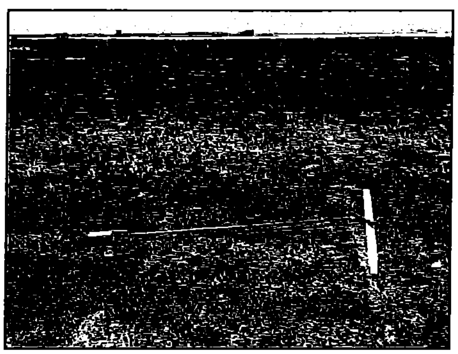

H. T. HARVEY & ASSOCIATES

Ecological Consultants

Alameda Point Veterans Administration Project: Wetland Mitigation Feasibility Study

(b) (5) [redacted]

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Section 1. Introduction

1.1 Background

The U.S. Department of Veteran's Affairs (VA) is planning to construct an outpatient care facility, a national cemetery, and other structures as part of the VA Outpatient Clinic and National Cemetery Complex Project (project). The project development area encompasses 112.4 acres and is located on the former Naval Air Station (Alameda Airfield) on Alameda Point, in the city of Alameda, Alameda County (Figure 1). Development of the 112.4-acre parcel would result in impacts on at least 11 acres of seasonal wetlands and 1 acre of northern coastal salt marsh habitat (approximately 12 acres of potential waters of the United States/state) under the jurisdiction of the U.S. Army Corps of Engineers (USACE) and Regional Water Quality Control Board (RWQCB) (AECOM 2012).

In 2014, HDR Engineering, Inc (HDR) was retained by the VA to provide guidance in developing an environmental documentation and permitting strategy to meet USACE and RWQCB requirements under Sections 404 and 401, respectively, of the Clean Water Act. In 2015, the VA, with the support of HDR, applied for permits to implement the VA Alameda Point project. In the permit application, the VA proposed to mitigate impacts on waters of the United States/state through the purchase of mitigation credits from the San Francisco Bay Wetland Mitigation Bank, located in Redwood City, California. During the public review period for the USACE permit application, two nonprofit environmental organizations (Citizens Committee to Complete the Refuge and Sierra Club) submitted letters requesting that the VA consider mitigating the wetland impacts on site at Alameda Airfield rather than purchasing off-site mitigation credits (USACE 2016). The letters stated that mitigating wetland impacts on site could provide unique ecological benefits, including:

- helping offset the high loss of historical wetlands in the project vicinity,
- protecting and enhancing habitat for migratory and resident waterbirds,
- replacing ecological functions of affected wetlands closer to the impact site, and
- expanding wetlands located at the southern end of Alameda Airfield.

In February 2016, RWQCB deemed the project's 401 Water Quality Certification application not yet complete and requested that the VA consider on-site mitigation because of [redacted] (b) (5) [redacted]

1.2 Study Purpose and Location

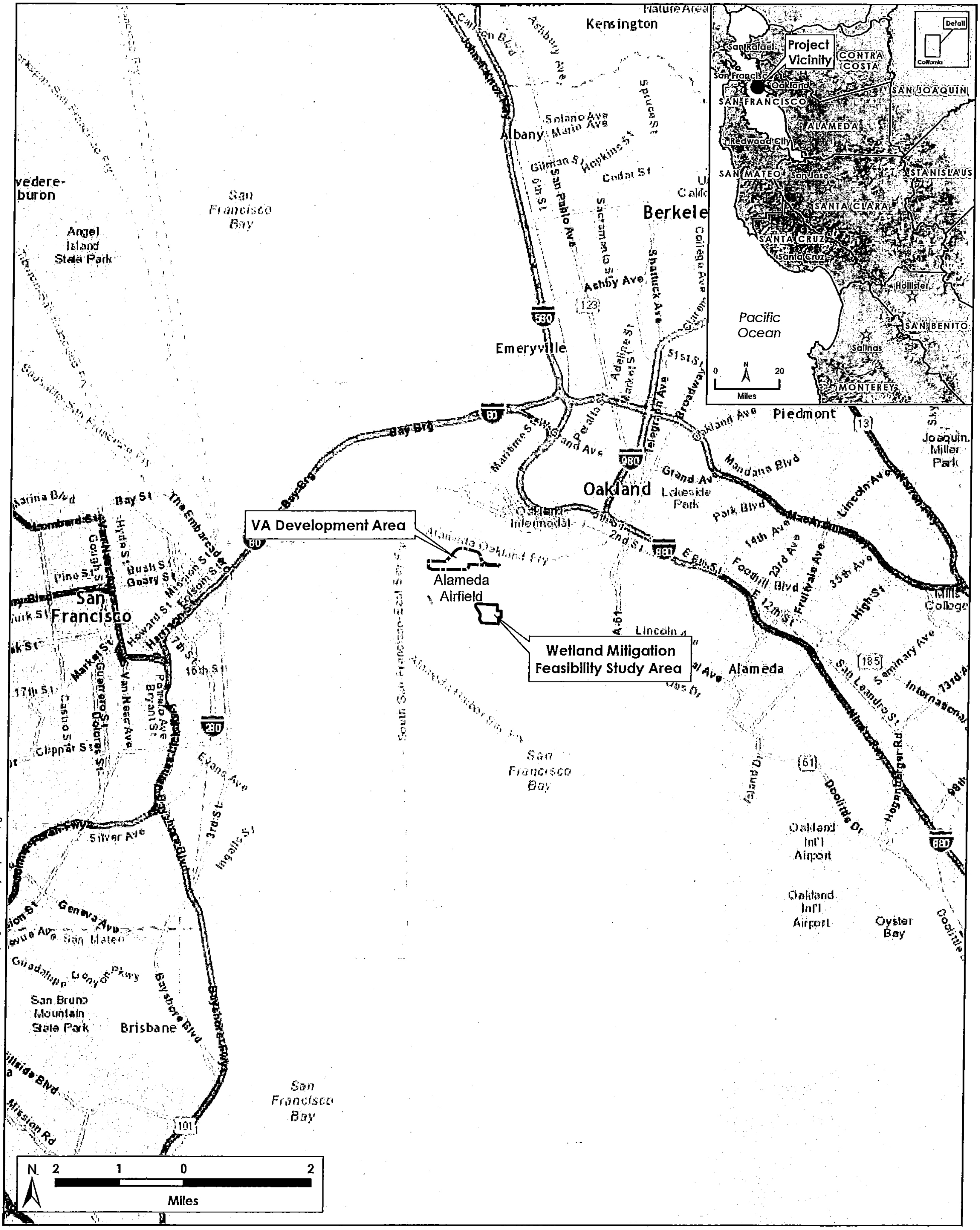
This study assesses the feasibility of mitigating impacts of the VA Alameda Point project by (b) (5) [redacted]

