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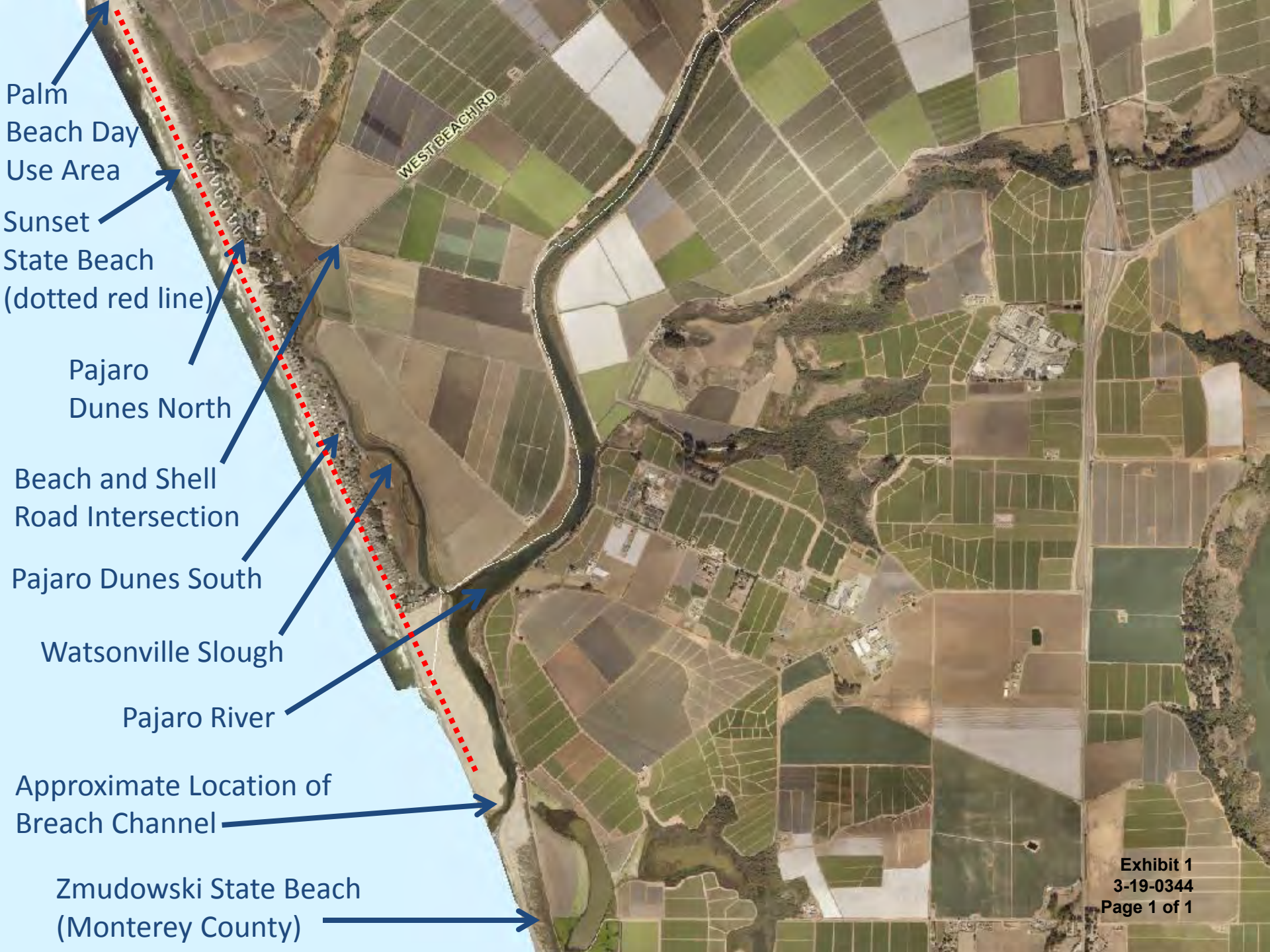
W33b

3-19-0344 (PAJARO RIVER BREACHING)

