
C Import/Export between Aviador Lot and Reaches

Locations

A U.S. 101 north of North Access Road
B U.S. 101 between San Bruno Avenue and Millbrae Avenue
C U.S. 101 south of Millbrae Avenue
D Millbrae Avenue east of U.S. 101
E North Access Road east of U.S. 101
F Millbrae Avenue west of U.S. 101 (Aviador Lot vehicles)
G San Bruno Avenue east of U.S. 101
H South Airport Boulevard south of North Access Road
500 NB U.S. 101 off-ramp to North Access Road eB
501 WB North Access Road on-ramp to U.S. 101 SB
502 EB I-380 off-ramp to U.S. 101 SB
503 NB U.S. 101 off-ramp to I-380 WB
504 EB Millbrae Avenue on-ramp to U.S. 101 NB
505 SB U.S. 101 off-ramp to Millbrae Avenue
506 NB U.S. 101 off-ramp to Millbrae Avenue
507 EB Millbrae Avenue on-ramp to U.S. 101 SB
508 WB North Access Road on-ramp to U.S. 101 NB
509 SB U.S. 101 off-ramp to North Access Road EB
510 EB I-380 EB off-ramp to North Access Road EB
511 WB North Access Road on-ramp to I-380 WB
512 WB Millbrae Avenue on-ramp to U.S. 101 NB
513 WB Millbrae Avenue on-ramp to U.S. 101 SB

Attachment 5 - Construction Trip Assignment to Study Locations

	REACH 1						REACH 2					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	12	12	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	7	7	0	7	0	0	9	9	0	9	0	0
Total	*19*	*19*	*2*	*8*	*0*	*0*	*23*	*23*	*2*	*11*	*0*	*0*
Plot 16D												
Deliveries B	39	39	5	5	0	0	74	74	10	10	0	0
Deliveries C	37	37	5	5	0	0	50	50	7	7	0	0
Total	*76*	*76*	*11*	*11*	*0*	*0*	*124*	*124*	*18*	*18*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	27	27	4	4	0	0	60	60	8	8	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	19	0	0	0	25	25	25	0	0	0
Total	*46*	*46*	*22*	*4*	*0*	*0*	*85*	*85*	*34*	*8*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	27	27	4	4	0	0	60	60	8	8	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	19	0	0	0	25	25	25	0	0	0
Total	*46*	*46*	*22*	*4*	*0*	*0*	*85*	*85*	*34*	*8*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	37	37	5	5	0	0	50	50	7	7	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*37*	*37*	*5*	*5*	*0*	*0*	*50*	*50*	*7*	*7*	*0*	*0*
Ramp 500/501												
Deliveries B	27	27	4	4	0	0	60	60	8	8	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*27*	*27*	*4*	*4*	*0*	*0*	*60*	*60*	*8*	*8*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 506/507												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509												
Deliveries B	12	12	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*12*	*12*	*2*	*2*	*0*	*0*	*14*	*14*	*2*	*2*	*0*	*0*
Ramp 510/511												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	9	9	9	0	0	0	12	12	12	0	0	0
Total	*9*	*9*	*9*	*0*	*0*	*0*	*12*	*12*	*12*	*0*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
G: San Bruno Avenue east of U.S. 101												
Workers	26	26	26	0	0	0	35	35	35	0	0	0
H: South Airport Blvd south of North Access Rd												
Workers	9	9	0	9	0	0	12	12	0	12	0	0
Worker Shuttle	6	6	3	3	0	0	6	6	3	3	0	0
	15	15	3	12	0	0	18	18	3	15	0	0

Attachment 5 - Construction Trip Assignment to Study Locations

	REACH 3						REACH 4					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	9	9	1	1	0	0	9	9	1	1	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	11	11	0	11	0	0	9	9	0	9	0	0
Total	*20*	*20*	*1*	*12*	*0*	*0*	*18*	*18*	*1*	*10*	*0*	*0*
Plot 16D												
Deliveries B	111	111	16	16	0	0	49	49	7	7	0	0
Deliveries C	65	65	9	9	0	0	65	65	9	9	0	0
Total	*176*	*176*	*25*	*25*	*0*	*0*	*114*	*114*	*16*	*16*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	88	88	12	12	0	0	26	26	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	30	0	0	0	24	24	24	0	0	0
Total	*118*	*118*	*42*	*12*	*0*	*0*	*50*	*50*	*27*	*4*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	88	88	12	12	0	0	26	26	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	30	0	0	0	24	24	24	0	0	0
Total	*118*	*118*	*42*	*12*	*0*	*0*	*50*	*50*	*27*	*4*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	65	65	9	9	0	0	65	65	9	9	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*65*	*65*	*9*	*9*	*0*	*0*	*65*	*65*	*9*	*9*	*0*	*0*
Ramp 500/501												
Deliveries B	88	88	12	12	0	0	26	26	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*88*	*88*	*12*	*12*	*0*	*0*	*26*	*26*	*4*	*4*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 506/507												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509												
Deliveries B	9	9	1	1	0	0	9	9	1	1	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*9*	*9*	*1*	*1*	*0*	*0*	*9*	*9*	*1*	*1*	*0*	*0*
Ramp 510/511												
Deliveries B	14	14	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	14	14	14	0	0	0	11	11	11	0	0	0
Total	*28*	*28*	*15*	*2*	*0*	*0*	*25*	*25*	*13*	*2*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
G: San Bruno Avenue east of U.S. 101												
Workers	41	41	41	0	0	0	32	32	32	0	0	0
H: South Airport Blvd south of North Access Rd												
Workers	14	14	0	14	0	0	11	11	0	11	0	0
Worker Shuttle	6	6	3	3	0	0	6	6	3	3	0	0
	20	20	3	17	0	0	17	17	3	14	0	0

	Reach 5						Reach 6					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	9	9	1	1	0	0	27	27	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	11	11	0	11	0	0	9	9	0	9	0	0
Total	*20*	*20*	*1*	*12*	*0*	*0*	*36*	*36*	*4*	*13*	*0*	*0*
Plot 16D												
Deliveries B	111	111	16	16	0	0	54	54	8	8	0	0
Deliveries C	65	65	9	9	0	0	64	64	9	9	0	0
Total	*176*	*176*	*25*	*25*	*0*	*0*	*118*	*118*	*17*	*17*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	88	88	12	12	0	0	27	27	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	30	0	0	0	24	24	24	0	0	0
Total	*118*	*118*	*42*	*12*	*0*	*0*	*51*	*51*	*28*	*4*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	88	88	12	12	0	0	27	27	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	30	0	0	0	24	24	24	0	0	0
Total	*118*	*118*	*42*	*12*	*0*	*0*	*51*	*51*	*28*	*4*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	65	65	9	9	0	0	64	64	9	9	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*65*	*65*	*9*	*9*	*0*	*0*	*64*	*64*	*9*	*9*	*0*	*0*
Ramp 500/501												
Deliveries B	88	88	12	12	0	0	27	27	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*88*	*88*	*12*	*12*	*0*	*0*	*27*	*27*	*4*	*4*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 506/507												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509												
Deliveries B	9	9	1	1	0	0	27	27	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*9*	*9*	*1*	*1*	*0*	*0*	*27*	*27*	*4*	*4*	*0*	*0*
Ramp 510/511												
Deliveries B	14	14	2	2	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	14	14	14	0	0	0	11	11	11	0	0	0
Total	*28*	*28*	*15*	*2*	*0*	*0*	*11*	*11*	*11*	*0*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
G: San Bruno Avenue east of U.S. 101												
Workers	41	41	41	0	0	0	33	33	33	0	0	0
H: South Airport Blvd south of North Access Rd												
Workers	14	14	0	14	0	0	11	11	0	11	0	0
Worker Shuttle	6	6	3	3	0	0	6	6	3	3	0	0
	20	20	3	17	0	0	17	17	3	14	0	0

	Reach 7						Reach 8					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	14	14	2	2	0	0	17	17	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	14	14	14	0	0	0	12	12	12	0	0	0
Total	*28*	*28*	*16*	*2*	*0*	*0*	*29*	*29*	*15*	*2*	*0*	*0*
Plot 16D												
Deliveries B	97	97	14	14	0	0	98	98	14	14	0	0
Deliveries C	57	57	0	0	8	8	65	65	0	0	9	9
Total	*154*	*154*	*14*	*14*	*8*	*8*	*163*	*163*	*14*	*14*	*9*	*9*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	69	69	10	10	0	0	67	67	9	9	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	37	37	0	37	0	0	34	34	0	34	0	0
Total	*106*	*106*	*10*	*47*	*0*	*0*	*100*	*100*	*9*	*43*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	69	69	10	10	0	0	67	67	9	9	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	37	37	0	37	0	0	34	34	0	34	0	0
Total	*106*	*106*	*10*	*47*	*0*	*0*	*100*	*100*	*9*	*43*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	57	57	0	0	8	8	65	65	0	0	9	9
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*57*	*57*	*0*	*0*	*8*	*8*	*65*	*65*	*0*	*0*	*9*	*9*
Ramp 500/501												
Deliveries B	69	69	10	10	0	0	67	67	9	9	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*69*	*69*	*10*	*10*	*0*	*0*	*67*	*67*	*9*	*9*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 506/507												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509												
Deliveries B	14	14	2	2	0	0	17	17	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*14*	*14*	*2*	*2*	*0*	*0*	*17*	*17*	*2*	*2*	*0*	*0*
Ramp 510/511												
Deliveries B	14	14	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	17	17	0	17	0	0	15	15	0	15	0	0
Total	*31*	*31*	*2*	*19*	*0*	*0*	*29*	*29*	*2*	*17*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
G: San Bruno Avenue east of U.S. 101												
Workers	51	51	0	51	0	0	46	46	0	46	0	0
H: South Airport Blvd south of North Access Rd												
Workers	17	17	17	0	0	0	15	15	15	0	0	0
Worker Shuttle	6	6	3	3	0	0	6	6	3	3	0	0
	23	23	20	3	0	0	21	21	18	3	0	0

Attachment 5 - Construction Trip Assignment to Study Locations

	Reach 9						Reach 10					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	13	13	2	2	0	0	9	9	1	1	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	11	11	11	0	0	0	9	9	9	0	0	0
Total	*24*	*24*	*13*	*2*	*0*	*0*	*18*	*18*	*10*	*1*	*0*	*0*
Plot 16D												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	13	13	2	2	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	0	30	0	0	25	25	0	25	0	0
Total	*43*	*43*	*2*	*32*	*0*	*0*	*48*	*48*	*3*	*28*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	68	68	9	9	0	0	62	62	9	9	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	30	30	0	30	0	0	25	25	0	25	0	0
Total	*97*	*97*	*9*	*39*	*0*	*0*	*87*	*87*	*9*	*33*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	44	44	0	0	6	6	65	65	0	0	9	9
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*44*	*44*	*0*	*0*	*6*	*6*	*65*	*65*	*0*	*0*	*9*	*9*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 500/501												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*14*	*14*	*2*	*2*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	13	13	2	2	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*13*	*13*	*2*	*2*	*0*	*0*	*23*	*23*	*3*	*3*	*0*	*0*
Ramp 506/507												
Deliveries B	68	68	9	9	0	0	62	62	9	9	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*68*	*68*	*9*	*9*	*0*	*0*	*62*	*62*	*9*	*9*	*0*	*0*
Ramp 508/509												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 510/511												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	14	0	0	0	0	0	11	11	0	11	0	0
Total	*14*	*0*	*0*	*0*	*0*	*0*	*11*	*11*	*0*	*11*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	81	81	11	11	0	0	85	85	12	12	0	0
Deliveries C	44	44	0	0	6	6	65	65	0	0	9	9
Total	*125*	*125*	*11*	*11*	*6*	*6*	*150*	*150*	*12*	*12*	*9*	*9*
G: San Bruno Avenue east of U.S. 101												
Workers	41	41	0	41	0	0	34	34	0	34	0	0
H: South Airport Blvd south of North Access Rd												
Workers	14	14	14	0	0	0	11	11	11	0	0	0
Worker Shuttle	0	0	0	0	0	0	0	0	0	0	0	0
	14	14	14	0	0	0	11	11	11	0	0	0

	Reach 11						Reach 12					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	1	1	0	0	1	1	0	0	0	0	0	0
Deliveries B	25	25	4	4	0	0	9	9	1	1	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	7	7	7	0	0	0	6	6	6	0	0	0
Total	*33*	*33*	*11*	*4*	*1*	*1*	*15*	*15*	*7*	*1*	*0*	*0*
Plot 16D												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	1	1	0	0	1	1	0	0	0	0	0	0
Deliveries B	39	39	5	5	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	0	19	0	0	15	15	0	15	0	0
Total	*59*	*59*	*5*	*25*	*1*	*1*	*38*	*38*	*3*	*19*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	1	1	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	0	19	0	0	15	15	0	15	0	0
Total	*20*	*20*	*0*	*19*	*0*	*0*	*15*	*15*	*0*	*15*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	1	1	0	0	1	1	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	90	90	0	0	13	13	65	65	0	0	9	9
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*91*	*91*	*0*	*0*	*14*	*14*	*65*	*65*	*0*	*0*	*9*	*9*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 500/501												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 502/503												
Deliveries B	14	14	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*14*	*14*	*2*	*2*	*0*	*0*	*14*	*14*	*2*	*2*	*0*	*0*
Ramp 504/505												
Deliveries A	0	1	0	0	0	1	0	0	0	0	0	0
Deliveries B	39	39	5	5	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*39*	*40*	*5*	*5*	*0*	*1*	*23*	*23*	*3*	*3*	*0*	*0*
Ramp 506/507												
Deliveries B	1	1	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 510/511												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	9	9	0	9	0	0	7	7	0	0	0	0
Total	*9*	*9*	*0*	*9*	*0*	*0*	*7*	*7*	*0*	*0*	*0*	*0*
Ramp 512/513												
Deliveries A	1	0	0	0	1	0	0	0	0	0	0	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	40	40	6	6	0	0	23	23	3	3	0	0
Deliveries C	90	90	0	0	13	13	65	65	0	0	9	9
Total	*130*	*130*	*6*	*6*	*13*	*13*	*88*	*88*	*3*	*3*	*9*	*9*
G: San Bruno Avenue east of U.S. 101												
Workers	26	26	0	26	0	0	21	21	0	21	0	0
H: South Airport Blvd south of North Access Rd												
Workers	9	9	9	0	0	0	7	7	7	0	0	0
Worker Shuttle	0	0	0	0	0	0	0	0	0	0	0	0
	9	9	9	0	0	0	7	7	7	0	0	0

Attachment 5 - Construction Trip Assignment to Study Locations

	Reach 13						Reach 14					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	1	1	0	0	1	1	1	1	0	0	1	1
Deliveries B	25	25	4	4	0	0	9	9	1	1	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	7	7	7	0	0	0	10	10	10	0	0	0
Total	*33*	*33*	*11*	*4*	*1*	*1*	*20*	*20*	*11*	*1*	*1*	*1*
Plot 16D												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	1	1	0	0	1	1	1	1	0	0	1	1
Deliveries B	39	39	5	5	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	0	19	0	0	27	27	0	27	0	0
Total	*59*	*59*	*5*	*25*	*1*	*1*	*51*	*51*	*3*	*30*	*1*	*1*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	1	1	0	0	0	0	45	45	6	6	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	19	19	0	19	0	0	27	27	0	27	0	0
Total	*20*	*20*	*0*	*19*	*0*	*0*	*72*	*72*	*6*	*33*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	1	1	0	0	1	1	1	1	0	0	1	1
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	90	90	0	0	13	13	65	65	0	0	9	9
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*91*	*91*	*0*	*0*	*14*	*14*	*66*	*66*	*0*	*0*	*10*	*10*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 500/501												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 502/503												
Deliveries B	14	14	2	2	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*14*	*14*	*2*	*2*	*0*	*0*	*14*	*14*	*2*	*2*	*0*	*0*
Ramp 504/505												
Deliveries A	0	1	0	0	0	1	0	1	0	0	0	1
Deliveries B	39	39	5	5	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*39*	*40*	*5*	*5*	*0*	*1*	*23*	*24*	*3*	*3*	*0*	*1*
Ramp 506/507												
Deliveries B	1	1	0	0	0	0	45	45	6	6	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*1*	*1*	*0*	*0*	*0*	*0*	*45*	*45*	*6*	*6*	*0*	*0*
Ramp 508/509												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 510/511												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	9	9	0	9	0	0	12	12	0	12	0	0
Total	*9*	*9*	*0*	*9*	*0*	*0*	*12*	*12*	*0*	*12*	*0*	*0*
Ramp 512/513												
Deliveries A	1	0	0	0	1	0	1	0	0	0	1	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*1*	*0*	*0*	*0*	*1*	*0*	*1*	*0*	*0*	*0*	*1*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	40	40	6	6	0	0	68	68	10	10	0	0
Deliveries C	90	90	0	0	13	13	65	65	0	0	9	9
Total	*130*	*130*	*6*	*6*	*13*	*13*	*133*	*133*	*10*	*10*	*9*	*9*
G: San Bruno Avenue east of U.S. 101												
Workers	26	26	0	26	0	0	37	37	0	37	0	0
H: South Airport Blvd south of North Access Rd												
Workers	9	9	9	0	0	0	12	12	12	0	0	0
Worker Shuttle	0	0	0	0	0	0	0	0	0	0	0	0
	9	9	9	0	0	0	12	12	12	0	0	0

Attachment 5 - Construction Trip Assignment to Study Locations

	Reach 15					
	Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road						
Deliveries A	6	6	1	1	0	0
Deliveries B	12	12	2	2	0	0
Deliveries C	0	0	0	0	0	0
Workers	8	8	0	8	0	0
Total	*26*	*26*	*3*	*10*	*0*	*0*
Plot 16D						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
B: U.S. 101 betw San Bruno and Millbrae						
Deliveries A	6	6	1	1	0	0
Deliveries B	12	12	2	2	0	0
Deliveries C	0	0	0	0	0	0
Workers	21	21	21	0	0	0
Total	*39*	*39*	*24*	*3*	*0*	*0*
C: U.S. 101 south of Millbrae Avenue						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	21	21	21	0	0	0
Total	*22*	*22*	*21*	*0*	*0*	*0*
D: Millbrae Avenue east of U.S. 101						
Deliveries A	6	6	1	1	0	0
Deliveries B	0	0	0	0	0	0
Deliveries C	40	40	6	6	0	0
Workers	0	0	0	0	0	0
Total	*46*	*46*	*7*	*7*	*0*	*0*
E: North Access Road east of U.S. 101						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 500/501						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 502/503						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 504/505						
Deliveries A	0	6	0	1	0	0
Deliveries B	12	12	2	2	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*12*	*18*	*2*	*3*	*0*	*0*
Ramp 506/507						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 508/509						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*
Ramp 510/511						
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	10	10	10	0	0	0
Total	*10*	*10*	*10*	*0*	*0*	*0*
Ramp 512/513						
Deliveries A	6	0	1	0	0	0
Deliveries B	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0
Workers	0	0	0	0	0	0
Total	*6*	*0*	*1*	*0*	*0*	*0*
F: Millbrae Ave west of U.S. 101						
Deliveries B	12	12	2	2	0	0
Deliveries C	40	40	6	6	0	0
Total	*52*	*52*	*7*	*7*	*0*	*0*
G: San Bruno Avenue east of U.S. 101						
Workers	29	29	29	0	0	0
H: South Airport Blvd south of North Access Rd						
Workers	10	10	0	10	0	0
Worker Shuttle	0	0	0	0	0	0
	10	10	0	10	0	0