The study was conducted in an approximately 61-acre area (study area) owned by the VA, located in the southeastern portion of Alameda Airfield, less than 1 mile from the proposed project development area (Figure 2). The study area is located in a 511.2-acre VA undeveloped area/California least tern (least tern) (*Sternula antillarum browni*) (b) (5) [redacted]. The conservation area, jointly managed by the U.S. Fish and Wildlife Service (USFWS) and the VA, was established to protect a large breeding colony of the least tern, federally and state listed as endangered, located on the former Alameda Airfield (Figure 2). The study area was selected in collaboration with USFWS and the VA to provide the greatest likelihood of meeting the mitigation goals (Section 2). Public letters received in response to the USACE 404 permit application also specifically requested consideration of this footprint for on-site wetlands expansion (i.e., mitigation).

The study area is bordered to the east by City of Alameda property and to the south and west by San Francisco Bay. U.S. coast survey maps of San Francisco Bay from the 1850s show that the study area was historically located primarily on former subtidal habitat located bayward of an extensive tidal salt marsh system (t-sheet #592, available in SFEI 2016). The study area was filled with dredged material during the 1900s to form the Alameda Airfield. It overlaps a former U.S. Navy soil contaminant remediation site (IR 33) that was successfully remediated by the U.S. Environmental Protection Agency before the Alameda Airfield was transferred to the VA (Figure 2). The remediation method at IR33 involved complete removal of contaminated soils and replacement with clean, imported sandy fill (EPA 2016).

Several characteristics suggested an opportunity to restore waters of the United States/state in the study area while providing substantial ecological benefits:

- The study area contains existing salt marsh, seasonal wetland, and open water habitats (Figure 2) (AECOM 2012). These jurisdictional features are referred to as the "Runway Wetlands." The presence of wetlands and other waters suggested a potential to expand the existing waters of the United States/state to provide on-site mitigation for the VA Alameda Point project.
- The 1999 baylands goals report recommends expanding diked and tidal wetland habitats on Alameda Island to provide ecological functions missing from the area (Goals Project 1999).
- Jurisdictional habitats have been successfully created on Alameda Point northwest of the study area in the "West Wetland" by tapping into groundwater. The West Wetland is located in the former U.S. Navy remediation site IR2 (Figure 2).



N:\Projects3800\3898-01\Reports\Wetland Mitigation Feasibility Study\Figure 1 Vicinity Map.mxd mlagarde

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1. Vicinity Map
Alameda Point Veterans Administration Project Wetland Mitigation Feasibility Study (3898-01)
August 2016

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Section 2. Study Approach and Mitigation Goals

2.1 Study Approach

(b) (5) [redacted]. Next, a series of meetings were held with key stakeholders: USFWS refuge wildlife ecologists (Joy Albertson, Susan Euing, and Cheryl Strong), the VA, H. T. Harvey & Associates wildlife and restoration ecologists, and HDR hydrologists. Meeting participants identified opportunities and constraints associated with restoring the habitat types listed above and identified specific mitigation goals (Section 2.2.). A field assessment by H. T. Harvey & Associates restoration and wildlife ecologists and investigations into the site's physical conditions by HDR hydrologists (Section 3) were carried out concurrently with stakeholder meetings. These studies were used to characterize the existing conditions in the study area (Section 4), as well as identify physical and biological constraints and opportunities associated with the mitigation options (Section 5). Using this information, stakeholders recommended a preferred mitigation option for on-site wetlands mitigation (Section 5.2) and developed conceptual design criteria for the preferred option (Section 5.3). Conclusions and next steps are described in Section 6.

2.2 Wetland Mitigation Goals

The following goals were identified for the on-site wetland mitigation project during stakeholder meetings:

- Create at least 13 acres of new waters of the United States/state by converting existing ruderal, poor-quality seasonal wetlands and developed uplands (i.e., airfield tarmac) to a mosaic of primarily open water habitat with a fringe of wetland habitat.
- Create high-quality, open water habitat with nesting/roosting islands to benefit a diversity of waterbirds, including migratory and resident shorebirds and dabbling ducks.
- Avoid impacts on the least tern colony.
- Do not increase flood risk relative to the existing condition.
- Configure the restored habitats without affecting the existing open water and salt marsh habitats at the Runway Wetlands.
- Restore a self-sustainable wetland system that requires minimal long-term maintenance and includes measures to provide resilience to sea level rise.

- Restore herbaceous (grasses and forbs) upland buffer habitat adjacent to restored wetlands.
- Reduce the cover of invasive plant species such as ice plant (*Carpobrotus edulis*) and Algerian sea lavender (*Limonium ramosissimum* ssp. *provinciale*) relative to the existing condition.

Section 3. Wetland Mitigation Opportunities and Constraints Assessment Methods

3.1 Field Assessment

H. T. Harvey & Associates restoration ecologists Max Busnardo, Gavin Archbald, and Matt Pollock and HDR hydrologist Libby Mesbah conducted field assessments on June 7 and 14, 2016. The field assessments focused on understanding the physical drivers of the existing wetland habitat in the Runway Wetlands and identifying wetland restoration (i.e., expansion) opportunities and constraints in the study area.