NOVEMBER 13, 2019 HEARING

EXHIBITS

- Exhibit 1 – Project Vicinity Map
- Exhibit 2 – Pajaro River Breaching Program Project Description
- Exhibit 3 – Project Site Plans
- Exhibit 4 – Site Photos
- Exhibit 5 – Technical Memorandum
- Exhibit 6 – National Marine Fisheries Service Biological Opinion
- Exhibit 7 – United States Fish and Wildlife Service Biological Opinion
- Exhibit 8 – CDFW’s Lake and Streambed Alteration Agreement
- Exhibit 9 – Alternatives Analysis
- Exhibit 10 – Except from Coastal Ecosystem Resiliency Project (Prop 1 Grant Application)
- Exhibit 11 – State Parks’ April 23, 2019 Letter



Palm
Beach Day
Use Area

Sunset
State Beach
(dotted red line)

Pajaro
Dunes North

Beach and Shell
Road Intersection

Pajaro Dunes South

Watsonville Slough

Pajaro River

Approximate Location of
Breach Channel

Zmudowski State Beach
(Monterey County)

WEST BEACH RD

Pajaro River Mouth Breaching Program Project Description

Determining when a Breach is Necessary

The Santa Cruz County Department of Public Works (DPW) staff observe the staff gage located at the intersection of Beach Road and Watsonville Slough (staff gage) and record the reading on a weekly basis. During periods of rainfall and/or high surf, the staff gage reading is observed and recorded daily. If consecutive gage readings are increasingly higher, DPW staff will walk out to the mouth of the Pajaro River, determine if the mouth is closed or likely to close, and take photographs that characterize the opened/closed nature of the lagoon.

If the river mouth is determined to be closed between October 15 and April 15, DPW staff will continue to record daily staff gage readings. If the staff gage reading exceeds 3.5 feet and is expected to rise based on rainfall and/or tidal forecasts, DPW staff will begin preparations for Stage 1 activities. DPW staff will confirm stand-by status for water quality samples (pre- and post-breach, lagoon and ocean water) as described in the 2019 Water Quality Sampling and Fish Survey Plan (WQSFSP). DPW staff will also review the Pajaro River Mouth Breaching Program Project Description, check for updates based on new permit conditions or standards, and check for updates to the breaching program email distribution list.

If breaching activities are expected to occur between April 16 and October 14, emergency permit applications will be prepared and filed with all authorizing agencies, as necessary, and if time allows. If time does not allow for emergency permit attainment and flooding is occurring on Beach and Shell Roads, DPW staff will commence breaching activities, according to the protocol described below, and apply for permits after the work is completed.

Breaching Activities Stage 1 – Mobilization Readiness

If the staff gage reading is 3.5 feet or greater, is expected to rise based on rainfall and/or tidal forecasts, and the river mouth is closed or likely to close, DPW staff will send a Stage 1 notification email to the breaching program distribution list. Water quality and wildlife survey monitoring activities, as detailed under Breaching Activities Stage 2 (below), will be scheduled, and crew and equipment will be confirmed to be on standby. DPW staff will continue to monitor the stream water levels, both locally and upstream, as well as the predicted tides and expected rainfall. Photographs of Watsonville Slough, the Pajaro River, and the river mouth will be taken daily during the time of intense monitoring (when waters are rising or are expected to rise).

Breaching Activities Stage 2 – Equipment Mobilization

If the staff gage reading is 4.5 feet or greater, is expected to rise based on rainfall and/or tidal forecasts, and the river mouth is closed or likely to close, DPW staff will send a Stage 2 notification email to the breaching program distribution list. The excavator will be transported on a rubber-tired vehicle to the Palm Beach State Park parking lot (staging area). DPW staff will schedule a training session to be held at the staging area and invite the qualified biologist, Santa Cruz County Planning Department representation, and all involved DPW staff (equipment operators and breaching activity monitors).

Water Quality Testing

Pre-breach lagoon water quality testing will commence as described in the WQSFSP.

Ocean water and lagoon water will be sampled for fecal indicator bacteria and algal toxins within 24 hours prior to breach activities. If the sample value for enterococcus exceeds 104 CFU/100mL, or if algal toxins are present at or above the cyanotoxin trigger levels, DPW staff will report the level to Central Coast Water Board staff as soon as possible and no later than 24 hours after the monitoring results are first available.