	Overlap 2, 3, 7						Overlap 7, 8, 14					
	Daily		AM Peak Hour		Night Avg Hour		Daily		AM Peak Hour		Night Avg Hour	
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
A: U.S. 101 north of North Access Road												
Deliveries A	0	0	0	0	0	0	1	1	0	0	1	1
Deliveries B	37	37	5	5	0	0	40	40	6	6	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	34	34	14	20	0	0	36	36	36	0	0	0
Total	*71*	*71*	*19*	*25*	*0*	*0*	*77*	*77*	*41*	*6*	*1*	*1*
Plot 16D												
Deliveries B	282	282	39	39	0	0	194	194	27	27	0	0
Deliveries C	172	172	16	16	8	8	122	122	0	0	17	17
Total	*454*	*454*	*56*	*56*	*8*	*8*	*316*	*316*	*27*	*27*	*17*	*17*
B: U.S. 101 betw San Bruno and Millbrae												
Deliveries A	0	0	0	0	0	0	1	1	0	0	1	1
Deliveries B	217	217	30	30	0	0	158	158	22	22	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	*309*	*309*	*85*	*68*	*0*	*0*	*257*	*257*	*22*	*120*	*1*	*1*
C: U.S. 101 south of Millbrae Avenue												
Deliveries B	217	217	30	30	0	0	181	181	25	25	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	92	92	55	37	0	0	98	98	0	98	0	0
Total	*309*	*309*	*85*	*68*	*0*	*0*	*278*	*278*	*25*	*123*	*0*	*0*
D: Millbrae Avenue east of U.S. 101												
Deliveries A	0	0	0	0	0	0	1	1	0	0	1	1
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	65	65	0	0	9	9
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*66*	*66*	*0*	*0*	*10*	*10*
E: North Access Road east of U.S. 101												
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	172	172	16	16	8	8	122	122	0	0	17	17
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*172*	*172*	*16*	*16*	*8*	*8*	*122*	*122*	*0*	*0*	*17*	*17*
Ramp 500/501												
Deliveries B	217	217	30	30	0	0	135	135	19	19	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*217*	*217*	*30*	*30*	*0*	*0*	*135*	*135*	*19*	*19*	*0*	*0*
Ramp 502/503												
Deliveries B	0	0	0	0	0	0	14	14	2	2	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*14*	*14*	*2*	*2*	*0*	*0*
Ramp 504/505												
Deliveries A	0	0	0	0	0	0	0	1	0	0	0	1
Deliveries B	0	0	0	0	0	0	23	23	3	3	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*23*	*24*	*3*	*3*	*0*	*1*
Ramp 506/507												
Deliveries B	0	0	0	0	0	0	45	45	6	6	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*45*	*45*	*6*	*6*	*0*	*0*
Ramp 508/509												
Deliveries B	37	37	5	5	0	0	31	31	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*37*	*37*	*5*	*5*	*0*	*0*	*31*	*31*	*4*	*4*	*0*	*0*
Ramp 510/511												
Deliveries B	28	28	4	4	0	0	28	28	4	4	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	42	42	25	17	0	0	45	45	0	45	0	0
Total	*70*	*70*	*29*	*21*	*0*	*0*	*73*	*73*	*4*	*48*	*0*	*0*
Ramp 512/513												
Deliveries A	0	0	0	0	0	0	1	0	0	0	1	0
Deliveries B	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries C	0	0	0	0	0	0	0	0	0	0	0	0
Workers	0	0	0	0	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*1*	*0*
F: Millbrae Ave west of U.S. 101												
Deliveries B	0	0	0	0	0	0	68	68	10	10	0	0
Deliveries C	0	0	0	0	0	0	65	65	0	0	9	9
Total	*0*	*0*	*0*	*0*	*0*	*0*	*133*	*133*	*10*	*10*	*9*	*9*
G: San Bruno Avenue east of U.S. 101												
Workers	126	126	75	51	0	0	134	134	0	134	0	0
H: South Airport Blvd south of North Access Rd												
Workers	42	42	17	25	0	0	45	45	45	0	0	0
Worker Shuttle	9	9	3	3	0	0	6	6	3	3	0	0
	51	51	20	28	0	0	51	51	48	3	0	0

VEHICLE TRIPS BY REACH AND OVERLAP

	Daily	A.M. Peak Hour	Overnight Hr	
R 2, 3 & 7				
Trucks A	0	0	0	
Trucks B Plot 16D	563	79	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	344	33	16	
Trucks C Aviador	0	0	0	
Workers	336	168	0	
Shuttles	18	6	0	reaches share shuttles
	1261	286	16	
R 7, 8 & 14				
Trucks A	2	0	2	
Trucks B Plot 16D	389	54	0	
Trucks B Aviador	136	19	0	
Trucks C Plot 16D	244	0	35	
Trucks C Aviador	130	0	19	
Workers	356	178	0	
Shuttles	24	12	0	reaches share shuttles
	1281	264	55	
Reach 1				
Trucks A	0	0	0	
Trucks B Plot 16D	78	11	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	74	11	0	76
Trucks C Aviador	0	0	0	
Workers	68	34	0	
Shuttles	12	6	0	
	232	61	0	
Reach 2				
Trucks A	0	0	0	
Trucks B Plot 16D	148	21	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	100	14	0	124
Trucks C	0	0	0	
Workers	92	46	0	
Shuttles	12	6	0	
	352	87	0	
Reach 3				
Trucks A	0	0	0	
Trucks B Plot 16D	222	31	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	130	19	0	176
Trucks C Aviador	0	0	0	
Workers	108	54	0	
Shuttles	12	6	0	
	472	110	0	
Reach 4				
Trucks A	0	0	0	
Trucks B Plot 16D	98	14	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	130	19	0	114
Trucks C Aviador	0	0	0	

Workers	86	43	0	
Shuttles	12	6	0	
	327	82	0	
Reach 5				
Trucks A	0	0	0	
Trucks B Plot 16D	222	31	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	130	19	0	176
Trucks C Aviador	0	0	0	
Workers	108	54	0	
Shuttles	12	6	0	
	472	110	0	
Reach 6				
Trucks A	0	0	0	
Trucks B Plot 16D	108	15	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	128	18	0	118
Trucks C Aviador	0	0	0	
Workers	88	44	0	
Shuttles	12	6	0	
	336	83	0	
Reach 7				
Trucks A	0	0	0	
Trucks B Plot 16D	193	27	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	114	0	16	154
Trucks C Aviador	0	0	0	
Workers	136	68	0	
Shuttles	12	6	0	
	455	101	16	
Reach 8				
Trucks A	0	0	0	
Trucks B Plot 16D	195	27	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	130	0	19	163
Trucks C Aviador	0	0	0	
Workers	122	61	0	
Shuttles	12	6	0	
	459	94	19	
Reach 9				
Trucks A	0	0	0	
Trucks B Aviador	161	23	0	
Trucks C Aviador	88	0	13	125
Workers	108	54	0	
Shuttles	12	6	0	
	369	83	13	
Reach 10				
Trucks A	0	0	0	
Trucks B Aviador	170	24	0	
Trucks C Aviador	130	0	19	150
Workers	90	45	0	
Shuttles	12	6	0	
	402	75	19	
Reach 11				
Trucks A	2	2	0	
Trucks B Aviador	79	11	0	
Trucks C Aviador	180	0	26	131
Workers	70	35	0	

Shuttles	12	6	0	
	343	54	26	
Reach 12				
Trucks A	0	0	0	
Trucks B Aviador	46	6	0	
Trucks C Aviador	130	0	19	88
Workers	56	28	0	
Shuttles	12	6	0	
	244	40	19	
Reach 13				
Trucks A	2	2	0	
Trucks B Aviador	79	11	0	
Trucks C Aviador	180	0	26	131
Workers	70	35	0	
Shuttles	12	6	0	
	343	54	26	
Reach 14				
Trucks A	2	0	2	
Trucks B Aviador	136	19	0	
Trucks C Aviador	130	0	19	134
Workers	98	49	0	
Shuttles	12	6	0	
	378	74	20	
Reach 15				
Trucks A	11	2	0	
Trucks B Aviador	24	3	0	
Trucks C Aviador	80	11	0	58
Workers	78	39	0	
Shuttles	12	6	0	
	206	62	0	
CHECKS				
R 2, 3 & 7				
Trucks A	0	0	0	
Trucks B Plot 16D	563	79	0	
Trucks B Aviador	0	0	0	
Trucks C Plot 16D	344	33	16	
Trucks C Aviador	0	0	0	
Workers	336	168	0	
Shuttles	18	6	0	
	1261	286	16	
R 7, 8 & 14				
Trucks A	2	0	2	
Trucks B Plot 16D	389	54	0	
Trucks B Aviador	136	20	0	
Trucks C Plot 16D	244	0	35	
Trucks C Aviador	130	0	19	
Workers	356	178	0	
Shuttles	24	12	0	
	1281	264	55	
Trucks A	17	9		
Trucks B	1960	980	1916	1916
Trucks C	1855	927		
Workers	1378	689		

Attachment 6
EXISTING TRAFFIC VOLUMES SOURCE DATA

Location: S McDonnell Rd N/O Millbrae Ave
Date Range: 4/24/2018 - 4/30/2018
Site Code: 01

Time	Tuesday 4/24/2018			Wednesday 4/25/2018			Thursday 4/26/2018			Friday 4/27/2018			Saturday 4/28/2018			Sunday 4/29/2018			Monday 4/30/2018			Mid-Week Average		
	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total	NB	SB	Total
12:00 AM	329	382	711	350	396	746	330	410	740	320	364	684	362	440	802	284	293	577	442	492	934	336	396	732
1:00 AM	185	211	396	160	199	359	186	262	448	218	236	454	166	240	406	127	204	331	385	422	807	177	224	401
2:00 AM	81	99	180	45	93	138	70	81	151	69	126	195	49	90	139	49	67	116	113	135	248	65	91	156
3:00 AM	44	24	68	45	71	116	43	35	78	72	61	133	42	43	85	35	37	72	63	55	118	44	43	87
4:00 AM	77	30	107	76	32	108	104	45	149	66	46	112	58	32	90	41	26	67	102	30	132	86	36	121
5:00 AM	108	57	165	178	66	244	114	60	174	125	47	172	75	37	112	65	47	112	151	77	228	133	61	194
6:00 AM	169	75	244	167	103	270	163	75	238	178	79	257	90	53	143	73	68	141	186	103	289	166	84	251
7:00 AM	212	130	342	211	150	361	190	138	328	194	120	314	139	93	232	118	75	193	220	166	386	204	139	344
8:00 AM	233	225	458	243	173	416	203	169	372	224	184	408	151	140	291	146	143	289	272	255	527	226	189	415
9:00 AM	310	201	511	307	227	534	296	195	491	261	200	461	204	147	351	177	201	378	286	215	501	304	208	512
10:00 AM	369	343	712	285	264	549	350	342	692	336	337	673	250	185	435	188	216	404	328	334	662	335	316	651
11:00 AM	402	387	789	278	347	625	449	437	886	318	374	692	239	265	504	226	199	425	361	363	724	376	390	767
12:00 PM	324	386	710	284	292	576	367	413	780	261	368	629	229	288	517	251	365	616	386	487	873	325	364	689
1:00 PM	383	323	706	266	282	548	302	367	669	317	374	691	333	307	640	314	328	642	399	404	803	317	324	641
2:00 PM	359	459	818	326	400	726	333	410	743	305	394	699	330	334	664	412	439	851	477	515	992	339	423	762
3:00 PM	315	557	872	278	553	831	375	637	1,012	295	526	821	305	433	738	385	519	904	392	611	1,003	323	582	905
4:00 PM	311	461	772	258	431	689	428	624	1,052	250	459	709	300	362	662	459	455	914	348	569	917	332	505	838
5:00 PM	288	451	739	298	461	759	292	523	815	342	420	762	280	407	687	408	502	910	365	481	846	293	478	771
6:00 PM	326	369	695	372	388	760	371	291	662	430	358	788	344	348	692	509	557	1,066	421	479	900	356	349	706
7:00 PM	431	478	909	518	437	955	492	572	1,064	408	473	881	345	373	718	556	513	1,069	581	498	1,079	480	496	976
8:00 PM	535	528	1,063	465	568	1,033	459	535	994	397	646	1,043	384	401	785	467	624	1,091	531	531	1,062	486	544	1,030
9:00 PM	406	473	879	364	553	917	498	551	1,049	526	548	1,074	416	444	860	430	507	937	536	575	1,111	423	526	948
10:00 PM	448	490	938	589	522	1,111	521	475	996	597	519	1,116	373	425	798	679	535	1,214	477	528	1,005	519	496	1,015
11:00 PM	481	454	935	425	464	889	486	507	993	510	515	1,025	331	353	684	481	524	1,005	419	442	861	464	475	939
Total	**7,126**	**7,593**	**14,719**	**6,788**	**7,472**	**14,260**	**7,422**	**8,154**	**15,576**	**7,019**	**7,774**	**14,793**	**5,795**	**6,240**	**12,035**	**6,880**	**7,444**	**14,324**	**8,241**	**8,767**	**17,008**	**7,112**	**7,740**	**14,852**
Percent	**48%**	**52%**	-	**48%**	**52%**	-	**48%**	**52%**	-	**47%**	**53%**	-	**48%**	**52%**	-	**48%**	**52%**	-	**48%**	**52%**	-	**48%**	**52%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Location: N Access Rd E/O I-380 Off Ramp
Date Range: 4/24/2018 - 4/30/2018
Site Code: 13

	Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday					
	4/24/2018			4/25/2018			4/26/2018			4/27/2018			4/28/2018			4/29/2018			4/30/2018			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	35	91	126	44	94	138	44	67	111	34	68	102	30	78	108	26	69	95	23	51	74	41	84	125
1:00 AM	40	83	123	42	74	116	39	77	116	40	78	118	30	64	94	17	49	66	34	50	84	40	78	118
2:00 AM	47	60	107	33	50	83	42	59	101	40	63	103	33	47	80	22	35	57	32	39	71	41	56	97
3:00 AM	84	29	113	88	42	130	67	27	94	70	35	105	57	33	90	40	24	64	66	25	91	80	33	112
4:00 AM	179	64	243	197	53	250	191	66	257	197	61	258	82	47	129	68	25	93	157	42	199	189	61	250
5:00 AM	544	110	654	549	117	666	576	108	684	535	120	655	211	51	262	203	36	239	538	112	650	556	112	668
6:00 AM	338	317	655	378	315	693	361	349	710	415	339	754	160	187	347	147	141	288	321	271	592	359	327	686
7:00 AM	296	300	596	296	294	590	261	300	561	269	274	543	137	166	303	85	130	215	256	249	505	284	298	582
8:00 AM	194	177	371	186	148	334	199	155	354	182	169	351	90	87	177	70	64	134	188	175	363	193	160	353
9:00 AM	221	204	425	227	175	402	212	183	395	200	191	391	91	90	181	69	78	147	217	183	400	220	187	407
10:00 AM	198	220	418	207	247	454	232	208	440	189	244	433	75	77	152	74	85	159	213	235	448	212	225	437
11:00 AM	236	269	505	259	243	502	214	221	435	241	289	530	107	93	200	98	87	185	185	220	405	236	244	481
12:00 PM	256	269	525	256	287	543	237	243	480	216	222	438	110	85	195	121	101	222	189	202	391	250	266	516
1:00 PM	373	483	856	374	470	844	374	399	773	320	346	666	162	116	278	177	100	277	332	369	701	374	451	824
2:00 PM	180	595	775	206	570	776	203	594	797	194	516	710	111	220	331	95	204	299	171	572	743	196	586	783
3:00 PM	179	330	509	190	333	523	170	305	475	159	319	478	71	110	181	85	127	212	143	285	428	180	323	502
4:00 PM	177	244	421	160	246	406	165	206	371	128	223	351	73	138	211	87	146	233	145	185	330	167	232	399
5:00 PM	172	211	383	155	190	345	159	217	376	123	166	289	92	129	221	82	90	172	138	183	321	162	206	368
6:00 PM	141	167	308	166	179	345	157	193	350	151	156	307	91	95	186	78	95	173	137	171	308	155	180	334
7:00 PM	232	122	354	247	147	394	223	158	381	223	145	368	159	87	246	146	72	218	223	142	365	234	142	376
8:00 PM	188	152	340	199	143	342	202	160	362	161	136	297	107	70	177	110	49	159	188	107	295	196	152	348
9:00 PM	148	177	325	180	128	308	154	153	307	136	143	279	79	74	153	126	97	223	165	113	278	161	153	313
10:00 PM	90	308	398	75	301	376	92	301	393	68	262	330	31	141	172	71	147	218	114	283	397	86	303	389
11:00 PM	73	122	195	57	113	170	63	118	181	73	128	201	50	68	118	36	72	108	69	151	220	64	118	182
Total	**4,621**	**5,104**	**9,725**	**4,771**	**4,959**	**9,730**	**4,637**	**4,867**	**9,504**	**4,364**	**4,693**	**9,057**	**2,239**	**2,353**	**4,592**	**2,133**	**2,123**	**4,256**	**4,244**	**4,415**	**8,659**	**4,676**	**4,977**	**9,653**
Percent	**48%**	**52%**	-	**49%**	**51%**	-	**49%**	**51%**	-	**48%**	**52%**	-	**49%**	**51%**	-	**50%**	**50%**	-	**49%**	**51%**	-	**48%**	**52%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Project Manager: (415) 310-6469
project.manager.ca@idaxdata.com

Location: N Access Rd W/O N Field Rd
Date Range: 4/24/2018 - 4/30/2018
Site Code: 15

	Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday					
	4/24/2018			4/25/2018			4/26/2018			4/27/2018			4/28/2018			4/29/2018			4/30/2018			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	20	66	86	32	63	95	31	44	75	22	50	72	24	56	80	21	44	65	16	38	54	28	58	85
1:00 AM	34	62	96	36	60	96	27	60	87	30	63	93	27	51	78	14	40	54	34	42	76	32	61	93
2:00 AM	34	45	79	32	41	73	38	51	89	30	45	75	36	42	78	21	30	51	37	34	71	35	46	80
3:00 AM	79	19	98	78	34	112	57	22	79	55	24	79	56	29	85	38	20	58	51	20	71	71	25	96
4:00 AM	111	41	152	123	37	160	116	46	162	117	46	163	72	38	110	57	22	79	88	27	115	117	41	158
5:00 AM	215	45	260	212	51	263	246	43	289	218	49	267	111	30	141	106	25	131	193	51	244	224	46	271
6:00 AM	268	148	416	280	141	421	297	156	453	335	162	497	123	92	215	119	71	190	229	120	349	282	148	430
7:00 AM	254	154	408	236	148	384	225	149	374	230	136	366	107	80	187	56	63	119	214	121	335	238	150	389
8:00 AM	179	128	307	142	100	242	171	98	269	157	116	273	68	44	112	50	40	90	149	120	269	164	109	273
9:00 AM	180	140	320	186	143	329	165	127	292	185	147	332	71	67	138	59	50	109	174	135	309	177	137	314
10:00 AM	170	152	322	158	166	324	180	153	333	158	181	339	58	55	113	58	45	103	181	148	329	169	157	326
11:00 AM	191	159	350	181	154	335	143	144	287	180	190	370	79	71	150	72	63	135	130	123	253	172	152	324
12:00 PM	201	201	402	192	192	384	165	159	324	157	155	312	69	62	131	94	68	162	141	140	281	186	184	370
1:00 PM	233	300	533	203	303	506	197	275	472	186	222	408	102	79	181	107	79	186	190	235	425	211	293	504
2:00 PM	160	261	421	166	248	414	157	254	411	154	221	375	82	111	193	70	105	175	127	230	357	161	254	415
3:00 PM	136	201	337	163	204	367	137	189	326	126	199	325	60	80	140	74	90	164	108	165	273	145	198	343
4:00 PM	141	158	299	101	165	266	127	133	260	103	165	268	50	98	148	65	116	181	108	123	231	123	152	275
5:00 PM	133	147	280	112	137	249	106	150	256	86	124	210	64	100	164	63	74	137	103	115	218	117	145	262
6:00 PM	95	117	212	124	121	245	132	127	259	129	120	249	71	73	144	60	69	129	97	113	210	117	122	239
7:00 PM	165	92	257	150	105	255	149	120	269	160	99	259	102	52	154	95	50	145	160	108	268	155	106	260
8:00 PM	118	120	238	131	105	236	157	110	267	117	100	217	70	49	119	66	31	97	116	84	200	135	112	247
9:00 PM	86	154	240	98	90	188	90	99	189	101	110	211	46	53	99	45	69	114	94	88	182	91	114	206
10:00 PM	56	110	166	52	129	181	58	125	183	40	110	150	19	66	85	45	64	109	76	120	196	55	121	177
11:00 PM	35	70	105	36	78	114	41	86	127	58	90	148	35	46	81	32	54	86	44	107	151	37	78	115
Total	**3,294**	**3,090**	**6,384**	**3,224**	**3,015**	**6,239**	**3,212**	**2,920**	**6,132**	**3,134**	**2,924**	**6,058**	**1,602**	**1,524**	**3,126**	**1,487**	**1,382**	**2,869**	**2,860**	**2,607**	**5,467**	**3,243**	**3,008**	**6,252**
Percent	**52%**	**48%**	-	**52%**	**48%**	-	**52%**	**48%**	-	**52%**	**48%**	-	**51%**	**49%**	-	**52%**	**48%**	-	**52%**	**48%**	-	**52%**	**48%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Location: N Access Rd S/O Clearwater Dr
Date Range: 4/24/2018 - 4/30/2018
Site Code: 17

	Tuesday 4/24/2018			Wednesday 4/25/2018			Thursday 4/26/2018			Friday 4/27/2018			Saturday 4/28/2018			Sunday 4/29/2018			Monday 4/30/2018			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	39	6	45	31	10	41	23	11	34	27	8	35	31	9	40	27	11	38	23	9	32	31	9	40
1:00 AM	36	10	46	40	13	53	38	9	47	37	12	49	30	11	41	23	8	31	26	8	34	38	11	49
2:00 AM	26	17	43	22	16	38	29	16	45	33	16	49	25	14	39	20	17	37	25	15	40	26	16	42
3:00 AM	6	36	42	6	29	35	4	31	35	6	23	29	13	27	40	12	25	37	11	32	43	5	32	37
4:00 AM	16	55	71	14	65	79	21	53	74	20	53	73	16	31	47	11	33	44	8	46	54	17	58	75
5:00 AM	21	125	146	22	132	154	21	150	171	20	124	144	18	78	96	11	82	93	19	121	140	21	136	157
6:00 AM	90	151	241	85	172	257	89	156	245	98	193	291	76	96	172	62	98	160	81	130	211	88	160	248
7:00 AM	84	66	150	85	65	150	81	48	129	74	48	122	56	29	85	50	25	75	74	50	124	83	60	143
8:00 AM	44	52	96	33	56	89	45	54	99	35	44	79	16	25	41	25	24	49	52	50	102	41	54	95
9:00 AM	47	71	118	54	61	115	37	46	83	34	51	85	23	33	56	38	32	70	43	44	87	46	59	105
10:00 AM	51	49	100	53	48	101	48	54	102	62	51	113	19	16	35	25	31	56	46	64	110	51	50	101
11:00 AM	50	54	104	60	78	138	57	52	109	108	81	189	38	49	87	49	48	97	48	56	104	56	61	117
12:00 PM	70	77	147	78	64	142	57	54	111	67	66	133	23	33	56	41	52	93	58	64	122	68	65	133
1:00 PM	106	100	206	136	90	226	118	84	202	67	72	139	48	62	110	54	65	119	109	83	192	120	91	211
2:00 PM	136	50	186	144	57	201	131	63	194	109	44	153	72	40	112	80	42	122	131	37	168	137	57	194
3:00 PM	82	36	118	80	49	129	71	42	113	79	39	118	42	25	67	56	27	83	57	23	80	78	42	120
4:00 PM	59	37	96	88	35	123	58	33	91	94	36	130	60	27	87	69	33	102	45	36	81	68	35	103
5:00 PM	51	50	101	48	40	88	64	39	103	50	27	77	50	34	84	47	32	79	40	42	82	54	43	97
6:00 PM	32	28	60	40	44	84	51	45	96	36	32	68	47	29	76	39	32	71	32	32	64	41	39	80
7:00 PM	32	86	118	44	81	125	49	78	127	34	77	111	24	61	85	30	66	96	37	76	113	42	82	123
8:00 PM	32	68	100	22	72	94	50	90	140	33	59	92	29	56	85	17	52	69	30	69	99	35	77	111
9:00 PM	76	39	115	39	44	83	36	39	75	34	40	74	32	20	52	30	27	57	28	42	70	50	41	91
10:00 PM	66	20	86	62	15	77	57	17	74	57	20	77	48	13	61	47	25	72	64	31	95	62	17	79
11:00 PM	32	11	43	36	12	48	44	17	61	36	13	49	26	9	35	41	11	52	49	18	67	37	13	51
Total	**1,284**	**1,294**	**2,578**	**1,322**	**1,348**	**2,670**	**1,279**	**1,281**	**2,560**	**1,250**	**1,229**	**2,479**	**862**	**827**	**1,689**	**904**	**898**	**1,802**	**1,136**	**1,178**	**2,314**	**1,295**	**1,308**	**2,603**
Percent	**50%**	**50%**	-	**50%**	**50%**	-	**50%**	**50%**	-	**50%**	**50%**	-	**51%**	**49%**	-	**50%**	**50%**	-	**49%**	**51%**	-	**50%**	**50%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Location: N Access Rd Location 19
Date Range: 4/24/2018 - 4/30/2018
Site Code: 19

	Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday					
	4/24/2018			4/25/2018			4/26/2018			4/27/2018			4/28/2018			4/29/2018			4/30/2018			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	6	33	39	8	21	29	8	19	27	6	21	27	6	25	31	6	23	29	5	21	26	7	24	32
1:00 AM	9	37	46	11	40	51	6	44	50	9	39	48	8	26	34	8	23	31	7	26	33	9	40	49
2:00 AM	16	21	37	12	17	29	11	18	29	10	17	27	11	16	27	15	13	28	10	17	27	13	19	32
3:00 AM	31	7	38	26	7	33	25	5	30	18	6	24	24	9	33	24	10	34	29	7	36	27	6	34
4:00 AM	48	11	59	56	10	66	49	17	66	47	12	59	28	14	42	32	9	41	40	11	51	51	13	64
5:00 AM	78	15	93	83	15	98	94	15	109	74	14	88	56	12	68	57	9	66	78	16	94	85	15	100
6:00 AM	70	77	147	69	76	145	66	100	166	59	76	135	25	67	92	23	57	80	53	63	116	68	84	153
7:00 AM	21	71	92	19	71	90	25	71	96	22	64	86	12	46	58	6	42	48	24	51	75	22	71	93
8:00 AM	23	16	39	16	15	31	23	16	39	18	14	32	14	9	23	11	12	23	25	26	51	21	16	36
9:00 AM	17	24	41	22	17	39	20	13	33	22	19	41	15	10	25	15	11	26	20	19	39	20	18	38
10:00 AM	20	23	43	25	37	62	26	20	46	20	24	44	9	9	18	18	16	34	27	24	51	24	27	50
11:00 AM	30	22	52	36	25	61	31	32	63	29	29	58	22	14	36	13	14	27	33	30	63	32	26	59
12:00 PM	33	29	62	27	28	55	24	24	48	30	25	55	15	14	29	16	14	30	31	22	53	28	27	55
1:00 PM	50	51	101	55	48	103	40	58	98	42	45	87	37	33	70	35	28	63	40	52	92	48	52	101
2:00 PM	24	67	91	36	76	112	30	71	101	27	61	88	21	48	69	28	46	74	22	68	90	30	71	101
3:00 PM	19	47	66	22	41	63	21	36	57	17	38	55	15	19	34	12	20	32	12	26	38	21	41	62
4:00 PM	20	17	37	16	22	38	35	15	50	15	19	34	14	14	28	19	13	32	19	20	39	24	18	42
5:00 PM	27	31	58	24	20	44	21	42	63	14	19	33	19	15	34	16	21	37	27	18	45	24	31	55
6:00 PM	18	20	38	34	22	56	27	26	53	26	23	49	18	18	36	18	12	30	22	17	39	26	23	49
7:00 PM	76	12	88	76	27	103	69	27	96	65	19	84	56	11	67	60	18	78	68	24	92	74	22	96
8:00 PM	48	20	68	64	14	78	69	20	89	58	24	82	49	17	66	46	11	57	60	18	78	60	18	78
9:00 PM	30	29	59	29	25	54	24	23	47	21	23	44	12	23	35	19	22	41	28	19	47	28	26	53
10:00 PM	13	45	58	7	42	49	10	41	51	12	39	51	7	35	42	17	36	53	18	44	62	10	43	53
11:00 PM	11	26	37	10	21	31	12	32	44	5	27	32	6	21	27	7	29	36	10	30	40	11	26	37
Total	**738**	**751**	**1,489**	**783**	**737**	**1,520**	**766**	**785**	**1,551**	**666**	**697**	**1,363**	**499**	**525**	**1,024**	**521**	**509**	**1,030**	**708**	**669**	**1,377**	**762**	**758**	**1,520**
Percent	**50%**	**50%**	-	**52%**	**48%**	-	**49%**	**51%**	-	**49%**	**51%**	-	**49%**	**51%**	-	**51%**	**49%**	-	**51%**	**49%**	-	**50%**	**50%**	-

1. Mid-week average includes data between Tuesday and Thursday.

Project Manager: (415) 310-6469
project.manager.ca@idaxdata.com

Location: Millbrae Ave, B/W Old Bayshore Hwy & US-101 NB On Ramp
Date Range: 10/22/2019 - 10/28/2019
Site Code: 01

	Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday					
	10/22/2019			10/23/2019			10/24/2019			10/25/2019			10/26/2019			10/27/2019			10/28/2019			Mid-Week Average		
Time	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total	EB	WB	Total
12:00 AM	480	645	1,125	376	530	906	358	427	785	599	611	1,210	448	657	1,105	346	411	757	759	923	1,682	405	534	939
1:00 AM	293	403	696	196	348	544	182	378	560	245	463	708	347	420	767	196	274	470	477	618	1,095	224	376	600
2:00 AM	227	200	427	143	119	262	148	113	261	190	143	333	168	142	310	144	120	264	179	197	376	173	144	317
3:00 AM	152	85	237	125	79	204	127	73	200	146	114	260	118	88	206	140	72	212	120	105	225	135	79	214
4:00 AM	253	134	387	223	94	317	241	117	358	228	94	322	155	105	260	129	99	228	215	88	303	239	115	354
5:00 AM	421	189	610	433	209	642	368	215	583	422	211	633	268	153	421	229	123	352	446	227	673	407	204	612
6:00 AM	603	354	957	645	409	1,054	597	370	967	590	323	913	389	288	677	298	233	531	550	309	859	615	378	993
7:00 AM	867	656	1,523	855	615	1,470	902	575	1,477	848	591	1,439	569	375	944	490	410	900	871	739	1,610	875	615	1,490
8:00 AM	1,120	840	1,960	**1,134**	784	1,918	**1,103**	774	1,877	**1,060**	712	1,772	580	528	1,108	530	561	1,091	1,150	907	2,057	1,119	799	1,918
9:00 AM	**1,207**	897	**2,104**	1,131	877	**2,008**	1,085	880	**1,965**	1,020	799	1,819	731	704	1,435	716	643	1,359	**1,319**	929	2,248	**1,141**	885	**2,026**
10:00 AM	1,074	937	2,011	1,031	867	1,898	1,023	850	1,873	985	887	1,872	**791**	661	1,452	765	715	1,480	1,247	1,058	**2,305**	1,043	885	1,927
11:00 AM	916	**1,021**	1,937	902	**925**	1,827	952	**914**	1,866	969	**1,014**	**1,983**	767	**917**	**1,684**	**822**	**844**	**1,666**	1,104	**1,096**	2,200	923	**953**	1,877
12:00 PM	983	1,193	**2,176**	958	1,041	1,999	**994**	1,073	2,067	**983**	1,071	2,054	811	889	1,700	841	817	1,658	1,097	1,075	2,172	978	1,102	2,081
1:00 PM	**1,052**	1,117	2,169	**1,060**	1,158	**2,218**	983	1,219	**2,202**	940	1,150	2,090	810	**946**	1,756	882	908	1,790	**1,126**	**1,104**	**2,230**	**1,032**	1,165	**2,196**
2:00 PM	940	**1,231**	2,171	896	1,112	2,008	928	1,183	2,111	903	1,244	2,147	**858**	906	**1,764**	899	1,018	1,917	965	991	1,956	921	1,175	2,097
3:00 PM	891	1,229	2,120	818	1,150	1,968	837	1,285	2,122	880	**1,403**	**2,283**	750	865	1,615	880	1,024	1,904	910	1,024	1,934	849	1,221	2,070
4:00 PM	845	1,167	2,012	819	1,259	2,078	874	1,219	2,093	913	1,311	2,224	748	833	1,581	763	862	1,625	804	887	1,691	846	1,215	2,061
5:00 PM	817	1,225	2,042	825	**1,291**	2,116	841	**1,349**	2,190	812	1,361	2,173	729	695	1,424	804	896	1,700	787	980	1,767	828	**1,288**	2,116
6:00 PM	818	1,166	1,984	838	1,173	2,011	873	1,270	2,143	821	1,121	1,942	751	704	1,455	**936**	936	1,872	813	875	1,688	843	1,203	2,046
7:00 PM	782	1,004	1,786	751	1,102	1,853	862	1,138	2,000	848	1,061	1,909	648	657	1,305	873	976	1,849	797	841	1,638	798	1,081	1,880
8:00 PM	863	1,039	1,902	869	1,098	1,967	913	1,195	2,108	846	1,134	1,980	657	685	1,342	849	1,094	1,943	801	853	1,654	882	1,111	1,992
9:00 PM	712	1,032	1,744	750	1,118	1,868	862	1,170	2,032	818	1,145	1,963	615	827	1,442	834	**1,236**	**2,070**	784	964	1,748	775	1,107	1,881
10:00 PM	711	842	1,553	850	1,002	1,852	738	984	1,722	766	1,062	1,828	562	637	1,199	847	1,126	1,973	736	842	1,578	766	943	1,709
11:00 PM	469	662	1,131	556	725	1,281	692	880	1,572	579	731	1,310	472	547	1,019	681	971	1,652	512	777	1,289	572	756	1,328
Total	17,496	19,268	36,764	17,184	19,085	36,269	17,483	19,651	37,134	17,411	19,756	37,167	13,742	14,229	27,971	14,894	16,369	31,263	18,569	18,409	36,978	17,388	19,335	36,722
Percent	48%	52%	-	47%	53%	-	47%	53%	-	47%	53%	-	49%	51%	-	48%	52%	-	50%	50%	-	47%	53%	-
AM Peak	09:00	11:00	09:00	08:00	11:00	09:00	08:00	11:00	09:00	08:00	11:00	11:00	10:00	11:00	11:00	11:00	11:00	11:00	09:00	11:00	10:00	09:00	11:00	09:00
Vol.	1,207	1,021	2,104	1,134	925	2,008	1,103	914	1,965	1,060	1,014	1,983	791	917	1,684	822	844	1,666	1,319	1,096	2,305	1,141	953	2,026
PM Peak	13:00	14:00	12:00	13:00	17:00	13:00	12:00	17:00	13:00	12:00	15:00	15:00	14:00	13:00	14:00	18:00	21:00	21:00	13:00	13:00	13:00	13:00	17:00	13:00
Vol.	1,052	1,231	2,176	1,060	1,291	2,218	994	1,349	2,202	983	1,403	2,283	858	946	1,764	936	1,236	2,070	1,126	1,104	2,230	1,032	1,288	2,196

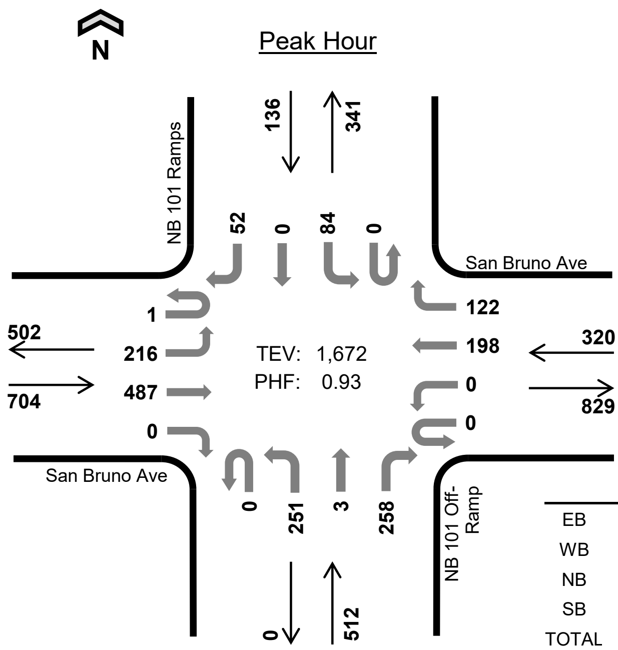
1. Mid-week average includes data between Tuesday and Thursday.