3.1.1 Habitat Types

The ecologists verified the approximate spatial extent of the jurisdictional habitats in the study area (Figure 3) by comparing the biotic habitat types on the wetland delineation map (AECOM 2012) to the presence and extent of wetland indicator species in the field. The extent of invasive Algerian sea lavender in the salt marsh was mapped using a Trimble Global Positioning System unit (submeter accuracy).

3.1.2 Habitat Elevations and Depth to Groundwater

Ground surface elevations and depth to groundwater were measured at several locations (Figure 3). The elevation measurements were used to understand the physical drivers of the biotic habitats and to estimate target/reference elevations for restored wetlands. A laser level and stadia rod were used to collect site elevations relative to a local benchmark. Site elevations were converted to the North American Vertical Datum 1988 (NAVD 88) using a publically available 2010 LiDAR survey.

3.1.3 Salinity of Ponds and Groundwater

The salinity of ponds, groundwater, and bay water was measured in the field using a handheld refractometer, which provided instantaneous salinity concentrations in parts per thousand (ppt). For groundwater measurements, water was extracted from saturated soil paste using a filtered syringe or it was sampled directly from previously installed still wells located on site; the still wells were not installed by H. T. Harvey & Associates/HDR. Locations of groundwater and surface water salinity measurements are provided in Figure 3.

3.1.4 Soil Sampling for Horticultural Suitability

(b) (5) [redacted] were collected to characterize the horticultural suitability of soil in the rooting zone for wetland vegetation at potential mitigation site design elevations (Figure 4). Soils were sampled using a hand auger, and a laser level was used to target specific elevation ranges. (b) (5) [redacted] Concrete debris was widespread throughout soil

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sample Area D, preventing sample collection. Soil samples were analyzed [redacted] for horticultural suitability (e.g., pH, electrical conductivity, percent organic matter, texture, and nutrient availability).

3.2 Topographic and Hydraulic/Hydrologic Assessment

An evaluation of the hydraulic/hydrologic function supporting the Runway Wetlands was performed by HDR. HDR hydrologists assessed existing conditions and the preferred mitigation option (presented in Section 5.3). The sources of information and methods used in HDR's analyses are discussed below.

3.2.1 Topographic Information

U.S. Geological Survey (USGS) Light Detecting and Ranging (LiDAR) data were used to develop topographic contours and raster Digital Elevation Model (DEM) terrains for the study area. These terrain models were used to assess existing conditions and potential wetland mitigation concepts, as described below. The LiDAR data were collected in 2010 and have an expected horizontal accuracy of 6.56 feet (95% confidence level) and an expected vertical accuracy of 0.39 foot (95% confidence level). [redacted]

3.2.2 Tidal Gauge Information

Tidal datums were downloaded from the National Oceanic and Atmospheric Administration (NOAA) website for the Alameda Point Station #9414750 and converted to NAVD 88 to allow comparison with existing site topography. Historical tidal elevations were also downloaded and used to evaluate parameters/hydraulic components of the preferred mitigation option.

3.2.3 Sea Level Rise Estimates

The *Alameda Point Master Infrastructure Plan* (City of Alameda 2014) was reviewed to determine sea level rise projections for the study area. These data were used to characterize the long-term maintenance/adaptive management that may be needed to address sea level rise at the mitigation site.

3.2.4 Hydrologic Assessment

HDR assessed the study area's hydrologic characteristics to understand the hydrologic functions of the jurisdictional wetland habitats (the salt marsh, salina/open water, and seasonal wetlands). The hydrologic assessment provided a preliminary review of the contributing water sources: [redacted].

To assess the specific contribution of rainfall runoff to the salt marsh and salina habitats in the study area, [redacted]

(b) (5) [redacted]

3.2.4.1 Stormwater Drainage System

A failing stormwater pipe drainage system extends throughout Alameda Point. These pipelines originally were built to collect rainfall runoff from the runways and to discharge the runoff into the San Francisco Bay. Over time, these pipelines and tide gates have failed. This failure and subsidence of the land combine to provide conduits for salt water intrusion into interior locations of Alameda Point via tidal action. The location of these stormwater drainage pipelines is shown in the *Alameda Point Master Infrastructure Plan* (City of Alameda 2014). This document was used as reference for evaluating the impacts of the pipeline system on the overall functionality of the salt marsh and salina habitats.

3.2.4.2 Watershed Delineation

Watersheds were delineated using the DEM terrain and topographic contours developed from USGS LiDAR. The *Alameda Point Master Infrastructure Plan* (City of Alameda 2014) watershed delineation also was referenced; however, it did not include a delineation specifically of the study area. These watersheds were used to compute the overall contributing drainage area into the salina habitat and preferred mitigation option.

3.2.4.3 Rainfall

Precipitation frequency estimates were downloaded from the NOAA Atlas 14 Volume 6, Version 2 website for the study area. Precipitation events considered for the HEC-HMS model development included the 2-year, 6-hour storm duration event and the 10-year, 24-hour storm duration event: precipitation depths of 1.33 inches and 3.56 inches, respectively. In addition, monthly average precipitation data were collected from www.usclimatedata.com and reviewed. Monthly average precipitation data were used to evaluate a mass balance on the preferred mitigation option.

3.2.4.4 Land Use

Land use for the study area was initially categorized using the *City of Alameda General Plan* (City of Alameda 2016) for future conditions. The general plan designated the study area as "open space/habitat." The existing and proposed land use category used for the HEC-HMS model was further refined to better designate paved runway areas and changes to open space areas.

3.2.4.5 Soils

Hydrologic soil group classification was provided by the NRCS. The hydrologic soil group classification for the study area falls under Group Soil A. Group Soil A is defined as soils of high infiltration rate and a high rate of water transmission. It is noted that a significant portion of the study area is covered by the paved runway/tarmac. For the evaluation of existing and proposed conditions, it was assumed that the paved areas provide zero infiltration.