If enterococcus and/or algal toxins exceed the thresholds described above, DPW staff will post signs during breach channel construction in the construction and discharge area advising the public against water contact recreation in the ocean. Signage will be photographed, and the location of the sign(s) will be documented for post-breach reporting purposes.

Wildlife Survey

A qualified biologist will survey the beach and breaching location for western snowy plover and other special-status wildlife species within 72 hours prior to mechanical breaching, at the appropriate time of day, and shall establish the appropriate equipment mobilization pathway to avoid any special-status species and their habitat. If lagoon will be manually breached between March 1 and April 15 or if snowy plover nesting activity is detected during pre-breach surveys, refer to Measure 2.15 of Streambed Alteration Agreement 1600-2018-0081-R3 for requirements.

Breaching Activities Stage 3 – Channel Excavation

A training session will be conducted prior to equipment mobilization onto the beach. The qualified biologist and DPW staff will provide the training to all persons employed on the project and a representative of the Santa Cruz County Planning Department. Instruction shall consist of:

1. A presentation by the qualified biologist that includes a discussion of the biology and general behavior of any sensitive species which may be in the area, how they may be encountered within the work area, and procedures to follow when they are encountered.
2. The status of California Endangered Species Act (CESA) listed species including legal protection, penalties for violations and project-specific protective management measures.
3. A review of permit conditions and condition compliance requirements during execution of breaching activities.

Upon completion of the training, employees shall sign an affidavit stating they attended the training and understand all protection measures. DPW staff will maintain these forms in the breaching activities file for review by authorizing agencies. In the case that workers join the project after breaching activity commencement, the same training will be provided prior to the workers commencing work on the project. Interpretation will be provided for non-English speaking workers.

Prior to equipment mobilization onto the sand, DPW staff will check equipment for leaks or other problems and take appropriate steps to fix the problem. Equipment operation over beach areas and at the excavation site shall be overseen by the qualified biologist. The qualified biologist will ensure that equipment operation will not result in the destruction of snowy plover habitat. Equipment will not be operated within a flowing or ponded stream at any time.

DPW staff will visually inspect and photo-document the river/lagoon before, during and after construction of the breach channel. Staff will determine and demarcate the channel location with the assistance of the qualified biologist. DPW staff will also advise any members of the public, if present, to stay back from the excavator, and that access across the channel once the channel excavation is completed will not be possible.

The breach channel will be constructed by excavating sand from the lagoon diagonally to the south, behind the barrier beach crest. After a sufficient distance, the breach channel shall be excavated in a direct line to the ocean, through the barrier beach crest. Approximately 5-10 feet inland from the barrier beach crest, the breach channel will be fanned out mechanically to reduce scour. The breach channel will be wide and shallow (approximately 10 feet wide and 3 feet deep) to minimize scouring and maintain lagoon habitat. The sufficient distance of the breach channel from the lagoon and the angle, depth and width of the breach channel shall be determined based on the current lagoon and beach conditions and approved by the biologist.

DPW Staff will excavate the channel from the ocean side of the barrier beach and work toward the lagoon. Excavated sand will be sidecast. A sand plug will be left in place between the ocean and lagoon. The sand plug will be 15 to 20 feet long and 10 to 15 feet wide and will be located at the lagoon end of the breach channel to prevent lagoon water from rushing out. The sand will then be scraped off the plug until the pressure of the lagoon water erodes the remainder of the plug. Once the water begins eroding the sand plug, the channel width is expected to increase to 50-100 feet and the depth is expected to decrease to 1-2 feet.

Equipment will be transported back to the staging area at Palm Beach State Park parking lot immediately following channel excavation activities. The qualified biologist will walk with the excavator and then return to the lagoon to continue monitoring.

The qualified biologist will remain onsite during and following breach channel construction and is responsible for monitoring and recording fish presence by species, and estimating the number of dead fish and cause of death, by species.

Breaching Activities Stage 4 – Post-Breach Monitoring

DPW staff will monitor the lagoon twice a day until the water level has stabilized and/or the sandbar has reformed. If the areal extent and depth of the lagoon has approached levels detrimental to tidewater goby and/or steelhead trout, the sandbar will be rebuilt. Although this is a very unlikely scenario, in the event that it becomes necessary, DPW staff will contact authorizing agencies for guidance and/or permits, if necessary, for rebuilding the sandbar.