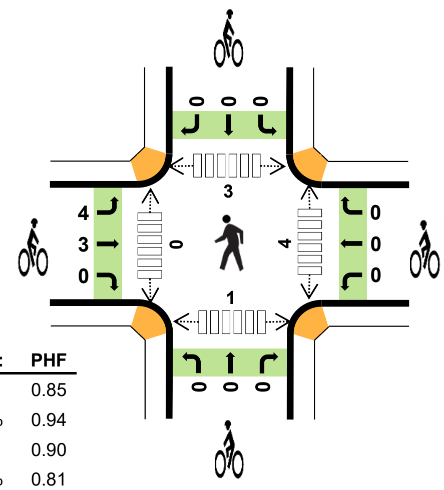
Project Manager: (415) 310-6469
project.manager.ca@idaxdata.com

NB 101 Off-Ramp
San Bruno Ave

Date: 04-24-2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 7:30 AM to 8:30 AM

Peak Hour





	HV %:	PHF
EB	2.3%	0.85
WB	17.8%	0.94
NB	6.1%	0.90
SB	23.5%	0.81
TOTAL	8.1%	0.93

Two-Hour Count Summaries

Interval Start		San Bruno Ave Eastbound UT	LT	TH	RT	San Bruno Ave Westbound UT	LT	TH	RT	NB 101 Off-Ramp Northbound UT	LT	TH	RT	NB 101 Ramps Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM		0	67	107	0	0	0	42	22	0	51	1	52	0	23	0	15	380	0
7:15 AM		0	78	113	0	0	0	56	24	0	60	0	58	0	23	0	18	430	0
7:30 AM		**1**	**56**	**130**	**0**	**0**	**0**	**49**	**34**	**0**	**65**	**1**	**66**	**0**	**17**	**0**	**11**	**430**	0
7:45 AM		**0**	**45**	**125**	**0**	**0**	**0**	**55**	**30**	**0**	**73**	**1**	**55**	**0**	**19**	**0**	**16**	**419**	1,659
8:00 AM		**0**	**49**	**91**	**0**	**0**	**0**	**43**	**39**	**0**	**41**	**1**	**66**	**0**	**26**	**0**	**16**	**372**	1,651
8:15 AM		**0**	**66**	**141**	**0**	**0**	**0**	**51**	**19**	**0**	**72**	**0**	**71**	**0**	**22**	**0**	**9**	**451**	**1,672**
8:30 AM		0	35	102	0	0	0	62	37	0	57	0	57	0	16	0	11	377	1,619
8:45 AM		0	41	106	0	0	0	59	24	0	61	0	64	0	13	0	12	380	1,580
Count Total		1	437	915	0	0	0	417	229	0	480	4	489	0	159	0	108	3,239	0
Peak Hour	**All**	**1**	**216**	**487**	**0**	**0**	**0**	**198**	**122**	**0**	**251**	**3**	**258**	**0**	**84**	**0**	**52**	**1,672**	**0**
	HV	**0**	**3**	**13**	**0**	**0**	**0**	**41**	**16**	**0**	**16**	**1**	**14**	**0**	**26**	**0**	**6**	**136**	**0**
	HV%	**0%**	**1%**	**3%**	**-**	**-**	**-**	**21%**	**13%**	**-**	**6%**	**33%**	**5%**	**-**	**31%**	**-**	**12%**	**8%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

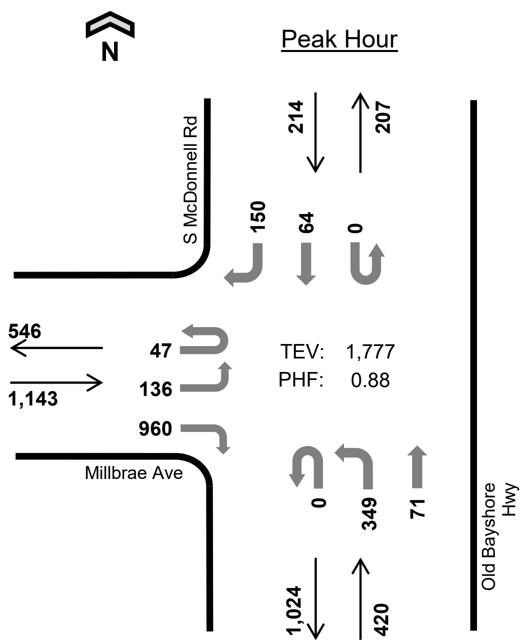
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	4	11	3	6	*24*	1	0	0	0	*1*	0	0	1	0	*1*
7:15 AM	4	13	5	10	*32*	0	0	0	0	*0*	0	0	0	0	*0*
7:30 AM	**3**	**16**	**5**	**8**	***32***	**1**	**0**	**0**	**0**	***1***	**0**	**0**	**1**	**0**	*1*
7:45 AM	**4**	**16**	**7**	**8**	***35***	**1**	**0**	**0**	**0**	***1***	**0**	**0**	**1**	**0**	*1*
8:00 AM	**4**	**14**	**8**	**7**	***33***	**3**	**0**	**0**	**0**	***3***	**4**	**0**	**1**	**0**	*5*
8:15 AM	**5**	**11**	**11**	**9**	***36***	**2**	**0**	**0**	**0**	***2***	**0**	**0**	**0**	**1**	***1***
8:30 AM	3	13	4	6	*26*	0	0	0	0	*0*	1	0	2	1	*4*
8:45 AM	2	11	9	8	*30*	0	0	0	0	*0*	1	0	1	0	*2*
Count Total	29	105	52	62	*248*	8	0	0	0	*8*	6	0	7	2	*15*
Peak Hour	**16**	**57**	**31**	**32**	***136***	**7**	**0**	**0**	**0**	***7***	**4**	**0**	**3**	**1**	***8***

Project Manager: (415) 310-6469 project.manager.ca@idaxdata.com

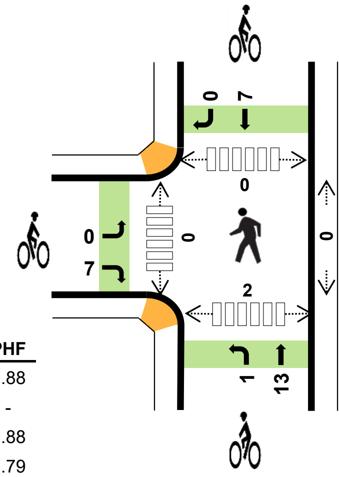
Old Bayshore Hwy
Millbrae Ave

Date: 04-24-2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM

Peak Hour



	HV %:	PHF
EB	4.5%	0.88
WB	-	-
NB	9.8%	0.88
SB	13.1%	0.79
TOTAL	6.8%	0.88



Two-Hour Count Summaries

Interval Start	Millbrae Ave Eastbound UT	LT	TH	RT	0 Westbound UT	LT	TH	RT	Old Bayshore Hwy Northbound UT	LT	TH	RT	S McDonnell Rd Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	12	42	0	153	0	0	0	0	0	82	17	0	0	0	10	16	332	0
7:15 AM	12	25	0	142	0	0	0	0	0	64	14	0	0	0	8	17	282	0
7:30 AM	8	37	0	157	0	0	0	0	0	82	21	0	0	0	8	22	335	0
7:45 AM	13	22	0	226	0	0	0	0	0	88	19	0	0	0	6	37	411	1,360
8:00 AM	**12**	**29**	**0**	**219**	**0**	**0**	**0**	**0**	**0**	**73**	**12**	**0**	**0**	**0**	**13**	**22**	**380**	1,408
8:15 AM	**12**	**27**	**0**	**243**	**0**	**0**	**0**	**0**	**0**	**99**	**21**	**0**	**0**	**0**	**10**	**33**	**445**	1,571
8:30 AM	**7**	**37**	**0**	**234**	**0**	**0**	**0**	**0**	**0**	**89**	**15**	**0**	**0**	**0**	**12**	**56**	**450**	1,686
8:45 AM	**16**	**43**	**0**	**264**	**0**	**0**	**0**	**0**	**0**	**88**	**23**	**0**	**0**	**0**	**29**	**39**	**502**	**1,777**
Count Total	92	262	0	1,638	0	0	0	0	0	665	142	0	0	0	96	242	3,137	0
Peak Hour All	**47**	**136**	**0**	**960**	**0**	**0**	**0**	**0**	**0**	**349**	**71**	**0**	**0**	**0**	**64**	**150**	**1,777**	**0**
Peak Hour HV	**0**	**26**	**0**	**26**	**0**	**0**	**0**	**0**	**0**	**33**	**8**	**0**	**0**	**0**	**7**	**21**	**121**	**0**
Peak Hour HV%	**0%**	**19%**	**-**	**3%**	**-**	**-**	**-**	**-**	**-**	**9%**	**11%**	**-**	**-**	**-**	**11%**	**14%**	**7%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

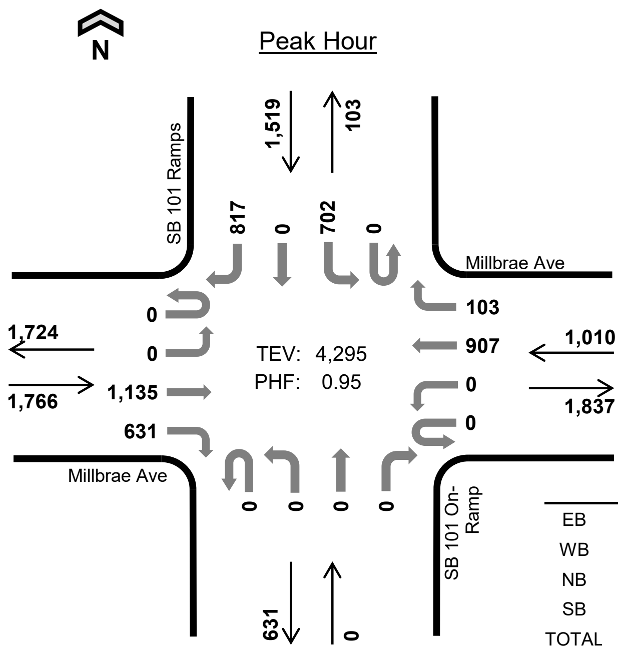
Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	13	0	9	4	*26*	0	0	0	1	*1*	0	0	0	2	*2*
7:15 AM	7	0	11	4	*22*	1	0	4	8	*13*	0	0	0	0	*0*
7:30 AM	10	0	10	5	*25*	0	0	3	4	*7*	0	0	0	2	*2*
7:45 AM	15	0	3	8	*26*	2	0	3	6	*11*	0	0	0	2	*2*
8:00 AM	**12**	**0**	**6**	**2**	***20***	**1**	**0**	**3**	**4**	***8***	**0**	**0**	**0**	**1**	*1*
8:15 AM	**7**	**0**	**13**	**9**	***29***	**4**	**0**	**4**	**2**	***10***	**0**	**0**	**0**	**0**	*0*
8:30 AM	**15**	**0**	**10**	**6**	***31***	**1**	**0**	**1**	**1**	***3***	**0**	**0**	**0**	**0**	*0*
8:45 AM	**18**	**0**	**12**	**11**	***41***	**1**	**0**	**6**	**0**	***7***	**0**	**0**	**0**	**1**	***1***
Count Total	97	0	74	49	*220*	10	0	24	26	*60*	0	0	0	8	*8*
Peak Hr	**52**	**0**	**41**	**28**	***121***	**7**	**0**	**14**	**7**	***28***	**0**	**0**	**0**	**2**	***2***

Project Manager: (415) 310-6469
project.manager.ca@idaxdata.com

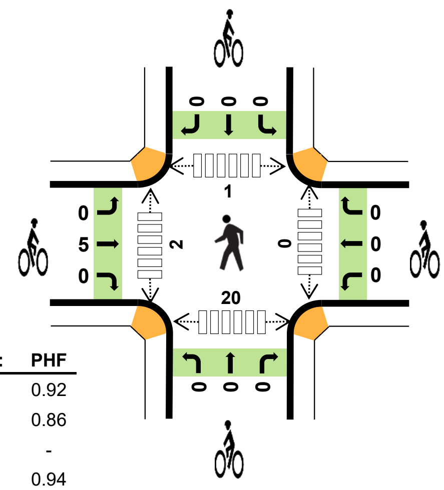
SB 101 On-Ramp
Millbrae Ave

Date: 04-24-2018
Count Period: 7:00 AM to 9:00 AM
Peak Hour: 8:00 AM to 9:00 AM

Peak Hour



	HV %:	PHF
EB	4.2%	0.92
WB	3.4%	0.86
NB	-	-
SB	4.9%	0.94
TOTAL	4.3%	0.95



Two-Hour Count Summaries

Interval Start	Millbrae Ave Eastbound UT	LT	TH	RT	Millbrae Ave Westbound UT	LT	TH	RT	SB 101 On-Ramp Northbound UT	LT	TH	RT	SB 101 Ramps Southbound UT	LT	TH	RT	15-min Total	Rolling One Hour
7:00 AM	0	0	253	130	0	0	204	29	0	0	0	0	0	121	0	178	915	0
7:15 AM	0	0	219	153	0	0	188	24	0	0	0	0	0	113	0	180	877	0
7:30 AM	0	0	249	120	0	0	217	21	0	0	0	0	0	126	0	203	936	0
7:45 AM	0	0	235	149	0	0	252	19	0	0	0	0	0	159	0	223	1,037	3,765
8:00 AM	**0**	**0**	**272**	**171**	**0**	**0**	**262**	**31**	**0**	**0**	**0**	**0**	**0**	**164**	**0**	**226**	**1,126**	3,976
8:15 AM	**0**	**0**	**264**	**164**	**0**	**0**	**237**	**22**	**0**	**0**	**0**	**0**	**0**	**173**	**0**	**194**	**1,054**	4,153
8:30 AM	**0**	**0**	**322**	**160**	**0**	**0**	**213**	**22**	**0**	**0**	**0**	**0**	**0**	**176**	**0**	**183**	**1,076**	4,293
8:45 AM	**0**	**0**	**277**	**136**	**0**	**0**	**195**	**28**	**0**	**0**	**0**	**0**	**0**	**189**	**0**	**214**	**1,039**	**4,295**
Count Total	0	0	2,091	1,183	0	0	1,768	196	0	0	0	0	0	1,221	0	1,601	8,060	0
Peak Hour All	**0**	**0**	**1,135**	**631**	**0**	**0**	**907**	**103**	**0**	**0**	**0**	**0**	**0**	**702**	**0**	**817**	**4,295**	**0**
Peak Hour HV	**0**	**0**	**48**	**27**	**0**	**0**	**28**	**6**	**0**	**0**	**0**	**0**	**0**	**40**	**0**	**35**	**184**	**0**
Peak Hour HV%	**-**	**-**	**4%**	**4%**	**-**	**-**	**3%**	**6%**	**-**	**-**	**-**	**-**	**-**	**6%**	**-**	**4%**	**4%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
7:00 AM	22	9	0	13	*44*	0	0	0	0	*0*	0	1	0	1	*2*
7:15 AM	17	9	0	10	*36*	0	0	0	0	*0*	0	1	0	4	*5*
7:30 AM	17	14	0	14	*45*	0	0	0	0	*0*	0	0	0	3	*3*
7:45 AM	14	11	0	17	*42*	0	0	0	0	*0*	0	1	0	1	*2*
8:00 AM	**25**	**4**	**0**	**18**	***47***	**2**	**0**	**0**	**0**	***2***	**0**	**0**	**0**	**5**	*5*
8:15 AM	**11**	**11**	**0**	**15**	***37***	**1**	**0**	**0**	**0**	***1***	**0**	**2**	**0**	**8**	*10*
8:30 AM	**19**	**9**	**0**	**18**	***46***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**2**	*2*
8:45 AM	**20**	**10**	**0**	**24**	***54***	**2**	**0**	**0**	**0**	***2***	**0**	**0**	**1**	**5**	***6***
Count Total	145	77	0	129	*351*	5	0	0	0	*5*	0	5	1	29	*35*
Peak Hour	**75**	**34**	**0**	**75**	***184***	**5**	**0**	**0**	**0**	***5***	**0**	**2**	**1**	**20**	***23***

Project Manager: (415) 310-6469 project.manager.ca@idaxdata.com

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Millbrae Ave Eastbound				Millbrae Ave Westbound				SB 101 On-Ramp Northbound				SB 101 Ramps Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	17	5	0	0	6	3	0	0	0	0	0	7	0	6	44	0
7:15 AM	0	0	11	6	0	0	8	1	0	0	0	0	0	5	0	5	36	0
7:30 AM	0	0	13	4	0	0	13	1	0	0	0	0	0	6	0	8	45	0
7:45 AM	0	0	8	6	0	0	10	1	0	0	0	0	0	9	0	8	42	167
8:00 AM	**0**	**0**	**14**	**11**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**10**	**47**	170
8:15 AM	**0**	**0**	**4**	**7**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**9**	**37**	171
8:30 AM	**0**	**0**	**14**	**5**	**0**	**0**	**7**	**2**	**0**	**0**	**0**	**0**	**0**	**11**	**0**	**7**	**46**	172
8:45 AM	**0**	**0**	**16**	**4**	**0**	**0**	**8**	**2**	**0**	**0**	**0**	**0**	**0**	**15**	**0**	**9**	**54**	**184**
Count Total	0	0	97	48	0	0	65	12	0	0	0	0	0	67	0	62	351	0
Peak Hour	**0**	**0**	**48**	**27**	**0**	**0**	**28**	**6**	**0**	**0**	**0**	**0**	**0**	**40**	**0**	**35**	**184**	**0**

Two-Hour Count Summaries - Bikes

Interval Start	Millbrae Ave Eastbound			Millbrae Ave Westbound			SB 101 On-Ramp Northbound			SB 101 Ramps Southbound			15-min Total	Rolling One Hour
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	2
8:15 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	3
8:30 AM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3
8:45 AM	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**5**
Count Total	0	5	0	0	0	0	0	0	0	0	0	0	5	0
Peak Hour	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

Project Manager: (415) 310-6469 project.manager.ca@idaxdata.com

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Millbrae Ave				0				Old Bayshore Hwy				S McDonnell Rd				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	5	0	8	0	0	0	0	0	9	0	0	0	0	2	2	26	0
7:15 AM	0	2	0	5	0	0	0	0	0	11	0	0	0	0	1	3	22	0
7:30 AM	0	4	0	6	0	0	0	0	0	9	1	0	0	0	0	5	25	0
7:45 AM	0	4	0	11	0	0	0	0	0	3	0	0	0	0	2	6	26	99
8:00 AM	**0**	**8**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**0**	**2**	**20**	93
8:15 AM	**0**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**12**	**1**	**0**	**0**	**0**	**3**	**6**	**29**	100
8:30 AM	**0**	**8**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**6**	**4**	**0**	**0**	**0**	**0**	**6**	**31**	106
8:45 AM	**0**	**9**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**10**	**2**	**0**	**0**	**0**	**4**	**7**	**41**	**121**
Count Total	0	41	0	56	0	0	0	0	0	65	9	0	0	0	12	37	220	0
Peak Hour	**0**	**26**	**0**	**26**	**0**	**0**	**0**	**0**	**0**	**33**	**8**	**0**	**0**	**0**	**7**	**21**	**121**	**0**