3.2.4.6 Evaporation

Monthly average evaporation data collected from USGS Water-Resources Investigation Report 03-4199 (USGS 2004) were reviewed. Monthly average evaporation data were used to evaluate a mass balance on the preferred mitigation options.

3.3 Wildlife, Including Special-Status Species

H. T. Harvey & Associates wildlife ecologist Steve Rottenborn visited the site on July 13, 2016, to assess wildlife habitats and wildlife use, as well as potential wildlife habitat restoration opportunities. In addition, he reviewed the following sources to identify special-status animals present on and in the vicinity of the study area:

- *Alameda Point Project Draft Environmental Impact Report* (ESA 2013), Chapter 4.E, "Biological Resources," and Appendix H, Table H-1, "Special-Status Species Considered in Evaluation of Alameda Point Project," including wildlife habitat descriptions;
- A USFWS species list for the study area (USFWS 2016);
- California Department of Fish and Wildlife California Natural Diversity Database (CNDDB) query results (CNDDB 2016); and
- *Biological Opinion on the Proposed Naval Air Station Alameda Disposal and Reuse Project in the City of Alameda, Alameda County, California* (USFWS 2012).

3.4 Special-Status Plants

H. T. Harvey & Associates plant ecologists reviewed the following sources to determine the likelihood that special-status plant species are present in the study area:

- *Alameda Point Project Draft Environmental Impact Report* (ESA 2013) Chapter 4.E, "Biological Resources," and Appendix H, Table H-1, "Special-Status Species Considered in Evaluation of Alameda Point Project," including vegetation habitat descriptions;
- California Native Plant Society Inventory of Rare and Endangered Plants (CNPS 2016);
- USFWS species list for the study area (USFWS 2016); and
- CNDDB query results (CDFW 2016).

Section 4. Existing Conditions

4.1 Study Area Habitats

The distribution and acreage of salt marsh, open water (salinas), seasonal wetlands, ruderal, and developed habitat types are presented in Figure 4. Salt marsh, seasonal wetlands, and open water habitats constitute the waters of the United States/state in the study area (AECOM 2012). These habitats are described further below.

4.1.1 Salt Marsh

Salt marsh habitat consisted primarily of native species characteristic of San Francisco Estuary tidal marshes: perennial pickleweed (*Salicornia pacifica*) interspersed with fleshy jaumea (*Jaumea carnosa*), saltgrass (*Distichlis spicata*), dodder (*Cuscuta salina*), and alkali heath (*Frankenia salina*). Salt marsh habitat appeared to be supported by regular tidal flushing. (b) (5) [redacted]

4.1.2 Open Water (Salina)

H. T. Harvey & Associates determined that the open waters mapped by AECOM (2012) in the study area (b) (5) [redacted]. Google Earth historical imagery shows that all salinas periodically dry out, particularly during summer. Salina water surface elevations ranged from approximately 6.3 to 6.6 feet NAVD 88 (Figure 3). The salinity of the ponded water ranged from 42 to 58 ppt, substantially higher than the salinity of seawater (32 ppt) (Figure 3). Our observations suggest (b) (5) [redacted]

4.1.3 Seasonal Wetland

Seasonal wetland habitat (Figure 4; Appendix A, Photo 4) was dominated by nonnative wetland plants, including bird's foot trefoil (*Lotus corniculatus*), creeping bentgrass (*Agrostis stolonifera*), and curly dock (*Rumex crispus*). Native brown-headed rush (*Juncus phaeocephalus*) and common rush (*Juncus effusus*) were also present. Seasonal wetland habitat is likely supported primarily by runoff from the adjacent tarmac and possibly by groundwater during the rainy season.

4.1.4 Ruderal Upland

Vegetation in the ruderal upland habitat in the study area was dominated by invasive ice plant interspersed with saltgrass, ripgut brome (*Bromus diandrus*) stinkwort (*Dittrichia graveolens*), coyote brush (*Baccharis pilularis*), and black mustard (*Brassica nigra*) (Appendix A, Photo 5). The VA has been actively controlling tall, weedy forbs and shrubs in the upland areas to reduce the cover of tall vegetation that could otherwise provide habitat for least tern predators and obstruct least tern predator visibility (Roaldson pers. comm. 2016).

4.1.5 Developed

The developed habitat consisted of tarmac (Figure 4). At the northeastern corner of the study area, a drain grate (Figure 3, Point ID 12) was present on the tarmac, part of the failing stormwater drainage infrastructure under the tarmac.

4.2 Soils

Soils in the reference salt marsh (Area REF) and ruderal uplands (Areas A, B, C, and E) were composed primarily of medium to very fine sands (Appendix B). Figure 4 shows the soil sampling area locations. (b) (5) [redacted]

In restored wetlands, coarse-textured sediments and low organic matter decrease primary productivity relative to wetlands restored in fine-textured, organic-rich sediments because nutrient storage, cycling, and uptake in plants are reduced and porewater retention is decreased. However, the addition of an organic amendment can help address these deficiencies, and the restoration of wetland habitats, including tidal salt marsh (e.g., pickleweed), has been successfully implemented in sandy soils (Craft et al. 2003, Byrd and Kelly 2006). Moreover, the high proportion of sand in the reference salt marsh (Area REF) demonstrates that healthy, productive tidal marsh vegetation can be restored on in-situ material. (b) (5) [redacted]

(b) (5) [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
B	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
C	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]					
E	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Notes: NA = not applicable; NAVD 88 = North American Vertical Datum 1988; USDA = U.S. Department of Agriculture; n = Sample size.
*Sample D assessed using field methods.

(b) (5) [redacted]

Sampling of soils beneath the tarmac was beyond the scope of this study. Therefore, the thickness of tarmac materials (e.g., concrete and base rock) and the horticultural suitability of soils beneath the tarmac are unknown

4.3 Site Hydrology and Topography

The following results further explain how hydrologic inputs and site elevations affect the function of the wetland habitats in the Runway Wetlands.