A brief summary of the monitoring activities will be emailed to the breaching distribution list, including the date and time of breaching, type of equipment and manpower used, and a description of tide and wave action.

A qualified fisheries biologist shall survey the project area for stranded native fish every day for three days, or until water levels have stabilized, following a mechanical breach. Stranded native fish shall be moved to the nearest appropriate site where they will not be subject to stranding and within

appropriate habitat. The qualified fisheries biologist will obtain all applicable permits for the relocation of native fish.

Post-breach lagoon water quality testing will be conducted as described in the WQSFSP.

Ocean water and lagoon water will be sampled for fecal indicator bacteria and algal toxins within 12 hours following mechanical breaching. If the sample value for enterococcus exceeds 104 CFU/100mL, or if algal toxins are present at or above the cyanotoxin trigger levels, DPW staff will report the level to Central Coast Water Board staff as soon as possible and no later than 24 hours after the monitoring results are first available.

If enterococcus and/or algal toxins exceed the thresholds described above and the project area has not already been posted, DPW staff will post signs in the discharge area advising the public against water contact recreation in the ocean. Signage will be photographed and the location of the sign(s) will be documented for reporting purposes.

While the lagoon remains open, grab samples will be collected once weekly until ocean water sampling shows that enterococcus levels are below the 104 CFU/100mL threshold and algal toxins in the lagoon fall below trigger levels in the 2016 Updates to the California Blue-Green Algae Draft Voluntary Guidance Document. Grab samples of ocean water will be collected where the ocean is at approximately knee to waist depth, at the location the lagoon water enters the ocean. DPW staff will coordinate all fecal indicator bacteria monitoring efforts with Santa Cruz County Environmental Health and C-Clean. For the ocean sampling, DPW staff will comply with AB411 monitoring with regard to methodology, frequency and timing of sampling to ensure that the samples are collected that are comparable to other beach data that the Central Coast Water Board receives for the area. Additionally, DPW staff will maintain posting of the area adjacent to affected ocean receiving waters as long as samples exceed the threshold(s).

Premature Channel Closure

If a second mechanical breach becomes necessary within the same storm season, DPW staff will review permit conditions for potential non-compliance and contact authorizing agency staff, as appropriate, to determine the best course of action.







Annual Fish Survey and Water Quality Sampling

During the last week of September or first week of October, annual fish survey and water quality monitoring will be conducted by a qualified biologist, as described in the WQSFSP.

If the sandbar forms, closing the Pajaro River mouth, outside of the permitted breaching season (October 15 through April 15), or if the sandbar forms during the permitted breaching season and a breach is not likely (meaning that the water surface elevation is below the permitted 3.5-foot mobilization threshold and rain is not forecasted), lagoon water quality sampling will be conducted within one week of mouth closure as described in the WQSFSP.