Two-Hour Count Summaries - Bikes

Interval Start	Millbrae Ave			0			Old Bayshore Hwy			S McDonnell Rd			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	1	0
7:15 AM	0	0	1	0	0	0	0	4	0	0	8	0	13	0
7:30 AM	0	0	0	0	0	0	0	3	0	0	4	0	7	0
7:45 AM	0	0	2	0	0	0	0	3	0	0	6	0	11	32
8:00 AM	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**4**	**0**	**8**	39
8:15 AM	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**2**	**0**	**10**	36
8:30 AM	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**3**	32
8:45 AM	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**5**	**0**	**0**	**0**	**0**	**7**	**28**
Count Total	0	0	10	0	0	0	1	23	0	0	26	0	60	0
Peak Hour	**0**	**0**	**7**	**0**	**0**	**0**	**1**	**13**	**0**	**0**	**7**	**0**	**28**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

Project Manager: (415) 310-6469

project.manager.ca@idaxdata.com

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	San Bruno Ave Eastbound				San Bruno Ave Westbound				NB 101 Off-Ramp Northbound				NB 101 Ramps Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	1	3	0	0	0	9	2	0	3	0	0	0	5	0	1	24	0
7:15 AM	0	1	3	0	0	0	10	3	0	4	0	1	0	8	0	2	32	0
7:30 AM	**0**	**1**	**2**	**0**	**0**	**0**	**11**	**5**	**0**	**2**	**0**	**3**	**0**	**6**	**0**	**2**	**32**	0
7:45 AM	**0**	**1**	**3**	**0**	**0**	**0**	**12**	**4**	**0**	**5**	**0**	**2**	**0**	**7**	**0**	**1**	**35**	123
8:00 AM	**0**	**0**	**4**	**0**	**0**	**0**	**11**	**3**	**0**	**1**	**1**	**6**	**0**	**6**	**0**	**1**	**33**	132
8:15 AM	**0**	**1**	**4**	**0**	**0**	**0**	**7**	**4**	**0**	**8**	**0**	**3**	**0**	**7**	**0**	**2**	**36**	**136**
8:30 AM	0	1	2	0	0	0	11	2	0	3	0	1	0	4	0	2	26	130
8:45 AM	0	1	1	0	0	0	8	3	0	3	0	6	0	6	0	2	30	125
Count Total	0	7	22	0	0	0	79	26	0	29	1	22	0	49	0	13	248	0
Peak Hour	**0**	**3**	**13**	**0**	**0**	**0**	**41**	**16**	**0**	**16**	**1**	**14**	**0**	**26**	**0**	**6**	**136**	**0**

Two-Hour Count Summaries - Bikes

Interval Start	San Bruno Ave Eastbound			San Bruno Ave Westbound			NB 101 Off-Ramp Northbound			NB 101 Ramps Southbound			15-min Total	Rolling One Hour
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
7:00 AM	0	1	0	0	0	0	0	0	0	0	0	0	1	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	0
7:45 AM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	3
8:00 AM	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	5
8:15 AM	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**7**
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	6
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Count Total	4	4	0	0	0	0	0	0	0	0	0	0	8	0
Peak Hour	**4**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

		Daily			A.M. Peak Hour		
		NB/EB	SB/WB	Total	NB/EB	SB/WB	Total
A.	U.S. 101 North of North Access Road						
B.	U.S. 101 between N. Access Rd and Millbrae Ave	142,000	142,000	284,000	8,500	8,500	17,000
C.	U.S. 101 South of Millbrae Ave						
D1.	Millbrae Ave west of S.McDonnell Rd/Old Bayshore	17,388	19,335	36,723	1,143	543	1,686
D2.	S. McDonnell Rd north of Millbrae Avenue	7,112	7,740	14,852	226	189	415
E1.	North Access Rd east of U.S. 101/I-380 ramps	4,676	4,977	9,653	359	327	686
E2.	North Access Rd west of N. Field Road	3,253	3,008	6,261	282	148	430
F.	Millbrae Avenue west of U.S. 101 ramps	32,469	34,572	67,041	1,766	1,724	3,490
G.	San Bruno Avenue east of U.S. 101 ramps	14,725	12,800	27,525	829	320	1,149

Sources:

A.

B. Approximate based on published Caltrans 2018 AADT and 2019 Peak Hour data.

C.

D1. IDAX Intersection Counts, AM Peak Period (7 to 9 AM), Old Bayshore Hwy/S. McDonnell Rd/Millbrae, 4-24-2018. Daily estimated based on 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, Midweek Average, 10/22/2019 – 10/28/2019

D2. IDAX 24-hour/Vehicle Classification Counts, S McDonnell Rd N of Millbrae Ave/Site Code 1, 4-24-2018 to 4-30. 2018.

E1. IDAX 24-hour/Vehicle Classification Counts, N Access Rd E of I-380 Off-ramp/Site Code 13, 4-24-2018 to 4-30-2018.

E2. IDAX 24-hour/Vehicle Classification Counts, N Access Rd W of N Field Rd/Site Code 15, 4-24-2018 to 4-30-2018.

F. IDAX Intersection Counts, AM Peak Period (7 to 9 AM), SB 101 On-ramp/Millbrae Avenue, 4-24-2018. Daily estimated based on 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, Midweek Average, 10/22/2019 – 10/28/2019.

G. IDAX, NB 101 Off-ramp/San Bruno Avenue, 4-24-2018. Daily estimated based on 24-hour counts on Millbrae Avenue between Old Bayshore/So. McDonnell and U.S. 101 NB, Midweek Average, 10/22/2019 – 10/28/2019.

|

G. Millbrae Avenue west of U.S. 101 SB ramps
SB 101 Off-ramp/Millbrae Avenue, 4-24-2018
Two-hour summaries

	EB	WB	
AM	3,274	3,369	6,643
MD	3,647	3,773	7,420
PM	3,469	3,921	7,390
	10,390	11,063	21,453
Daily	32,469	34,572	67,041

G. San Bruno Avenue east of U.S. 101 NB ramps
NB 101 Off-ramp/San Bruno Avenue, 4-24-2018
Two-hour summaries

	EB	WB	
AM	1,563	646	2,209
MD	2,032	2,010	4,042
PM	1,117	1,440	2,557
	4,712	4,096	8,808
Daily	14,725	12,800	27,525

Millbrae Avenue between Old Bayshore and
U.S. 101 NB ramps

	EB	WB	Total
12	405	534	939
1	224	376	600
2	173	144	317
3	135	79	214
4	239	115	354
5	407	204	611
6	615	378	993
7	875	615	1,490
8	1,119	799	1,918
9	1,141	885	2,026
10	1,043	885	1,928
11	923	953	1,876
12	978	1,102	2,080
1	1,032	1,165	2,197
2	921	1,175	2,096
3	849	1,221	2,070
4	846	1,215	2,061
5	828	1,288	2,116
6	843	1,203	2,046
7	798	1,081	1,879
8	882	1,111	1,993
9	775	1,107	1,882
10	766	943	1,709
11	572	756	1,328
	17,389	19,334	36,723
	5,678	6,184	11,862
	32.7%	32.0%	32.3%

Traffic Census Program

Traffic Counts (a.k.a. Traffic Volumes) are for the State Highway System only (in various formats).

Highways are signed as **Interstate**, **California State Route**, or **United States Route**. See examples below:

Traffic count information for city and county streets may be found at the city Traffic Engineering or Public Works Department, or the Community Development Office in the area where the street is located.

- Explanation of Traffic Counts (Back & Ahead Leg Diagrams) (PDF)

Caltrans Traffic Counts are summarized annually into four categories:

Traffic Volumes: Annual Average Daily Traffic (AADT)

For ALL vehicles on California State Highways.

by Webpage: 2017

by PDF: 2016-AADT (PDF) | 2015-AADT (PDF) | 2014-AADT (PDF) | 2013-AADT (PDF)

by Excel: 2019-AADT (XLSX) | 2018-AADT (XLSX) | 2017-AADT (XLSX) | 2016-AADT (XLSX) | 2015-AADT (XLSX) | 2014 -AADT(XLSX) | 2013-AADT (XLSX)

Note: Only Excel format available from 2017 to current year.

Truck Traffic: Annual Average Daily Truck Traffic

For truck traffic on California State Highways.

by PDF: 2016-AADT Truck (PDF) | 2015-AADT Truck (PDF) | 2014-AADT Truck (PDF) | 2013-AADT Truck (PDF)

Traffic Census Program

- Traffic Census Homepage
- Monthly Vehicle Miles of Travel (MVMT)
- Traffic Counts (Volumes)
- Explanation of Traffic Counts (PDF)
- Traffic Volume Trends (TVT) FAQ
- Traffic Data FAQ (PDF)

Related Resources

- Planning Economic Forecasting
- Highway Performance Monitoring System (HPMS)
- GIS Data Library
- Mobility Performance Reporting and Analysis Program
- Performance Measurement System (PeMS)
- Weigh-In-Motion (WIM) Data
- Freight Mobility & Planning
- Quick Map
- FHWA Office of Travel Monitoring

by Excel: 2018-AADT Truck (XLSX) | 2017-AADT Truck (XLSX) | 2016-AADT Truck (XLSX) | 2015-AADT Truck (XLSX) | 2014-AADT Truck (XLSX) | 2013-AADT Truck (XLSX)

Note: Only Excel format available from 2017 to current year.

Ramp Volumes

For ramp volumes on California State Freeways, by Caltrans District.

- Legend of District County Names (JPG)

by PDF:
- District 1: 2017-D1 (PDF) | 2016-D1 (PDF)
- District 2: 2017-D2 (PDF) | 2016-D2 (PDF)
- District 3: 2017-D3 (PDF) | 2016-D3 (PDF)
- District 4: 2017-D4 (PDF) | 2016-D4 (PDF)
- District 5: 2017-D5 (PDF) | 2016-D5 (PDF)
- District 6: 2017-D6 (PDF) | 2016-D6 (PDF)
- District 7: 2017-D7 (PDF) | 2016-D7 (PDF)
- District 8: 2017-D8 (PDF) | 2016-D8 (PDF)
- District 9: 2017-D9 (PDF) | 2016-D9 (PDF)
- District 10: 2017-D10 (PDF) | 2016-D10 (PDF)
- District 11: 2017-D11 (PDF) | 2016-D11 (PDF)
- District 12: 2017-D12 (PDF) | 2016-D12 (PDF)

by Excel:
- District 1: 2019-D1 (XLSX) | 2018-D1 (XLSX) | 2017-D1 (XLSX)
- District 2: 2019-D2 (XLSX) | 2018-D2 (XLSX) | 2017-D2 (XLSX)
- District 3: 2019-D3 (XLSX) | 2018-D3 (XLSX) | 2017-D3 (XLSX)
- District 4: 2019-D4 (XLSX) | 2018-D4 (XLSX) | 2017-D4 (XLSX)
- District 5: 2019-D5 (XLSX) | 2018-D5 (XLSX) | 2017-D5 (XLSX)
- District 6: 2019-D6 (XLSX) | 2018-D6 (XLSX) | 2017-D6 (XLSX)
- District 7: 2019-D7 (XLSX) | 2018-D7 (XLSX) | 2017-D7 (XLSX)
- District 8: 2019-D8 (XLSX) | 2018-D8 (XLSX) | 2017-D8 (XLSX)
- District 9: 2019-D9 (XLSX) | 2018-D9 (XLSX) | 2017-D9 (XLSX)
- District 10: 2019-D10 (XLSX) | 2018-D10 (XLSX) | 2017-D10 (XLSX)
- District 11: 2019-D11 (XLSX) | 2018-D11 (XLSX) | 2017-D11 (XLSX)
- District 12: 2019-D12 (XLSX) | 2018-D12 (XLSX) | 2017-D12 (XLSX)

Peak Hour Volume Data

Hourly volume relationships and traffic monitoring sites on the State Highway System. Morning (AM) and evening (PM) peak periods are expressed as a percentage of AADT.

- Peak Hour Definitions K and D Factors (PDF)

by Year: 2019 (XLSX) | 2018 (XLSX) | 2017 (PDF) | 2017 (XLSX) | 2016 (PDF) | 2016 (XLSX) | 2015 (PDF) | 2015 (XLSX) | 2014 (XLSX)

For questions regarding AADT reports, Ramp Volumes, or the Peak Hour Volume Data Reports above, please contact: Cindy.Pribyl@dot.ca.gov.

For AADT GIS data, visit the Caltrans GIS Data webpage.

2018_aadt-a11y

Home | Insert | Draw | Page Layout | Formulas | Data | Review | View | Acrobat | Tell me

Open recovered workbooks? Your recent changes were saved. Do you want to continue working where you left off? Yes No

A1 fx DISTRICT

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	DISTI	RTE	RT	CNTY	PN	PM	PN	DESCRIPTION	BACK_PI	BACK_PI	BACK_A/	AHEAD_I	AHEAD_I	AHEAD_AADT
2	12	001		ORA	R	0.129		DANA POINT, JCT. RTE. 5				4250	42000	38900
4386	04	101		SM		0.890		EAST PALO ALTO, UNIVERSITY AVENUE	15800	224000	219700	15500	220000	215600
4387	04	101		SM		1.869		JCT. RTE. 114	15500	220000	215600	14600	206000	202200
4388	04	101		SM		3.592		MENLO PARK, MARSH ROAD	14600	206000	202200	16000	226000	221700
4389	04	101		SM		5.385		REDWOOD CITY, JCT. RTE. 84	16000	226000	221700	15600	221000	216500
4390	04	101		SM		6.623		REDWOOD CITY, WHIPPLE AVENUE	15600	221000	216500	16700	235000	229900
4391	04	101		SM		8.401		HOLLY STREET	16700	235000	229900	16700	236000	230800
4392	04	101		SM		9.552		BELMONT, RALSTON AVENUE	16700	236000	230800	17800	251000	246200
4393	04	101		SM		11.147		SAN MATEO, EAST HILLSDALE BOULEVARD	17800	251000	246200	17600	248000	243100
4394	04	101		SM		11.895		SAN MATEO, JCT. RTE. 92	17600	248000	243100	19200	278000	272800
4395	04	101		SM		12.690		SAN MATEO, KEHOE AVENUE	19200	278000	272800	19100	276000	270700
4396	04	101		SM		13.461		SAN MATEO, THIRD AVENUE	19100	276000	270700	18700	273000	265600
4397	04	101		SM		14.330		SAN MATEO, POPLAR/DORE AVENUE	18700	273000	265600	18000	266000	257400
4398	04	101		SM		14.690		SAN MATEO, PENINSULA AVENUE	18000	266000	257400	17900	264000	255300
4399	04	101		SM		16.575		BURLINGAME, BROADWAY	18000	266000	256400	18100	269000	258500
4400	04	101		SM		17.947		MILLBRAE, MILLBRAE AVENUE	18100	270000	258500	17900	266000	255300
4401	04	101		SM		19.120		SAN FRANCISCO AIRPORT	17900	266000	255300	17600	260000	249200
4402	04	101		SM	R	20.719		SOUTH SAN FRANCISCO, JCT. RTE. 380 WEST	17600	260000	249200	17800	258000	250300
4403	04	101		SM		21.691		SB OFF TO PRODUCE/AIRPORT	17800	258000	250300	16500	238000	230800
4404	04	101		SM		21.915		SOUTH SAN FRANCISCO, GRAND AVENUE	16500	238000	230800	17000	244000	237000
4405	04	101		SM		22.713		SOUTH SAN FRANCISCO, OYSTER POINT BOULEVARD	17000	244000	237000	16200	235000	227800
4406	04	101		SM		23.393		SOUTH SAN FRANCISCO, OLD BAYSHORE CONNECT	14700	215000	208400	15700	230000	227700
4407	04	101		SM		25.700		BRISBANE, CANDLESTICK PARK	15600	229000	221700	15500	227000	220600
4408	04	101		SM		26.107		SAN FRANCISCO/SAN MATEO COUNTY LINE	15500	227000	220600			
4409	04	101		SF		0		SAN FRANCISCO/SAN MATEO COUNTY LINE				15500	227000	220600
4410	04	101		SF		0.774		SAN FRANCISCO, THIRD STREET	15500	227000	220600	16800	245000	238000
4411	04	101		SF		1.108		SAN FRANCISCO, PAUL AVENUE	16800	245000	238000	17400	254000	246200
4412	04	101		SF		1.976		SAN FRANCISCO, JCT. RTE. 280	17400	254000	246200	16500	241000	233900
4413	04	101		SF		2.920		SAN FRANCISCO, ARMY STREET	16500	241000	233900	15600	229000	221700
4414	04	101		SF		4.100		SAN FRANCISCO, VERMONT STREET	15600	229000	221700	15000	220000	213500
4415	04	101		SF		4.241		SAN FRANCISCO, JCT. RTE. 80	15000	220000	213500			
4416	04	101		SF	R	4.241	R	SAN FRANCISCO, JCT. RTE. 80, RIGHT ALIGN				7500	110000	107300
4417	04	101		SF	R	4.241	L	SAN FRANCISCO, JCT. RTE. 80, LEFT ALIGN				7500	110000	106300
4418	04	101		SF	T	4.850		BREAK IN ROUTE						
4419	04	101		SF	T	4.860		MARKET ST	3500	49500	47700	3300	46500	45800
4420	04	101		SF	T	5.260		SAN FRANCISCO, ON VAN NESS AVENUE AT GOLDEN GATE AVEN	3300	46500	45000	3400	48500	47000

PREFACE | 2018 AADT DATA

Count: 14 156%

2019-Peak-Hours

Home | Insert | Draw | Page Layout | Formulas | Data | Review | View | Acrobat | Tell me | Share | Comments

Paste | Arial | 10 | Number | Conditional Formatting | Format as Table | Cell Styles | Cells | Editing | Analyze Data | Create and Share Adobe PDF

Open recovered workbooks? Your recent changes were saved. Do you want to continue working where you left off? Yes | No