4.3.1 Existing Rock Seawall

The entire perimeter of the study area (and Alameda Point as a whole) is surrounded by a permeable large rock seawall that protects the banks from erosion caused by tidal wave action (Figures 3 and 4). The average top elevation of the seawall in the study area was approximately 8.5 feet (NAVD 88). (b) (5) [redacted]

4.3.2 Salinity Readings and Groundwater Infiltration

(b) (5) [redacted]

(b) (5) [redacted] The hypersaline condition observed in salinas is the result of the inflow of bay water entering the salinas and evaporating, leaving a high concentration of salt (Survey Points 8–10). Infiltration in the salinas is likely restricted by (1) a high groundwater table and/or (2) accumulation of fine bay sediments in salina bottoms.

(b) (5) [redacted] The area in the vicinity of the storm drain regularly floods during high tides (Roaldson pers. comm. 2016).

Groundwater in the uplands outside of the salinas was brackish (Figure 3). This is likely attributable to subsurface mixing of groundwater and seawater. Salinity of groundwater decreased with distance from the bay.

4.3.3 Site Topography and Existing Drainage Watersheds

Figure 5 shows the project area's DEM, contours data, and watershed map. The horizontal projection of the data is North American Datum of 1983 Universal Transverse Mercator Zone 10. The vertical projection is NAVD 88. The total area contributing rainfall runoff to the salinas occupies approximately 195 acres. Table 2 provides the hydrologic characteristics of the contributing rainfall runoff watershed. Monthly average precipitation data for the study area are presented in Table 3. Monthly average evaporation data for the study area are presented in Table 4.

Table 2. Existing Drainage Watershed Parameters

(b) (5) [redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Table 3. Average Monthly Precipitation (Inches)

Months	Average Precipitation
January	4.49
February	4.45
March	3.27
April	1.46
May	0.71
June	0..16
July	0
August	0.08
September	0.2
October	1.1
November	3.15
December	4.57

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Table 4. Average Monthly Evaporation (Inches)

Months	Average Evaporation
January	1.77
February	2.24
March	4.02
April	5.91
May	8.07
June	9.65
July	9.76
August	8.73
September	6.86
October	4.94
November	2.24
December	1.77

4.3.4 Existing Stormwater Drainage System

Figure 5 illustrates the location of the stormwater drainage pipelines in the project area. Because land has subsided and storm drain pipelines and outfalls have failed, bay water enters into the interior of the study area via the pipeline conduits. When the tide is higher than the outfall during larger storm events, stormwater runoff is trapped in low-lying areas, causing surficial flooding until the tides recede and allow for the ponded stormwater to be discharged through the pipe system.

4.3.5 Tidal Stages and Tidal Flooding

Tidal datums for the study area are provided in Table 5.

Table 5. Tidal Datums for Alameda, California (NOAA Tides and Currents Station ID #9414750)

Tidal Datum	Feet NAVD 88
Highest observed water level	9.42
Highest astronomical tide	7.75
Mean higher high water	6.37
Mean high water	5.75
Mean sea level	3.22
Mean low water	0.91
Mean lowest low water	-0.23
Lowest astronomical tide	-2.17

Notes: NAVD 88 = North American Vertical Datum 1988; NOAA = National Oceanic and Atmospheric Administration.

Seepage of tidal flows through the seawall was detected during the field visits in June 2016. (b) (5) [redacted] Figures 6–8 capture the extent of flooding associated with particular tidal datums. Figure 7 shows that ground higher than MHHW likely exists between the salinas and the rock seawall and that the salinas themselves are below MHHW (Figure 6). Figure 7 also shows that the highest astronomical tide floods the salinas through the seawall. Figure 8 shows a 9.0-foot flood event. As noted above, (b) (5) [redacted]

4.3.6 Sea Level Rise

Table 6 provides sea level rise projections for the study area.

Table 6. CO-CAT Sea Level Rise Projections (March 2013)

Time Period	Amount of Sea Level Rise (inches)
2000–2030	1.5 to 12
2000–2050	5–24
2000–2100	17–66

Note: CO-CAT = Coastal and Ocean Working Group of the California Climate Action Team

4.3.7 Existing Flood Risk

The current Federal Emergency Management Agency (FEMA) preliminary Digital Flood Insurance Rate Map (DFIRM), dated April 16, 2015, shows the project area in a 100-year special flood hazard zone (AE) with a base flood elevation of 10 feet (Figure 9). The entire southern portion of Alameda Point is inundated during a 100-year flood elevation.

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4.4 Wildlife, Including Special-Status Species

4.4.1 Common Wildlife Species

A variety of waterbirds use the complex of salinas and salt marsh in the study area. Most of these species are present only during migration and winter. For example, dabbling ducks, such as the mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), northern shoveler (*Anas clypeata*), and American wigeon (*Anas americana*), forage in the salinas and likely forage in the salt marsh to some extent when it is inundated. Migrant and wintering shorebirds also forage in these habitats. Larger, longer-legged shorebirds, such as the willet (*Tringa semipalmata*) and greater yellowlegs (*Tringa melanoleuca*), forage in both shallow and deeper-water habitats in the salinas and salt marsh, whereas smaller shorebirds, such as the western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), dunlin (*Calidris alpina*), and semipalmated plover (*Charadrius semipalmatus*), forage in shallow water or exposed mud. Numbers of these waterbirds peak during spring migration (March to early May) and fall migration (early July to October).

California least terns from the colony just north of the study area routinely roost and loaf on the tarmac of the former runways, sometimes in the study area but usually just outside the study area to the north and west. Western gulls (*Larus occidentalis*) and California gulls (*Larus californicus*) also may roost in the study area, on the tarmac, in salinas, or along the riprap on the southern and southwestern borders of the study area.