PAJARO RIVER BREACHING

LEGEND

-  TRAINING SESSION LOCATION
-  STREETS
-  CONTOURS
-  RIVERS AND STREAMS
-  ACCESS ROUTE
-  PARCEL BOUNDARIES

DATE: 4/30/2019

DRAFTER: JRB

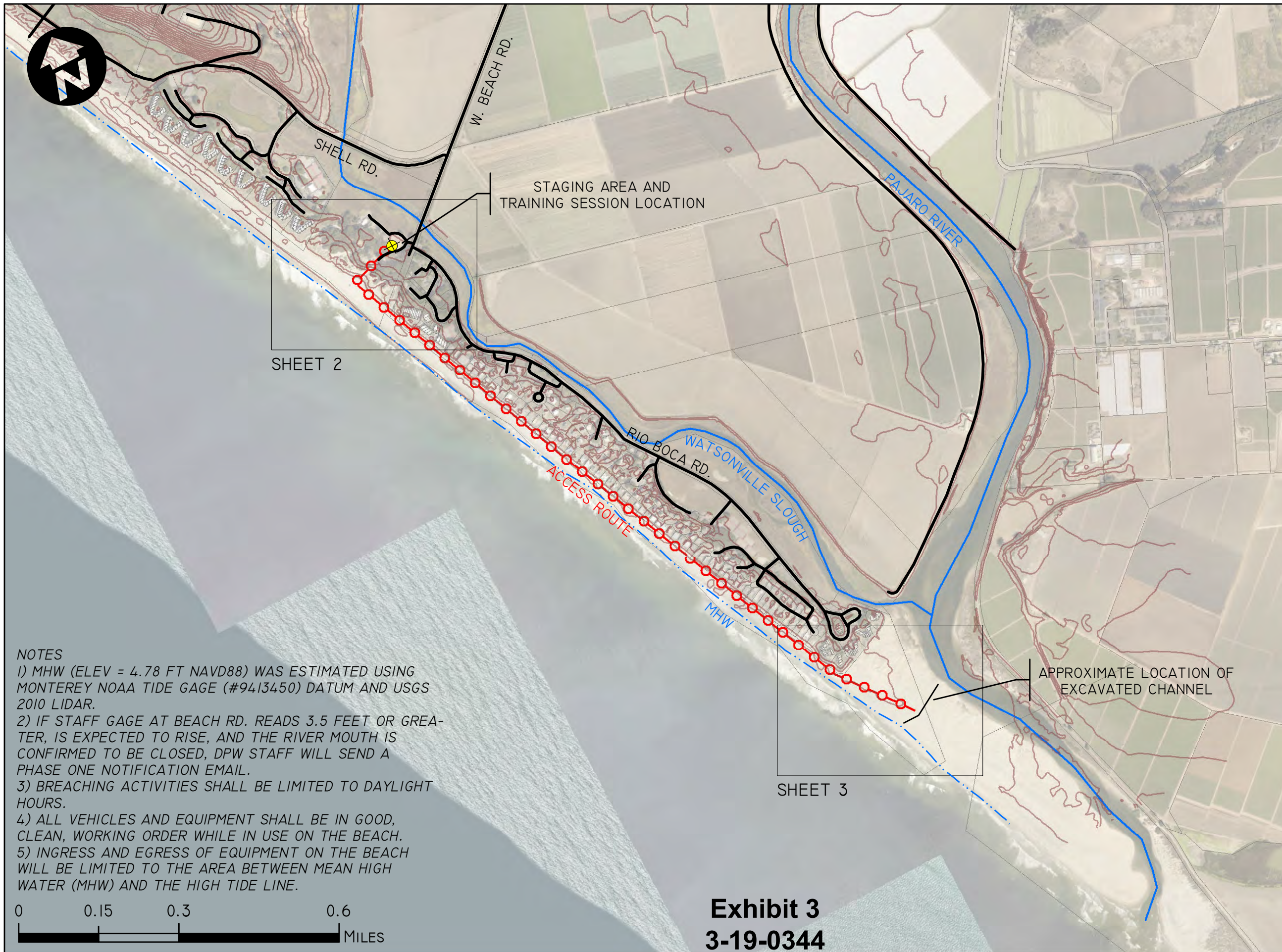
SCALE: 1" = 940'

PROJECT: P24825

FILE NAME: BREACHINGPLAN_V2.MXD

SHEET 1 OF 3

SANTA CRUZ COUNTY
DEPT. OF PUBLIC WORKS
ZONE 7 FLOOD CONTROL
701 OCEAN ST., ROOM 410
SANTA CRUZ, CA 95060



NOTES

- 1) MHW (ELEV = 4.78 FT NAVD88) WAS ESTIMATED USING MONTEREY NOAA TIDE GAGE (#9413450) DATUM AND USGS 2010 LIDAR.
- 2) IF STAFF GAGE AT BEACH RD. READS 3.5 FEET OR GREATER, IS EXPECTED TO RISE, AND THE RIVER MOUTH IS CONFIRMED TO BE CLOSED, DPW STAFF WILL SEND A PHASE ONE NOTIFICATION EMAIL.
- 3) BREACHING ACTIVITIES SHALL BE LIMITED TO DAYLIGHT HOURS.
- 4) ALL VEHICLES AND EQUIPMENT SHALL BE IN GOOD, CLEAN, WORKING ORDER WHILE IN USE ON THE BEACH.
- 5) INGRESS AND EGRESS OF EQUIPMENT ON THE BEACH WILL BE LIMITED TO THE AREA BETWEEN MEAN HIGH WATER (MHW) AND THE HIGH TIDE LINE.