R806 | fx | APR

	DI	RTE	RTE_SFX	CO	PRE	PM	PM_SFX	CS	LEG	YR	AM_DIR	AM_WAY_PHV	_K_FACTOR_AMT	_D_FACTOR_AMT	AM_KD_FACTOR	AM_HOUR	AM_DAY	AM_MONTH	PM_DIR	PM_WAY_PHV	PM_K_FACTOR_AMT	PM_D_FACTOR_AMT	PM_KD_FACTOR	PM_HOUR	PM_DAY	PM_MONTH
799	05	101		SLO	R	69.322		552	O	18	S	1,141	11	57	7	11	SAT	OCT	N	1,432	14.97	54.53	8.17	14	SUN	OCT
800	05	101		MON	R	0.000		552	O	18	S	1,141	11	57	7	11	SAT	OCT	N	1,432	14.97	54.53	8.17	14	SUN	OCT
801	05	101		MON	R	32.015		508	B	18	S	1,093	11	57	6	12	FRI	OCT	N	1,311	12.04	59.65	7.18	17	SUN	OCT
802	05	101		MON		47.694		741	A	19	N	1,459	9	57	5	11	MON	SEP	N	1,664	10.43	55.65	5.81	16	SUN	APR
803	05	101		MON		66.398		510	B	19	N	2,699	8	69	6	7	THU	SEP	S	2,746	9.09	65.33	5.94	17	THU	SEP
804	04	101		SCL		3.197		58	B	19	S	2,992	8	58	5	10	SAT	AUG	N	2,889	8.46	56.14	4.75	16	FRI	OCT
805	04	101		SCL	R	6.080		230	A	19	N	4,530	5	81	4	5	MON	OCT	S	4,725	7.20	60.41	4.35	16	THU	OCT
806	04	101		SCL	R	10.270		911	B	19	S	4,756	7	56	4	11	SAT	APR	S	4,866	7.26	58.25	4.23	13	FRI	DEC
807	04	101		SCL	R	12.460		425	B	19	S	8,371	8	71	6	11	THU	MAY	S	8,764	8.41	73.60	6.19	14	TUE	MAY
808	04	101		SCL	R	16.006		229	B	19	S	5,102	7	55	4	11	SAT	OCT	S	5,446	7.07	61.52	4.35	14	THU	FEB
809	04	101		SCL		48.103		452	B	19	N	7,033	7	52	4	9	WED	APR	N	6,564	6.68	52.80	3.52	17	MON	JUL
810	04	101		SM		13.461		201	B	19	N	8,605	6	51	3	12	SAT	DEC	N	8,691	6.30	52.26	3.29	16	SAT	JUN
811	04	101		SM		13.461		445	A	19	N	8,482	6	53	3	7	FRI	SEP	S	8,500	6.34	51.14	3.24	15	MON	DEC
812	04	101		SM		16.575		436	B	19	S	8,624	6	51	3	7	WED	JUN	S	10,279	6.73	56.27	3.79	15	FRI	MAR
813	04	101		SM		22.713		225	A	19	N	7,792	7	54	4	7	TUE	JUN	N	7,555	6.29	54.82	3.45	15	FRI	DEC
814	04	101		SF		0.774		108	B	19	S	7,632	7	53	3	7	WED	JUN	S	7,137	6.46	50.42	3.26	16	MON	MAR
815	04	101		SON		19.646		404	A	19	S	5,245	8	51	4	12	FRI	JUN	S	5,544	7.81	52.55	4.10	14	TUE	APR
816	01	101		MEN		17.280		937	O	18	S	743	8	59	5	11	SUN	JUL	N	912	9.99	57.98	5.79	15	FRI	JUL
817	01	101		MEN	R	21.800		933	B	18	S	940	8	60	5	12	SUN	JUN	N	1,066	9.61	56.43	5.42	14	FRI	MAY
818	01	101		MEN		30.833		121	A	19	S	1,302	9	61	5	12	MON	JUL	N	1,377	9.21	62.25	5.74	17	THU	JUN
819	01	101		MEN		42.200		164	O	19	S	879	8	64	5	11	SUN	AUG	N	998	9.78	60.38	5.90	17	FRI	JUL
820	01	101		MEN	R	43.787		150	B	19	S	400	10	60	6	11	WED	NOV	N	485	11.09	64.07	7.10	17	FRI	MAY
821	01	101		MEN	R	48.220		151	B	19	S	386	11	66	7	11	SUN	AUG	S	428	12.54	62.57	7.85	13	SUN	AUG
822	01	101		MEN		55.380		115	B	19	S	525	12	56	7	12	SAT	JUL	N	549	11.32	61.07	6.91	14	FRI	MAY
823	01	101		MEN		59.330		122	A	18	S	932	17	87	14	9	THU	JAN	S	698	13.60	79.32	10.79	16	THU	JAN
824	01	101		MEN		93.602		152	B	19	S	470	14	61	9	11	SUN	JUL	N	463	12.35	69.62	8.60	13	THU	JUL
825	01	101		HUM	T	0.190		142	O	19	S	442	10	80	8	10	SUN	MAY	S	445	13.67	58.25	7.96	13	SUN	AUG
826	01	101		HUM		33.246		928	A	19	N	559	9	92	8	11	SUN	NOV	N	1,056	17.12	89.95	15.40	19	MON	JUN
827	01	101		HUM	R	51.840		801	B	17	S	557	10	59	6	11	FRI	AUG	N	615	11.14	60.29	6.72	15	MON	AUG
828	01	101		HUM		57.510		185	B	19	N	749	8	61	5	12	SUN	DEC	N	932	10.92	57.39	6.27	17	FRI	OCT

Preface | 2019 Peak Hour Report | +

100%

AASHTO's functional classes are based on travel volume, mileage, and the characteristic of service the urban street is intended to provide. The analysis method in this manual makes use of the AASHTO distinction between principal arterial and minor arterial. But a second classification step is used herein to determine the appropriate design category for the arterial. The design category depends on the posted speed limit, signal density, driveway/access-point density, and other design features. The third step is to determine the appropriate urban street class on the basis of a combination of functional category and design category. Exhibits 10-3 and 10-4 are useful for establishing urban street class.

Four urban street classes are defined in this manual. The classes are designated by number (i.e., I, II, III, and IV) and reflect unique combinations of street function and design, as shown in Exhibit 10-3. The functional component is separated into two categories: principal arterial and minor arterial. The design component is separated into four categories: high-speed, suburban, intermediate, and urban. The characteristics associated with each category are described in the remainder of this section. Exhibit 10-4 summarizes these characteristics.

EXHIBIT 10-3. URBAN STREET CLASS BASED ON FUNCTIONAL AND DESIGN CATEGORIES

	Functional Category	
Design Category	Principal Arterial	Minor Arterial
High-Speed	I	N/A
Suburban	II	II
Intermediate	II	III or IV
Urban	III or IV	IV

EXHIBIT 10-4. FUNCTIONAL AND DESIGN CATEGORIES

	Functional Category	
Criterion	Principal Arterial	Minor Arterial
Mobility function	Very important	Important
Access function	Very minor	Substantial
Points connected	Freeways, important activity centers, major traffic generators	Principal arterials
Predominant trips served	Relatively long trips between major points and through-trips entering, leaving, and passing through the city	Trips of moderate length within relatively small geographical areas

	Design Category			
Criterion	High-Speed	Suburban	Intermediate	Urban
Driveway/access density	Very low density	Low density	Moderate density	High density
Arterial type	Multilane divided; undivided or two-lane with shoulders	Multilane divided; undivided or two-lane with shoulders	Multilane divided or undivided; one-way, two-lane	Undivided one-way, two-way, two or more lanes
Parking	No	No	Some	Significant
Separate left-turn lanes	Yes	Yes	Usually	Some
Signals/mi	0.5–2	1–5	4–10	6–12
Speed limit	45–55 mi/h	40–45 mi/h	30–40 mi/h	25–35 mi/h
Pedestrian activity	Very little	Little	Some	Usually
Roadside development	Low density	Low to medium density	Medium to moderate density	High density

A principal arterial serves major through movements between important centers of activity in a metropolitan area and a substantial portion of trips entering and leaving the area. It also connects freeways with major traffic generators. In smaller cities

RECOMMENDED CHANGES FOR ERRATA (US CUSTOMARY)

This table contains approximate values. It is meant for illustrative purposes only. The values are highly dependent on the assumptions used. It should not be used for operational analyses or final design. This table was derived using assumed values listed in the footnote.

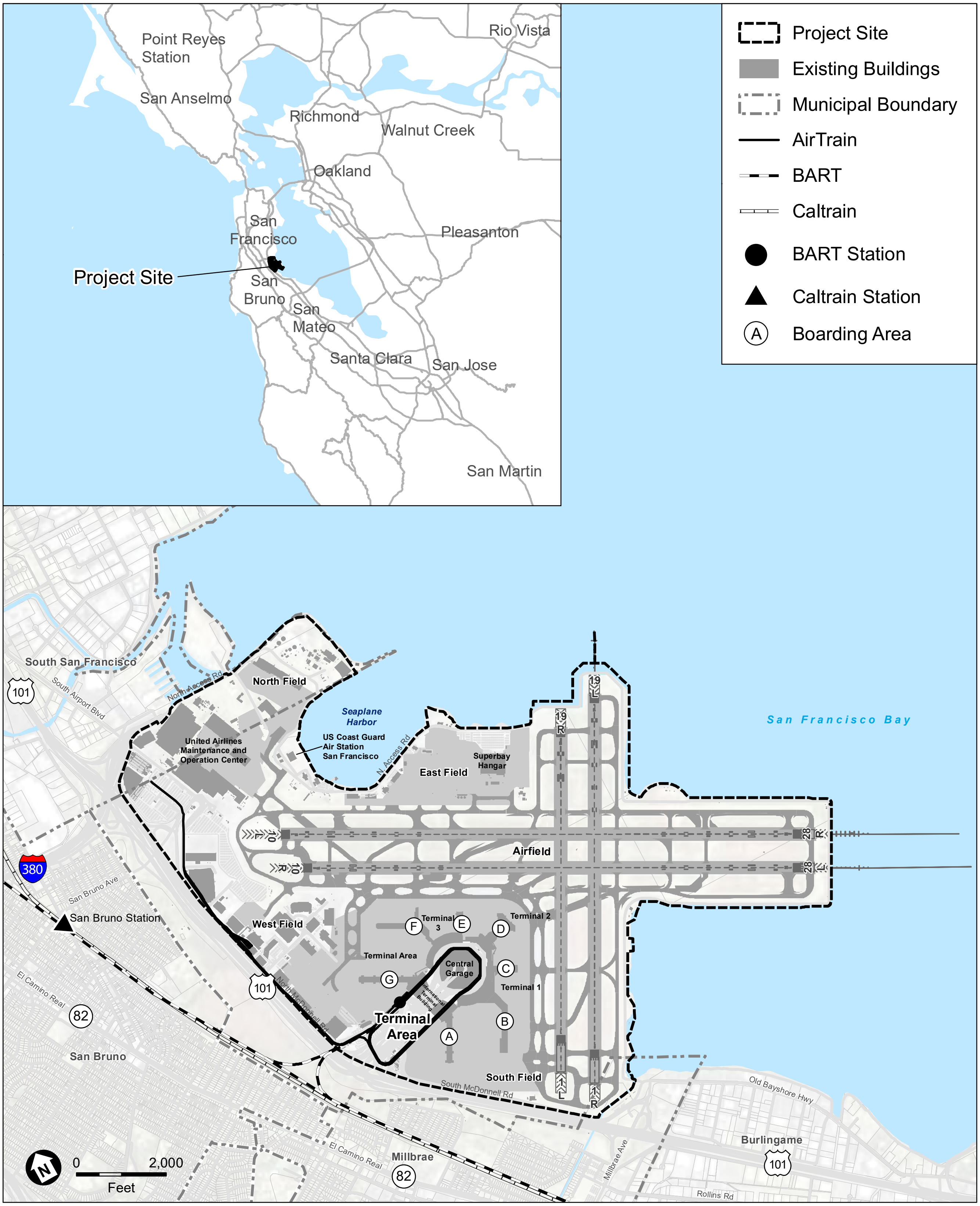
EXHIBIT 10-7. EXAMPLE SERVICE VOLUMES FOR URBAN STREETS (SEE FOOTNOTES FOR ASSUMED VALUES)

Lanes	Service Volumes (veh/h)				
	A	B	C	D	E
Class I					
1	N/A	850	920	1010	1130
2	N/A	1710	1850	2020	2280
3	N/A	2570	2770	3050	3420
4	N/A	3440	3700	4060	4560
Class II					
1	N/A	N/A	670	840	880
2	N/A	N/A	1470	1690	1770
3	N/A	N/A	2280	2540	2660
4	N/A	N/A	3090	3390	3550
Class III					
1	N/A	N/A	480	780	840
2	N/A	N/A	1020	1600	1680
3	N/A	N/A	1560	2410	2530
4	N/A	N/A	2130	3220	3380
Class IV					
1	N/A	N/A	N/A	780	800
2	N/A	N/A	N/A	1570	1620
3	N/A	N/A	N/A	2370	2430
4	N/A	N/A	N/A	3160	3250

Notes
N/A - not achievable given assumptions below.
This table was derived from the conditions listed in the following table.

	Class			
	I	II	III	IV
Signal density (sig/mi)	0.8	3	5	10
Free-flow speed (mi/h)	50	40	35	30
Cycle length (s)	110	90	80	70
Effective green ratio	0.45	0.45	0.45	0.45
Adj. sat. flow rate	1850	1800	1750	1700
Arrival type	3	4	4	5
Unit extension (s)	3	3	3	3
Initial queue	0	0	0	0
Other delay	0	0	0	0
Peak-hour factor	0.92	0.92	0.92	0.92
% lefts, % rights	10	10	10	10
Left-turn bay	Yes	Yes	Yes	Yes
Lane utilization factor	According to Exhibit 10-23, Default Lane Utilization Factors			