Smaller numbers of waterbirds nest in the study area. A few pairs of black-necked stilts (*Himantopus mexicanus*), and possibly American avocets (*Recurvirostra americana*), nest in the salt marsh around the edges of the salinas. Canada geese (*Branta canadensis*), and possibly a few pairs of mallards and gadwall, also nest in these areas, and killdeer (*Charadrius vociferus*) nest in ruderal areas, along the edges of the salinas, and even on the tarmac. A small colony of great blue herons (*Ardea herodias*) nests in cypress trees in ruderal areas adjacent to the salinas; Figure 4 shows the approximate location of the heron rookery.

Aside from waterbirds, wildlife diversity in the study area is relatively low, primarily because of the paucity and structural simplicity of vegetation. Small numbers of Bryant's savannah sparrows (*Passerculus sandwichensis alaudinus*) nest in ruderal habitat and higher salt marsh on the site, and a few pairs of horned larks (*Eremophila alpestris*) nest in ruderal and bare areas. However, use of habitats on the site by landbirds is limited primarily to foraging birds that breed elsewhere. Such birds include the house finch (*Haemorhous mexicanus*), Brewer's blackbird (*Euphagus cyanocephalus*), lesser goldfinch (*Spinus psaltria*), and barn swallow (*Hirundo rustica*). Common mammals in the study area include the black-tailed jackrabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*), Norway rat (*Rattus norvegicus*), Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), and California ground squirrel (*Spermophilus beecheyi*). The western fence lizard (*Sceloporus occidentalis*) occurs on the site, but it is unlikely that other reptiles occur here.

4.4.2 Special-Status Wildlife Species

Figure 10 depicts occurrences of special-status species mapped on the site by the CNDDB. As mentioned above, California least terns (state and federally listed as endangered) nest at the colony north of the study area and occasionally roost and loaf on tarmac in the study area. Bryant's savannah sparrow is a California species of special concern that nests in low numbers on the site.

Several other special-status wildlife species may occur in the study area as occasional visitors but are not expected to breed there or to occur regularly or in numbers. Although the western snowy plover (*Charadrius nivosus nivosus*) (federally listed as threatened) has been recorded in the least tern colony (ESA 2013) in the past, the species has not been known to nest at Alameda Point in recent decades. Habitat in the study area is of low quality for this species, which may occur as an occasional visitor but is not expected to nest in the study area. The Alameda song sparrow (*Melospiza melodia pusillula*) nests at Alameda Point, but it is typically associated with taller vegetation than is present in most of the study area. Therefore, it likely occurs there only (or primarily) as an occasional nonbreeding visitor. Other special-status species that may forage in the study area, particularly during the nonbreeding season, but that do not nest here include the burrowing owl (*Athene cunicularia*), northern harrier (*Circus cyaneus*), and loggerhead shrike (*Lanius ludovicianus*), which are California species of special concern, and the white-tailed kite (*Elanus leucurus*) and peregrine falcon (*Falco peregrinus*), which are listed by the state of California as fully protected species.

San Francisco Bay waters immediately adjacent to the study area potentially support several special-status fish, including the green sturgeon (*Acipenser medirostris*) and Central California Coast steelhead (*Oncorhynchus mykiss*) (both federally listed as threatened), the longfin smelt (*Spirinchus thaleichthys*) (state listed as threatened and a candidate for federal listing), and the Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*) (California species of special concern). Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*), both of which are protected by the Marine Mammal Protection Act, occur in adjacent waters as well. However, none of these fish or marine mammals occurs in the study area itself.

4.5 Special-Status Plants

On the basis of our review of background materials, including the CNDDB map (Figure 10), and our experience with projects in the vicinity, (b) (5) [redacted].

(b) (5) – Page withheld in its entirety

Section 5. Restoration Opportunities and Constraints

5.1 Constraints to Restoration

Our studies and stakeholder meetings identified the following biotic and physical constraints for restoration.

5.1.1 Biotic Constraints

5.1.1.1 California Least Tern Colony

The least tern colony adjacent to the study area is the largest and most stable breeding colony in the San Francisco Bay and the source population for the region (Figure 2). The below constraints are derived both from the existing Biological Opinion (USFWS 2012) and input from USFWS staff (Susan Euing and Joy Albertson). Least terns use the tarmac immediately north and west of the study area for roosting and to access San Francisco Bay for feeding and foraging (Euing pers. comm. 2016). Restoration actions are constrained by the need to preserve tarmac roosting areas; therefore, mitigation actions are limited to the study area. The study area was purposefully configured with guidance from USFWS (Susan Euing and Joy Albertson) to avoid most of the tarmac roosting areas.

Least terns favor areas with large, unrestricted viewsheds for roosting so that they can see approaching predators. Therefore, vegetation or infrastructure (e.g., flood control berms) associated with mitigation should be less than 2 vertical feet above the ground surface to avoid reducing the viewshed of the surrounding habitat for the terns (Albertson pers. comm. 2016).

Tall vegetation in wetlands or uplands can provide nesting habitat and/or cover for species that prey on the least tern, such as feral cats (*Felis silvestris catus*), raccoon, striped skunk, crows, and northern harrier (Albertson pers. comm. 2016). Therefore, restoration should avoid creating conditions that favor medium-statured emergent wetland vegetation, such as alkali bulrush (*Bolboschoenus maritimus*), or taller vegetation (e.g., tules [*Schoenoplectus californicus* or *S. acutus*], willows [*Salix* sp.]). Restored upland vegetation should consist of low-growing grasses and forbs, not trees or shrubs.