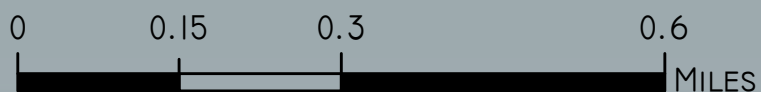








Exhibit 3
3-19-0344

PAJARO RIVER BREACHING

LEGEND

-  TRAINING SESSION LOCATION
-  STREETS
-  CONTOURS
-  RIVERS AND STREAMS
-  ACCESS ROUTE
-  PARCEL BOUNDARIES

DATE: 4/30/2019

DRAFTER: JRB

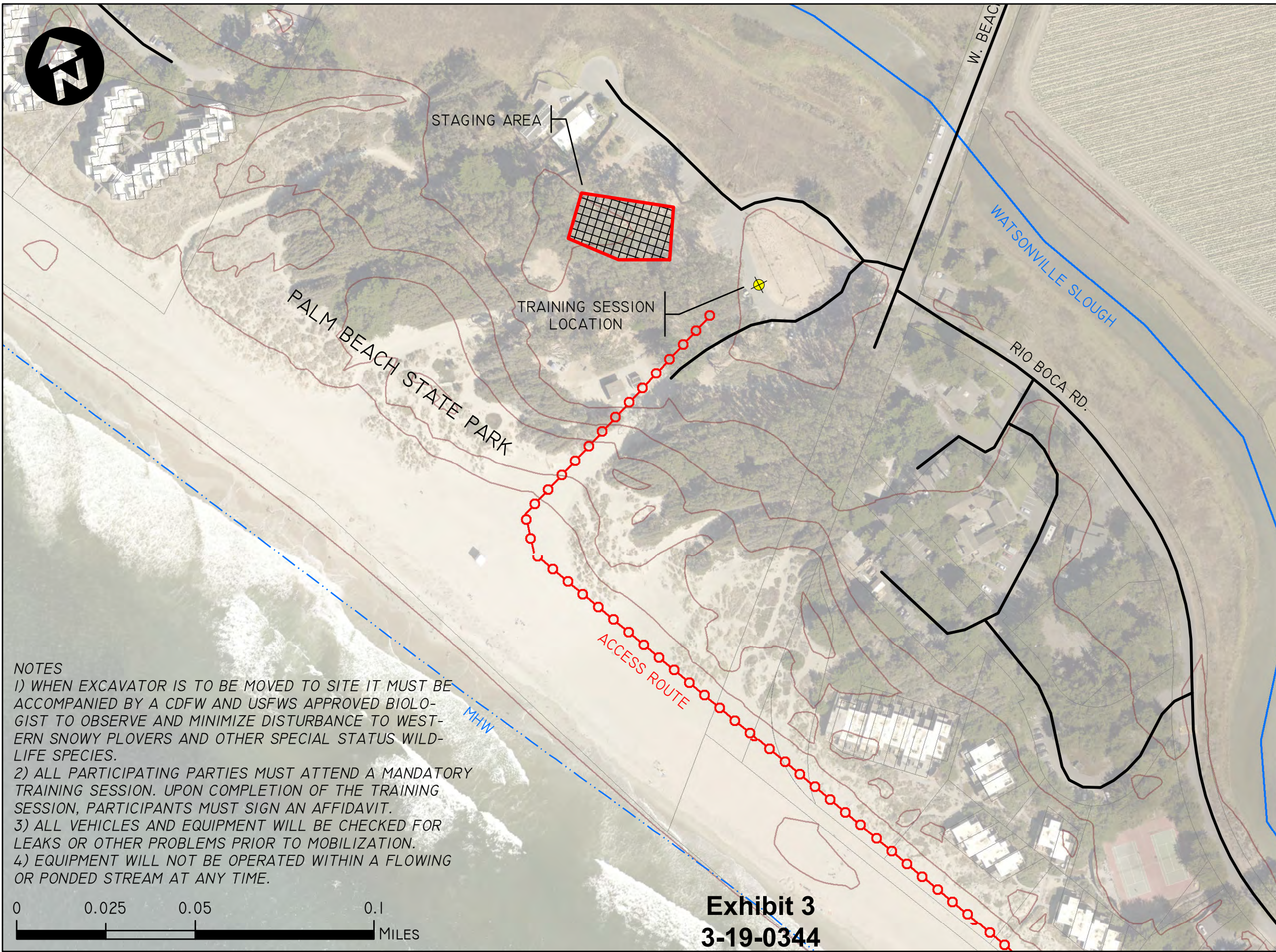
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PROJECT: P24825