Attachment 7
SUPPORTING VEHICLE ASSIGNMENT FIGURES



SOURCE: SFO, 2021

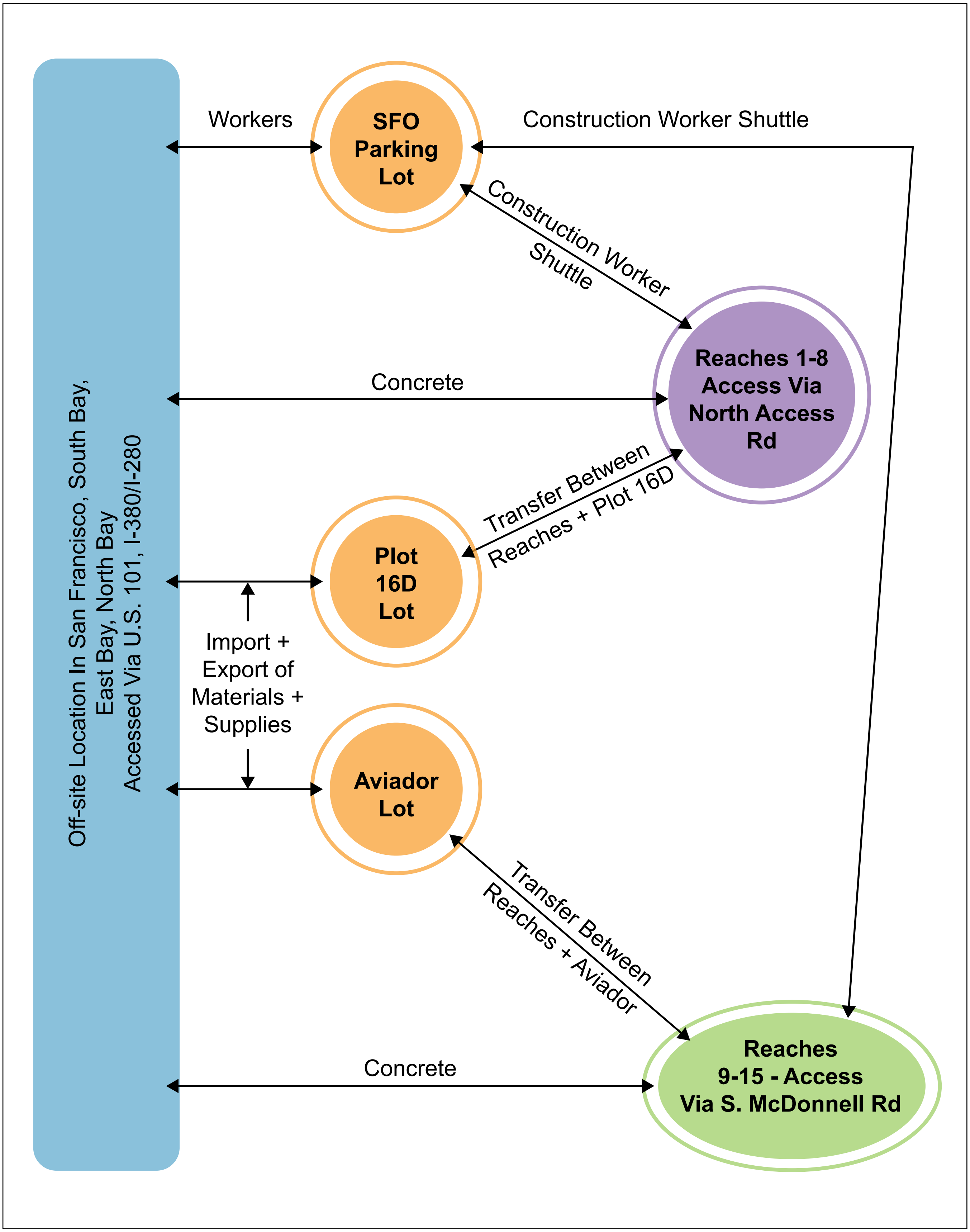
SFO Shoreline Protection Program

FIGURE A-1
PROJECT LOCATION

SOURCE: SFO, 2021

SFO Shoreline Protection Program

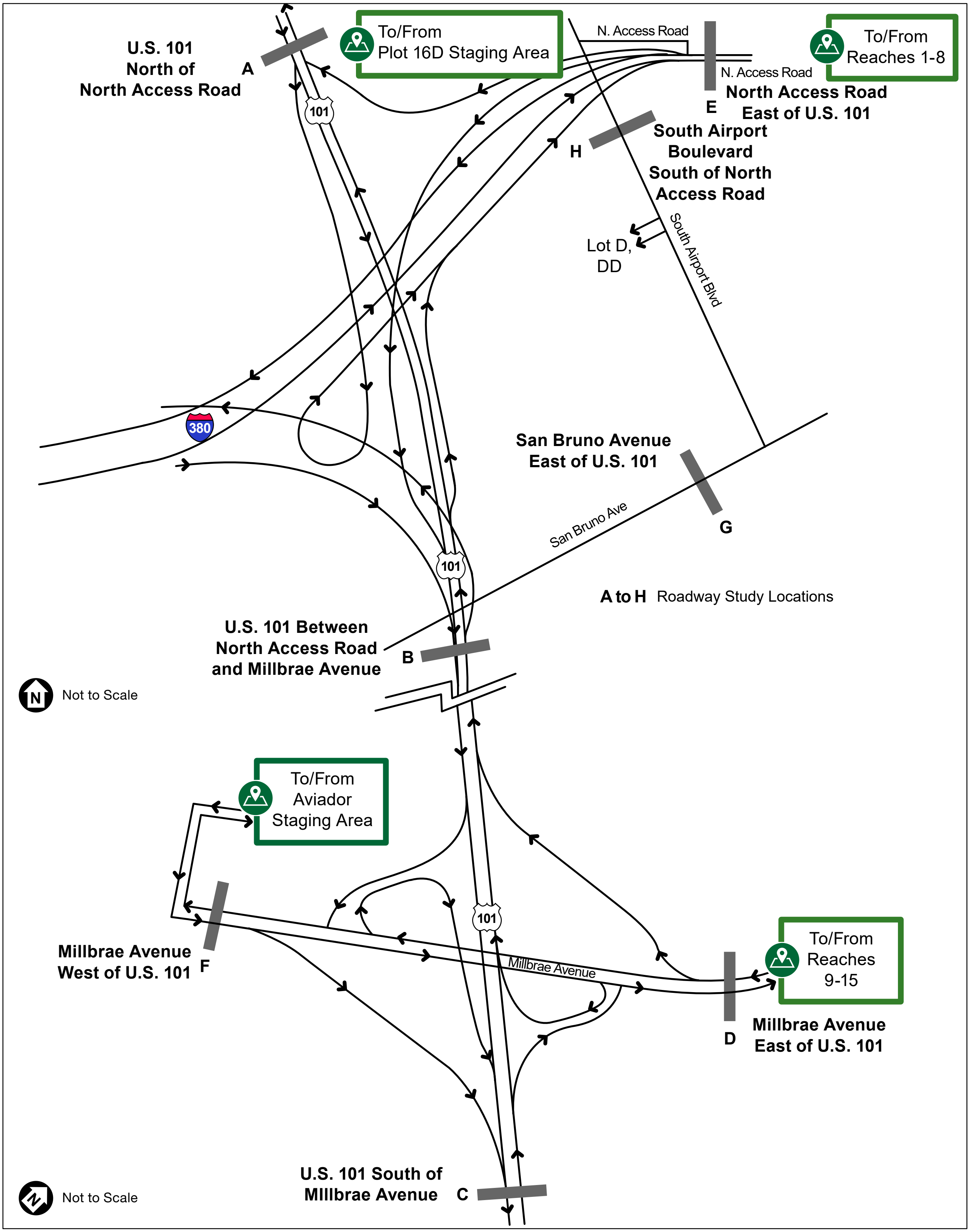
FIGURE A-2
REACH LOCATIONS



SOURCE: ESA, 2021

SFO Shoreline Protection Program

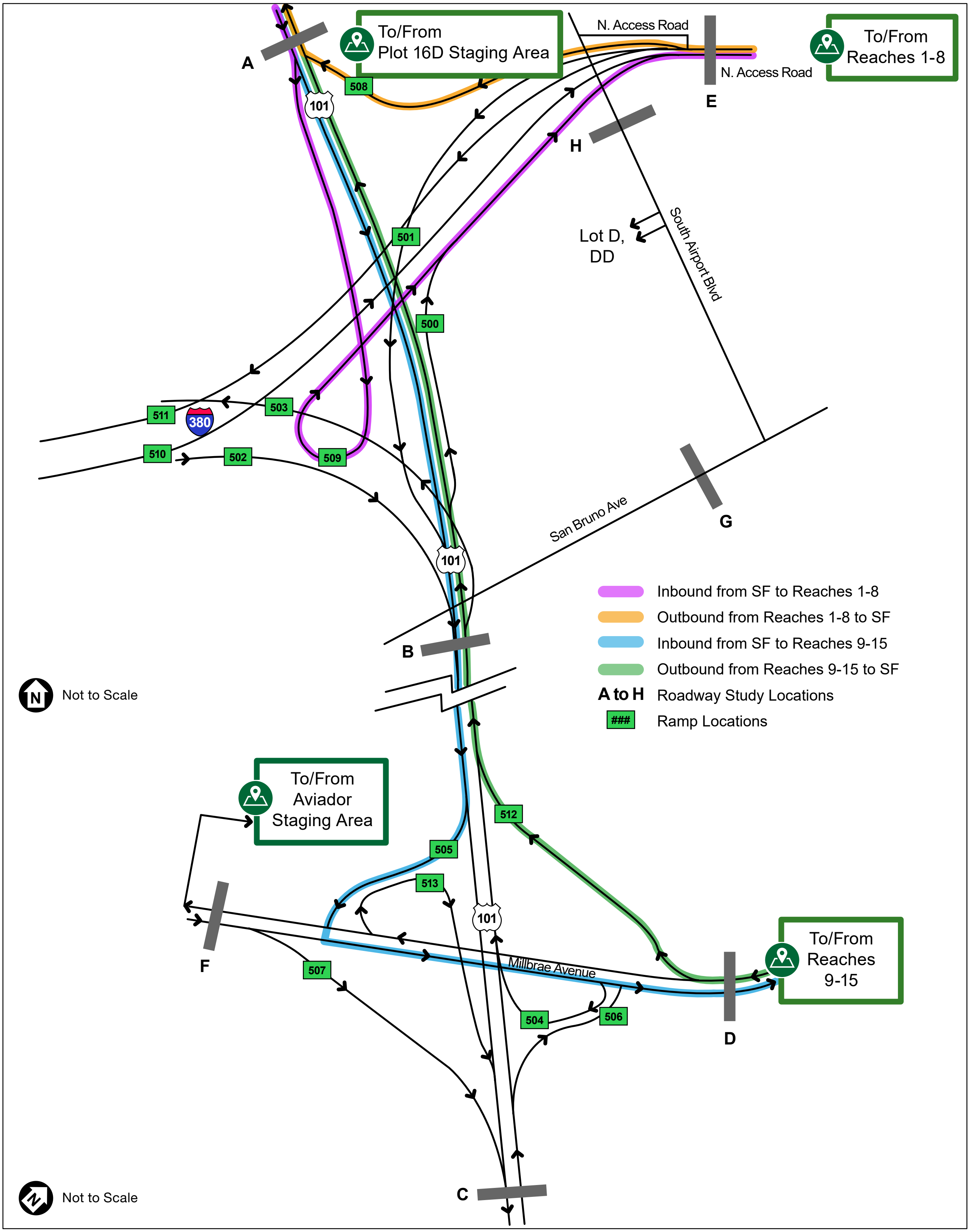
FIGURE A-3
OVERVIEW OF PROJECT CONSTRUCTION VEHICLE TRAVEL



SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-4
STUDY LOCATIONS

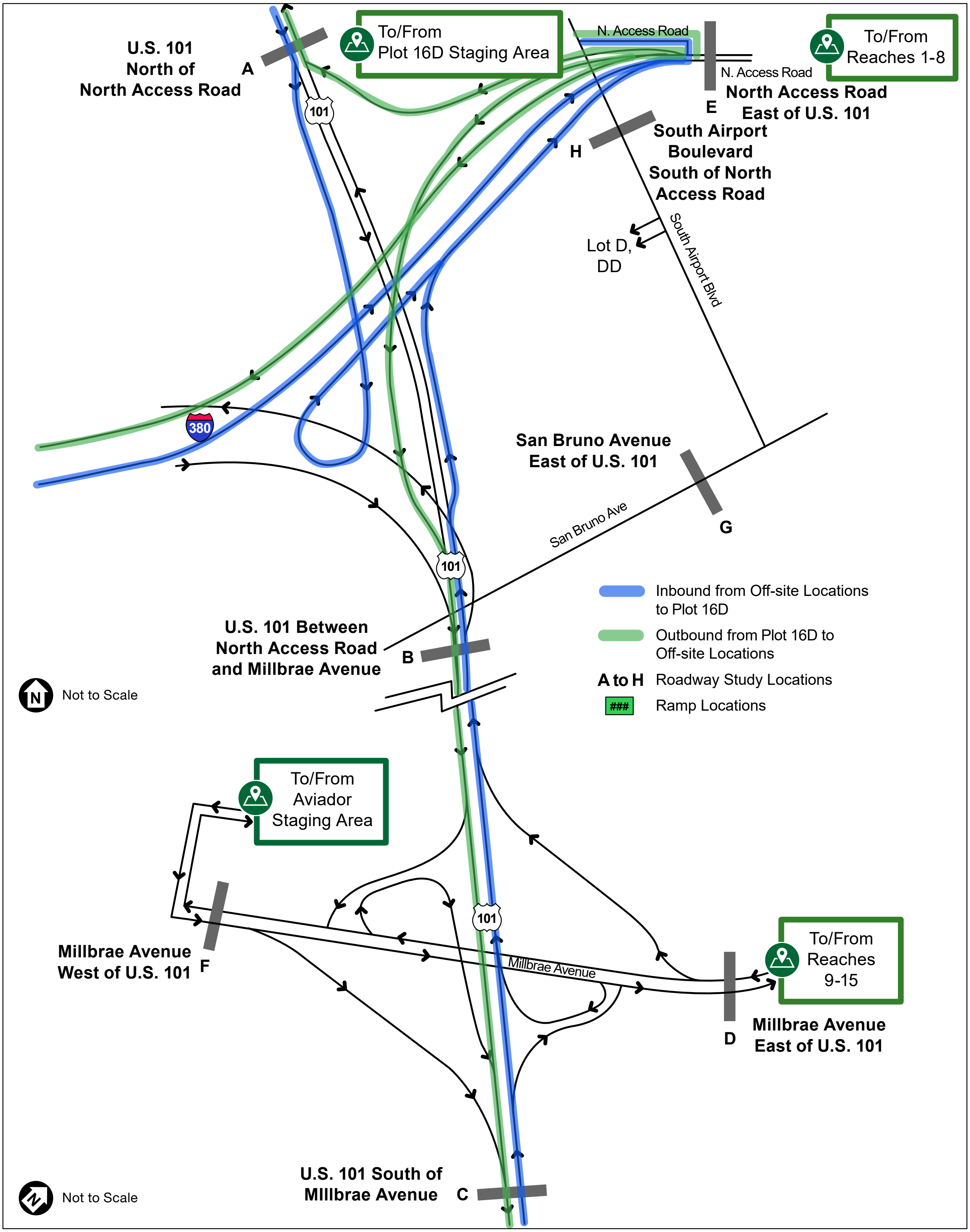


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-5

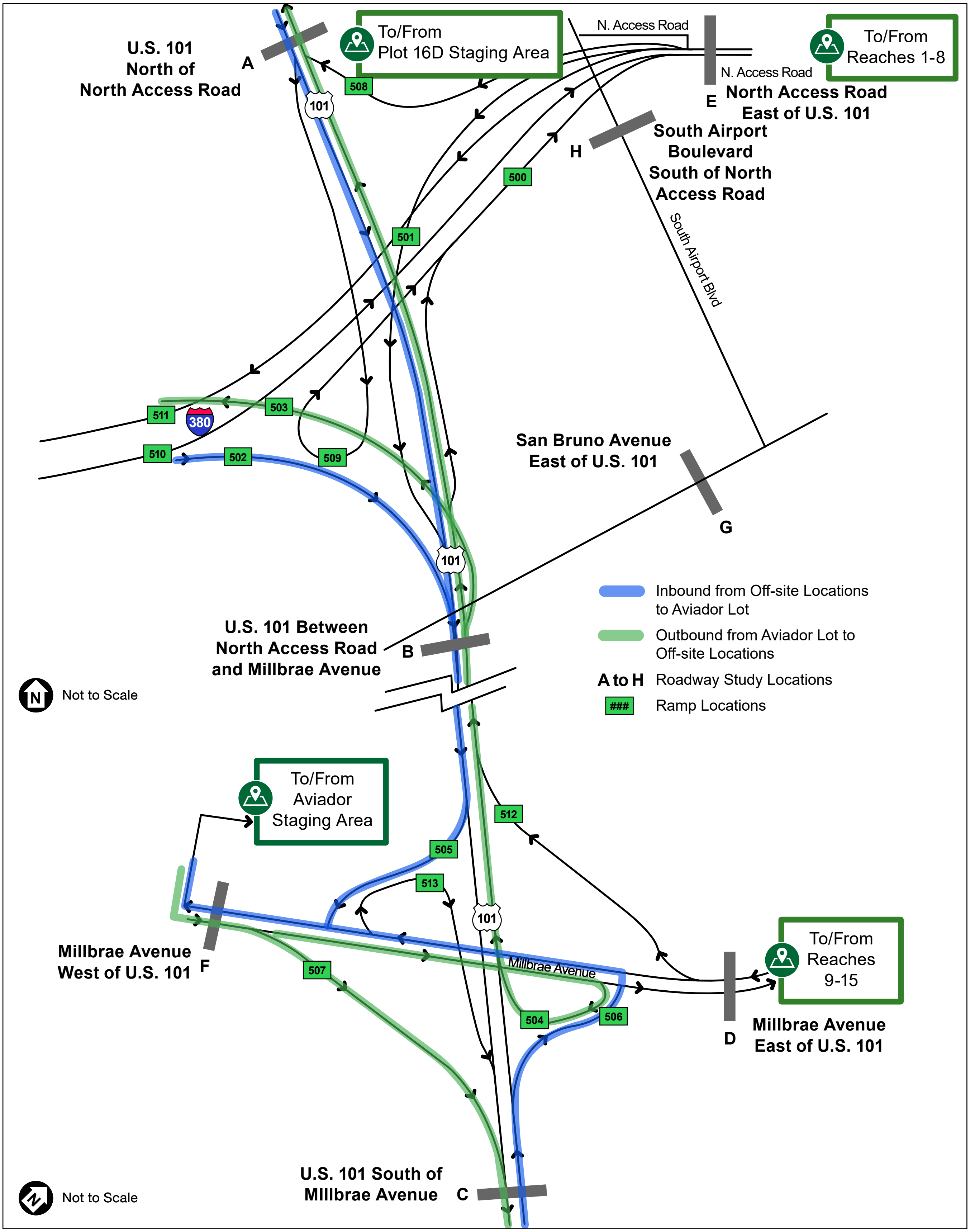
CONCRETE TRUCK TRAVEL PATHS BETWEEN SAN FRANCISCO AND REACHES



SOURCE: ESA, 2021

FIGURE A-6A

CONSTRUCTION TRUCK TRAVEL PATHS BETWEEN OFF-SITE LOCATIONS AND PLOT 16D

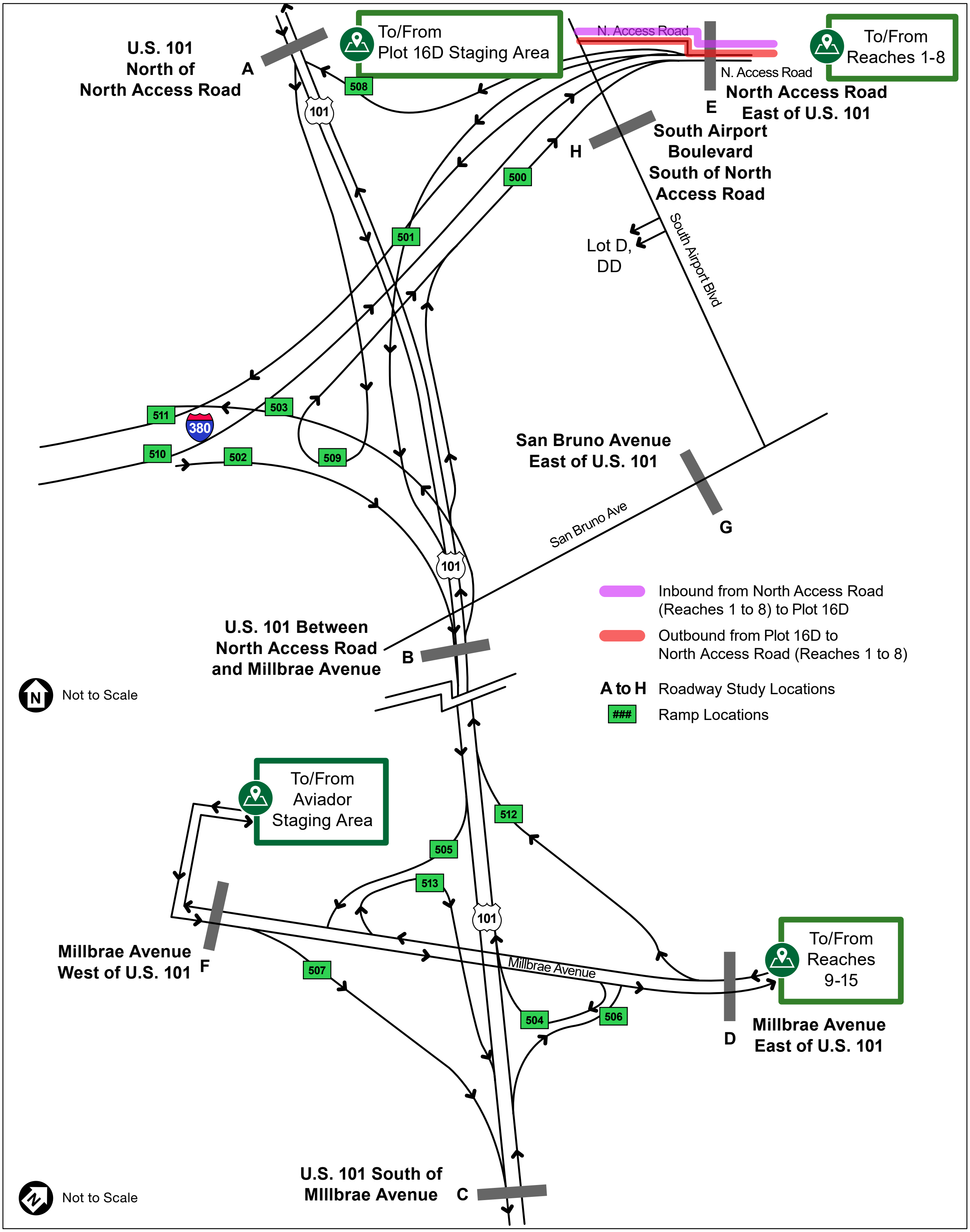


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-6B

CONSTRUCTION TRUCK TRAVEL PATHS BETWEEN OFF-SITE LOCATIONS AND AVIADOR LOT