In addition, construction activity during the least tern nesting season (early April to mid-August) may result in disturbance of nesting terns. (b) (5) [redacted]

5.1.1.2 Jurisdictional Habitats

Salt marsh and salina habitats in the study area are supported primarily by tidal waters passing through holes in the outboard seawall. The salinas are supported by subtle topographic variability, changes in sediment permeability, and high groundwater, which allow water to remain ponded following high tides. (b) (5) [redacted]

(b) (5) [redacted]

The seasonal wetland is sustained by a combination of surficial runoff from the Alameda Airfield tarmac watershed and possibly seasonally high groundwater. It is dominated by nonnative vegetation and provides little wildlife value in its current condition. Restoration actions therefore (b) (5) [redacted]

5.1.1.3 Soil/Substrate Suitability

All restoration options considered (b) (5) [redacted]. No hazardous waste was present in the study area following the cleanup of IR 33 (EPA 2016). (b) (5) [redacted]

Soils at the design grade will need to support both benthic invertebrates (for shorebird foraging) and wetland vegetation. As noted above, soils in the ruderal upland areas are suitable for these purposes with organic amendment. However, soil is of unknown suitability at potential wetland design grades beneath the tarmac ("Developed" habitat) and in Area D (Figure 3), and the thickness of the tarmac is also unknown. Therefore, aggregate base rock or debris may be present at design grades in portions of the site and require over-excavation (by a depth of 1.5 feet) and replacement with texturally suitable material. Suitable (b) (5) [redacted]

Although no waste hazardous to humans is present in the study area (EPA 2016), it is unknown whether soil within the upper 1.5 feet of target wetland design grades will meet RWQCB's contaminant criteria for aquatic life (RWQCB 2000). The RWQCB contaminant criteria for aquatic life are well below thresholds hazardous to humans. I (b) (5) [redacted].

5.1.1.4 Heron Rookery

The great blue heron rookery contains only a few nests and therefore is not regionally significant from the perspective of the species' populations. However, as the only heron rookery present on Alameda Point, this colony has biological value and interest. (b) (5) [redacted].

5.1.1.5 Mosquito Habitat

Ponded water associated with mitigation could provide breeding habitat for mosquitos. The potential for mosquito breeding should be minimized by (b) (5) [redacted].

5.1.1.6 Avian Botulism

Avian botulism is an often fatal disease of birds that results when birds ingest a toxin produced by the bacterium *Clostridium botulinum.* The bacterium is most likely to proliferate in fresh to brackish (highest risk in water with a salinity level of less than 6 ppt) anoxic ponded wetlands with decaying organic matter during summer months (USGS 2016). (b) (5) [redacted]

5.1.2 Physical Constraints

5.1.2.1 Impacts on Flood Risk

The current FEMA preliminary DFIRM dated, April 16, 2015, shows the study area in a 100-year special flood hazard zone (AE) with a base flood elevation of 10 feet (Figure 9). The current seawall has an approximate elevation of 8.5 feet NAVD 88. To achieve the current level of flood protection for any tidal wetland mitigation option (e.g., tidal or muted tidal marsh restoration, including installation of a salina), (b) (5) [redacted]

5.1.2.2 Reinforcement of the Southern Rock Seawall

(b) (5) [redacted].

5.2 Pond and Wetland Mitigation Opportunities

5.2.1 Salina

Substantial opportunities are present to create salina habitat in the study area. Salinas are typically hypersaline (greater than 40 ppt during summer) seasonally evaporating ponds formed in shallow depressions with restricted drainage at the upper edge of tidal marshes. Salinas are filled by spring tides to a depth of approximately 1–2 feet and may evaporate completely during summer. This habitat is primarily open water/mudflat with a fringe of salt marsh vegetation. Salinas were historically characteristic of the intertidal portion of the salt marsh-terrestrial transition zone, particularly on alluvial fan edges. The hydrology and salinity of salinas located at the backshore (upland) edge of marshes can be substantially influenced by groundwater (Goals Project 1999, Baye 2008, Beller et al. 2013).

(b) (5) [redacted] would meet all the on-site wetland mitigation goals (Section 2.2) and result in the following benefits:

- (b) (5) [redacted]
- [redacted]
- (b) (5) [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

(b) (5) [redacted]

(b) (5) [redacted] these options are not preferred for the following reasons:

- [redacted]

- [redacted]

5.2.3 Nontidal Wetlands

(b) (5) [redacted] These options are not preferred because they do not meet the wetland mitigation goals for the following reasons:

- [redacted]

(b) (5) [redacted]

[redacted]

5.3 Preliminary Concept for Preferred Mitigation Option

On the basis of our assessment of opportunities and constraints in the study area, (b) (5) [redacted]

5.3.1 Salina Conceptual Planning Criteria

The conceptual planning of created salina habitat should be guided by the following planning criteria:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- (b) (5) [redacted]

[redacted]

Island characteristics should include:

[redacted]

5.3.2 Proposed Preliminary Salina Concept

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

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(b) (5) – Page withheld in its entirety

(b) (5) [redacted]

(b) (5) [redacted]

(b) (5) [redacted]

Long-term maintenance would consist of:

- [redacted]
- [redacted]
- [redacted]

5.3.2.1 Enhancement of Jurisdictional Wetland Habitat

Implementation of the salina concept would enhance approximately 4-5 acres of low-quality seasonal wetland habitat (b) (5) [redacted] Therefore, the VA should (b) (5) [redacted].

5.3.2.2 Hydrologic Effects of Proposed Salina

(b) (5) [redacted]

(b) (5) – Page withheld in its entirety

(b) (5) [redacted]

(b) (5) [redacted]

[redacted]		[redacted]		[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

(b) (5) [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

5.3.2.3 Sea Level Rise Adaptation

(b) (5) [redacted]

(b) (5) [redacted]

5.3.3 Additional Mitigation Opportunities

(b) (5) [redacted]

[redacted] If the VA decides to include this work in a mitigation proposal, (b) (5) [redacted]

(b) (5) [redacted]

It was observed in the field that the seawall outboard of the existing salt marsh and salina habitat is experiencing erosion on the landside at two primary seawall erosion locations within the study area (Figure 5). (b) (5) [redacted]

[redacted]

(b) (5) [redacted]

California sea-blight (*Sueda californica*) is a rare native wetland plant that has been extirpated from San Francisco Bay. Efforts are under way to reintroduce the species to suitable habitats. Alameda Point has been identified as historically supporting California sea-blight, and the baylands goals report (1999) calls for its reintroduction to the area. California sea-blight favors sandy substrates and sheltered conditions, especially where fresh water inputs are available. (b) (5) [redacted].