FILE NAME: BREACHINGPLAN_V2.MXD

SHEET 2 OF 3

SANTA CRUZ COUNTY
DEPT. OF PUBLIC WORKS
ZONE 7 FLOOD CONTROL
701 OCEAN ST., ROOM 410
SANTA CRUZ, CA 95060



NOTES

- 1) WHEN EXCAVATOR IS TO BE MOVED TO SITE IT MUST BE ACCOMPANIED BY A CDFW AND USFWS APPROVED BIOLOGIST TO OBSERVE AND MINIMIZE DISTURBANCE TO WESTERN SNOWY PLOVERS AND OTHER SPECIAL STATUS WILDLIFE SPECIES.
- 2) ALL PARTICIPATING PARTIES MUST ATTEND A MANDATORY TRAINING SESSION. UPON COMPLETION OF THE TRAINING SESSION, PARTICIPANTS MUST SIGN AN AFFIDAVIT.
- 3) ALL VEHICLES AND EQUIPMENT WILL BE CHECKED FOR LEAKS OR OTHER PROBLEMS PRIOR TO MOBILIZATION.
- 4) EQUIPMENT WILL NOT BE OPERATED WITHIN A FLOWING OR PONDED STREAM AT ANY TIME.

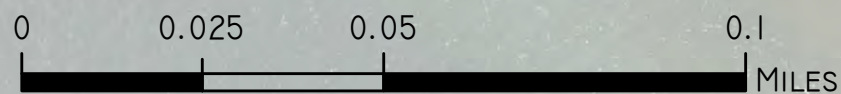










Exhibit 3
3-19-0344

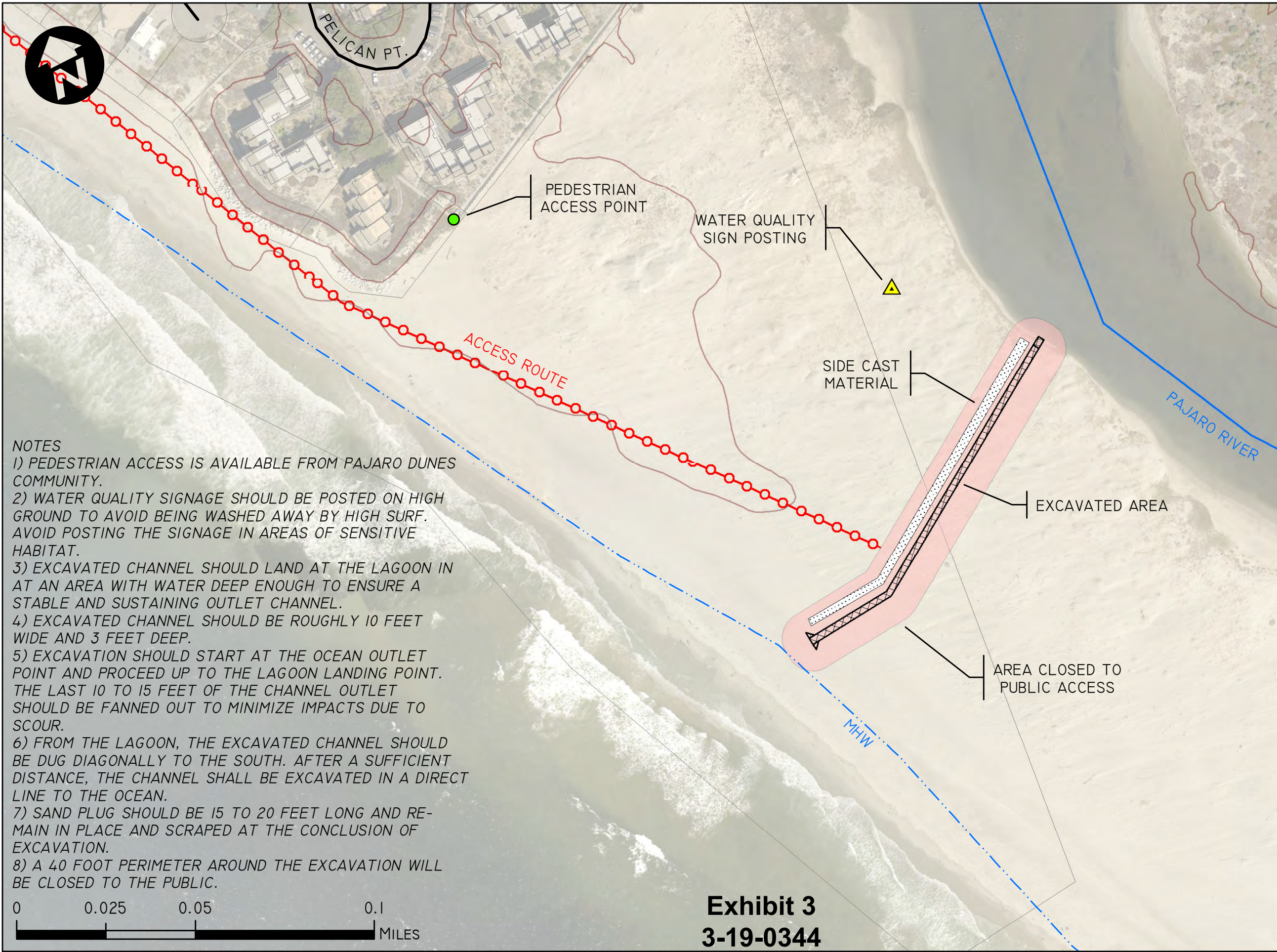
PAJARO RIVER BREACHING

LEGEND

-  STREETS
-  CONTOURS
-  RIVERS AND STREAMS
-  ACCESS ROUTE
-  EXCAVATED CHANNEL
-  SIDE CAST MATERIAL
-  PUBLIC CLOSURE AREA
-  PARCEL BOUNDARIES

DATE: 4/30/2019
 DRAFTER: JRB
 SCALE: 1" = 140'