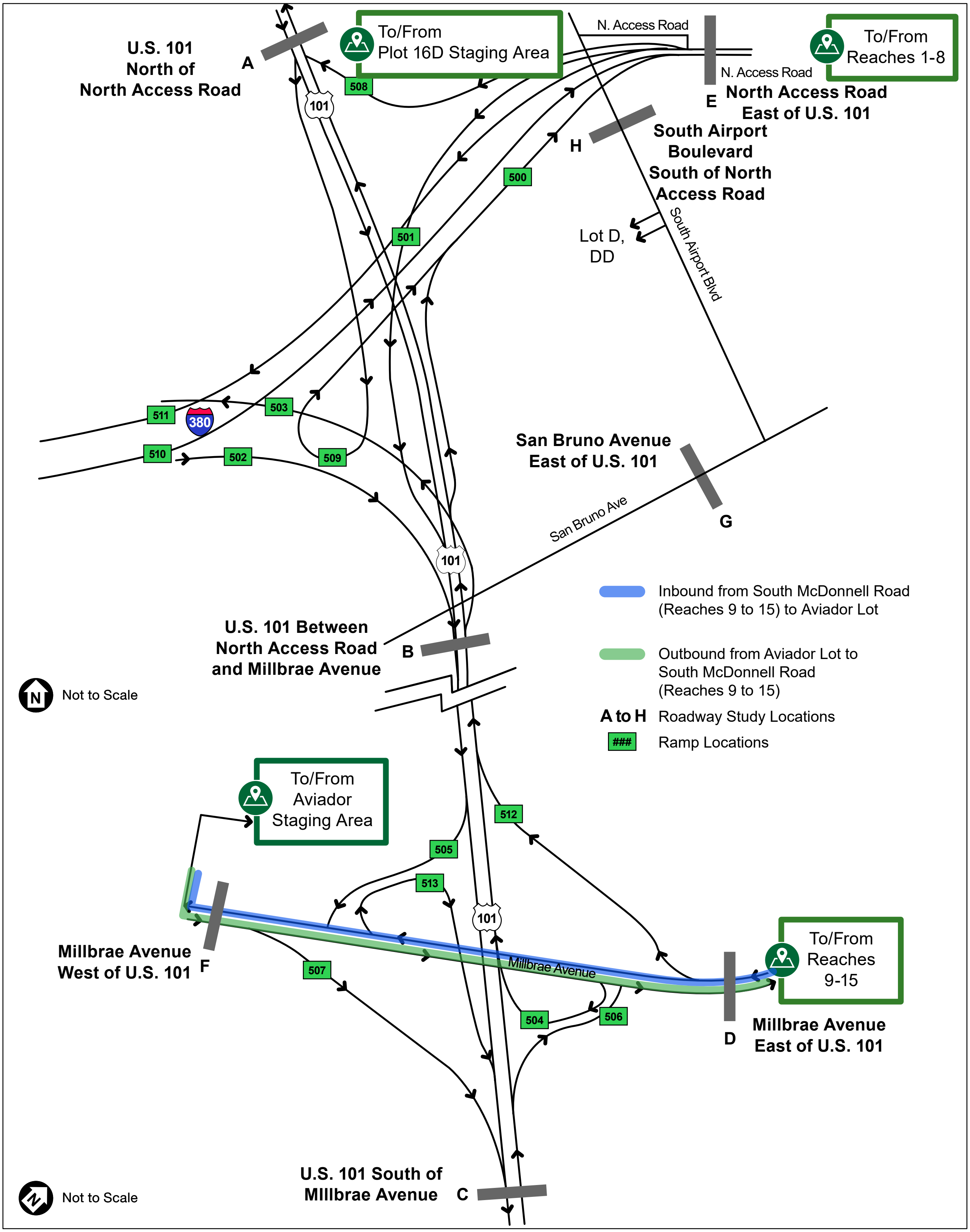


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-7A

CONSTRUCTION TRUCK TRAVEL PATHS BETWEEN PLOT 16D AND NORTH ACCESS ROAD

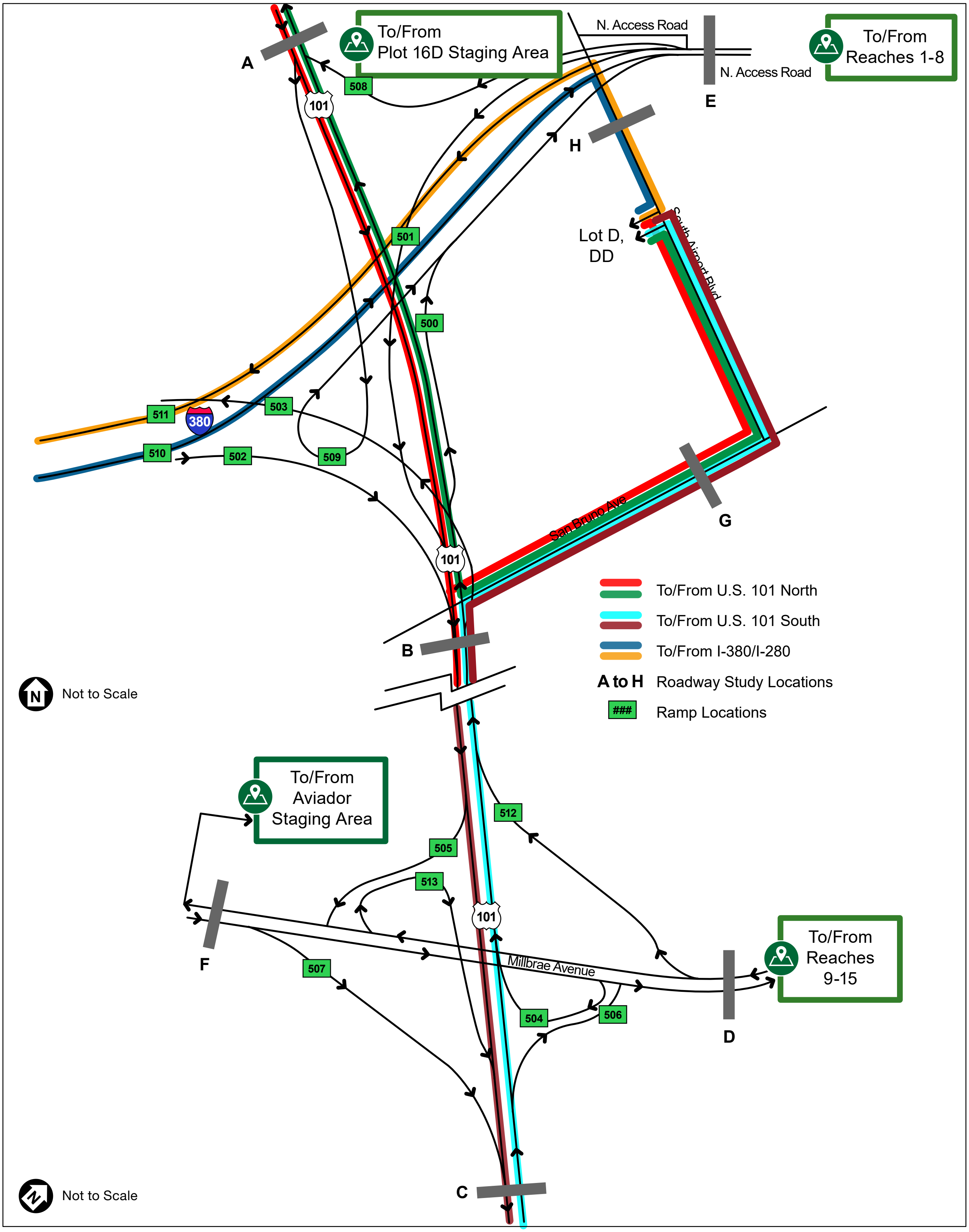


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-7B

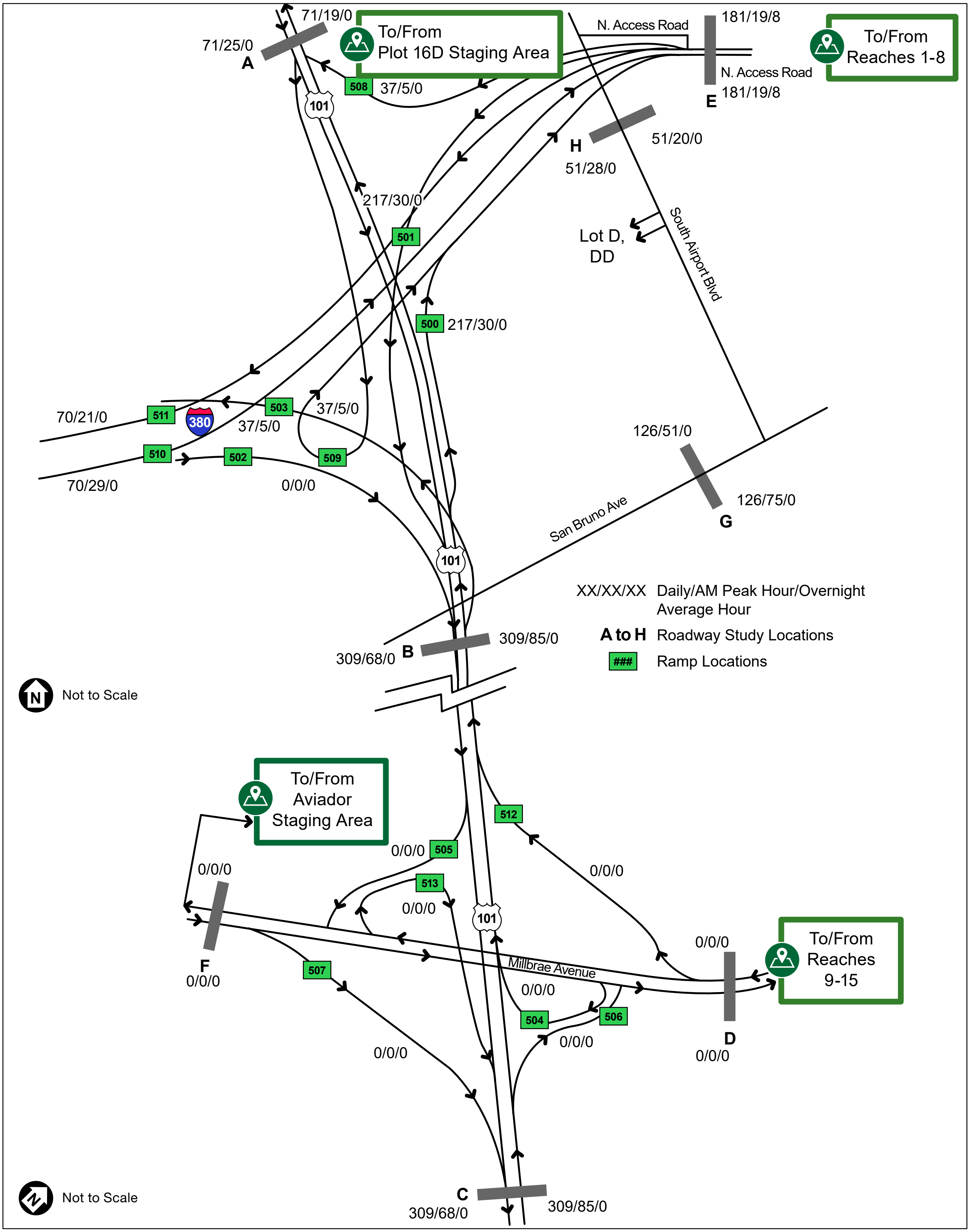
CONSTRUCTION TRUCK TRAVEL PATHS BETWEEN AVIADOR LOT AND SOUTH MCDONNELL ROAD/MILLBRAE AVENUE



SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-8
CONSTRUCTION WORKER TRAVEL PATHS BETWEEN OFF-SITE LOCATIONS AND SFO PARKING LOTS

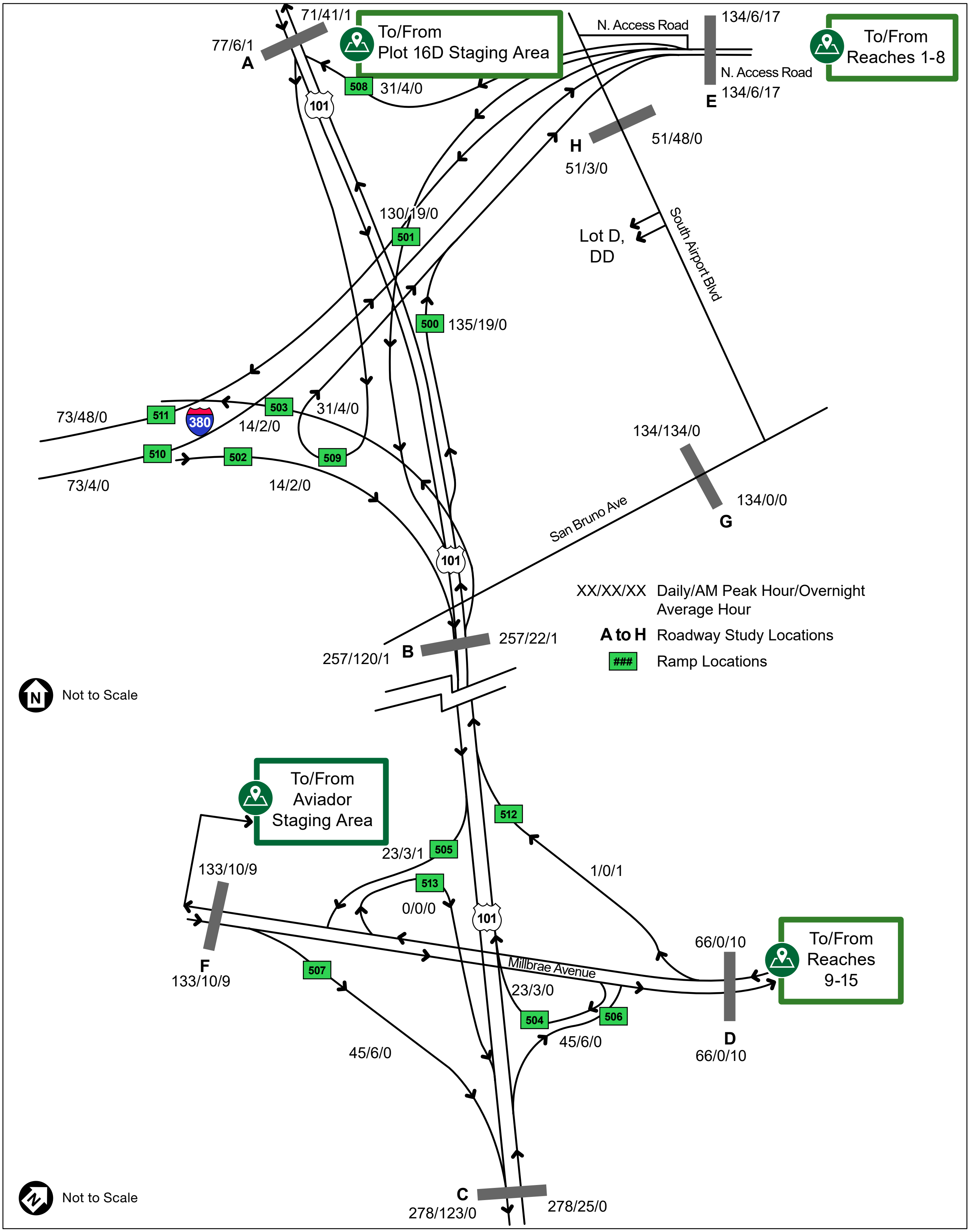


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-9

OVERLAP SCENARIO 1: REACHES 2, 3 AND 7 PROJECT VEHICLE TRIPS

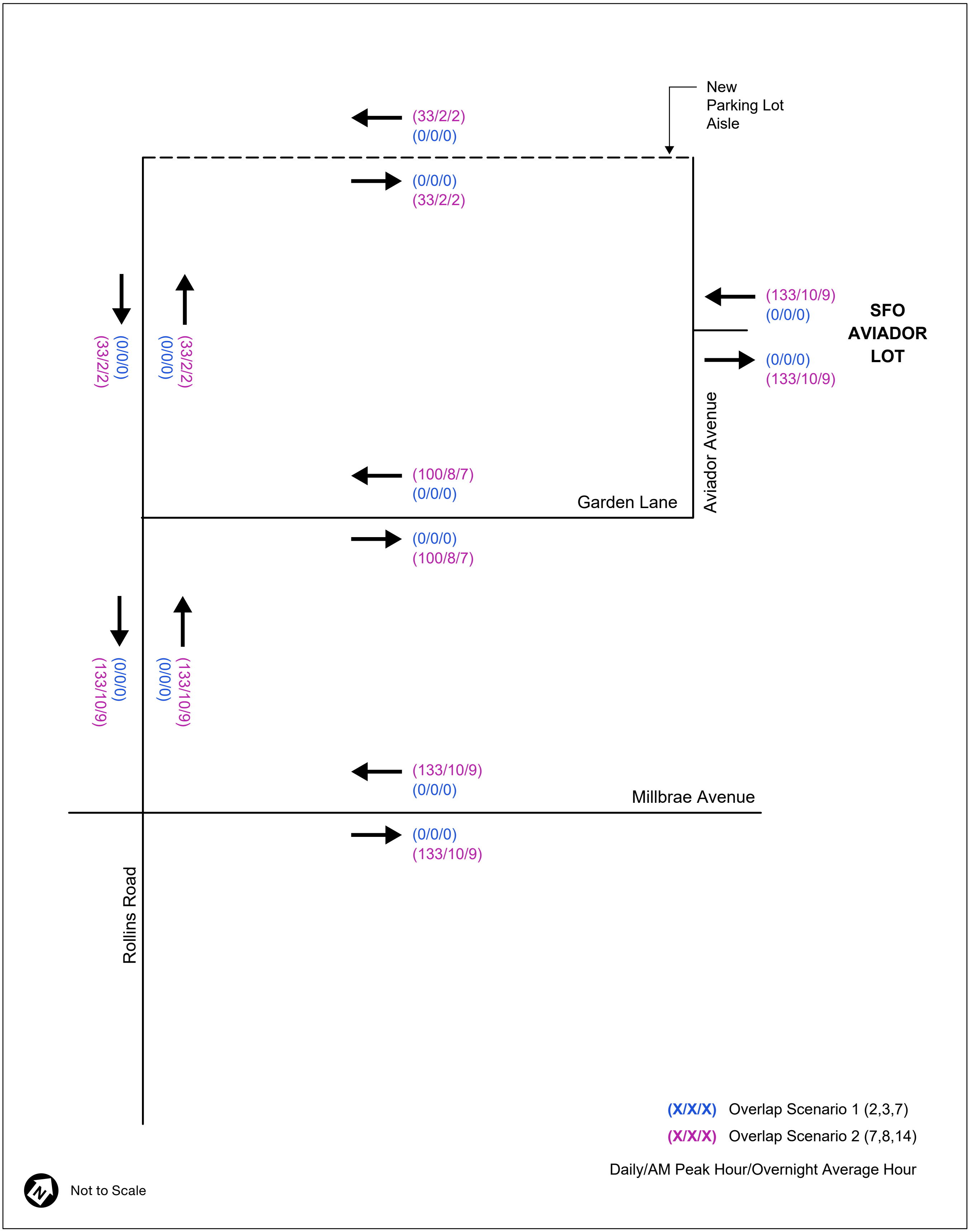


SOURCE: ESA, 2021

SFO Shoreline Protection Program

FIGURE A-10

OVERLAP SCENARIO 2: REACHES 7, 8 AND 14 PROJECT VEHICLE TRIPS



SOURCE: LCW Consulting, 2021

FIGURE A-11

PROJECT CONSTRUCTION VEHICLE TRIPS - AVIADOR LOT DETAIL