(b) (5) [redacted]

Section 6. Conclusion and Recommended Next Steps

6.1 Conclusion

Substantial opportunities exist to expand and enhance the existing wetlands complex in the study area at Alameda Point (b) (5) [redacted]

(b) (5) [redacted]

6.2 Next Steps

(b) (5) [redacted]

The following additional studies would be necessary to develop the basis of design (b) (5) [redacted]

- (b) (5) [redacted]
- A topographic survey of the study area would be necessary to produce accurate grading plans.

- (b) (5) [redacted]
- (b) (5) [redacted]
- [redacted]
- (b) (5) [redacted]
- [redacted]

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Appendix A. Photos

Photo 1. A Tidal Channel Extends Through the Southwest Rock Seawall Erosion Site into Tidal Salt Marsh in the Study Area. Ponded Open Water (Salinas) Are Visible in the Background with the Least Tern Conservation Area and Oakland Harbor Beyond.

Photo 2. A Rock Seawall Separates Existing Salt Marsh from San Francisco Bay. Photo Taken at Southwest Rock Seawall Erosion Site. Tidal Channel in Foreground. Alameda Airfield in Midground.

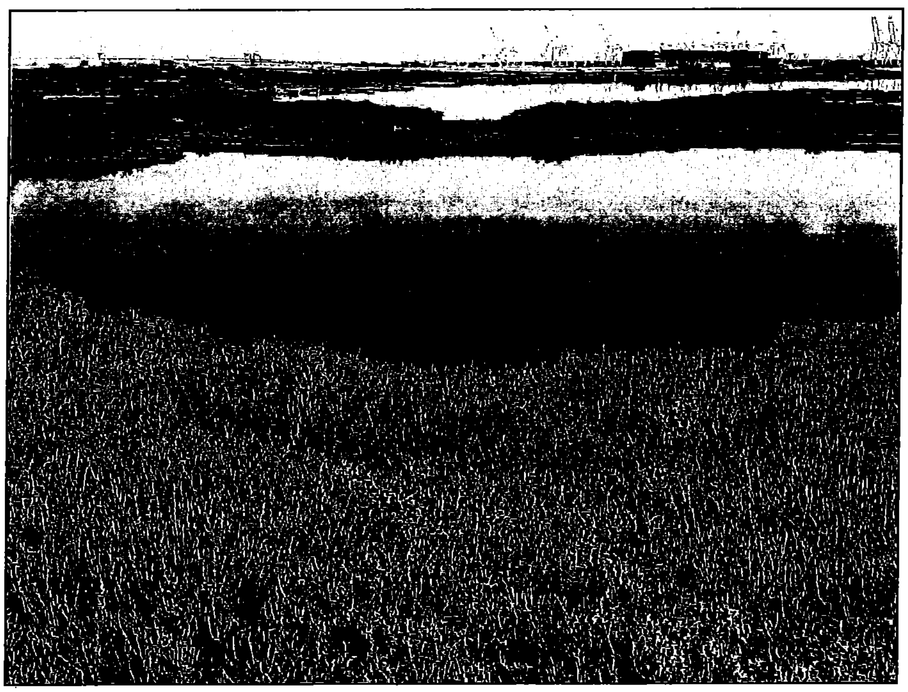

Photo 3. Open Water (Salinas) Located in the Study Area.

Photo 4. Seasonal Wetland Located in the Study Area.

Photo 5. Ruderal Upland (Foreground) and Developed Habitats (Tarmac in the Midground) in the Study Area.

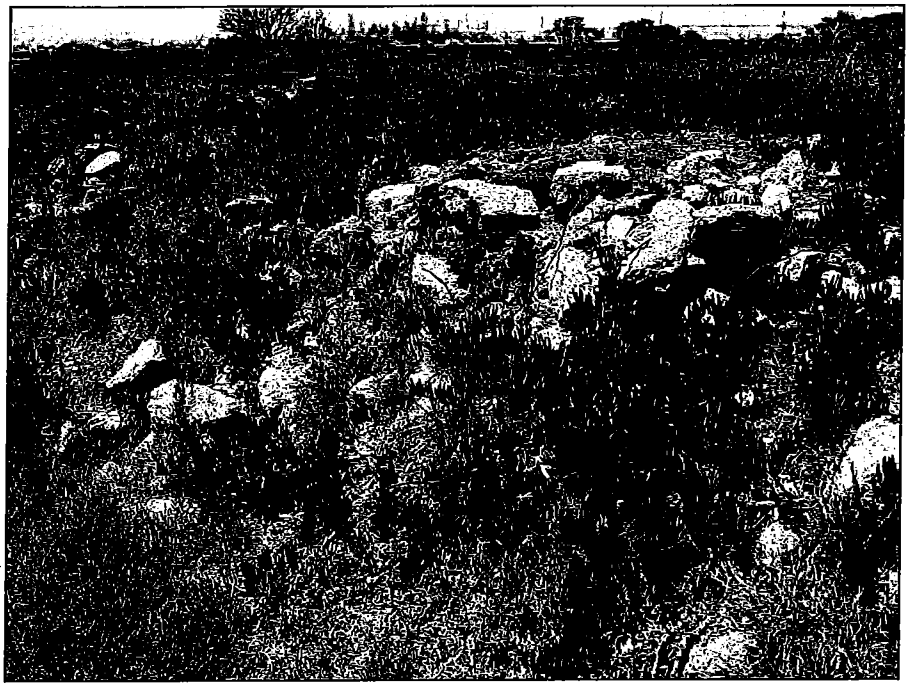

Photo 6. Rubble and Concrete Debris in Soil Sample Area D.

Appendix B. Soil Sample Horticultural Laboratory Results

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