 PROJECT: P24825
 FILE NAME: BREACHINGPLAN_V2.MXD
 SHEET 3 OF 3

SANTA CRUZ COUNTY
 DEPT. OF PUBLIC WORKS
 ZONE 7 FLOOD CONTROL
 701 OCEAN ST., ROOM 410
 SANTA CRUZ, CA 95060

- NOTES**
- 1) PEDESTRIAN ACCESS IS AVAILABLE FROM PAJARO DUNES COMMUNITY.
 - 2) WATER QUALITY SIGNAGE SHOULD BE POSTED ON HIGH GROUND TO AVOID BEING WASHED AWAY BY HIGH SURF. AVOID POSTING THE SIGNAGE IN AREAS OF SENSITIVE HABITAT.
 - 3) EXCAVATED CHANNEL SHOULD LAND AT THE LAGOON IN AT AN AREA WITH WATER DEEP ENOUGH TO ENSURE A STABLE AND SUSTAINING OUTLET CHANNEL.
 - 4) EXCAVATED CHANNEL SHOULD BE ROUGHLY 10 FEET WIDE AND 3 FEET DEEP.
 - 5) EXCAVATION SHOULD START AT THE OCEAN OUTLET POINT AND PROCEED UP TO THE LAGOON LANDING POINT. THE LAST 10 TO 15 FEET OF THE CHANNEL OUTLET SHOULD BE FANNED OUT TO MINIMIZE IMPACTS DUE TO SCOUR.
 - 6) FROM THE LAGOON, THE EXCAVATED CHANNEL SHOULD BE DUG DIAGONALLY TO THE SOUTH. AFTER A SUFFICIENT DISTANCE, THE CHANNEL SHALL BE EXCAVATED IN A DIRECT LINE TO THE OCEAN.
 - 7) SAND PLUG SHOULD BE 15 TO 20 FEET LONG AND REMAIN IN PLACE AND SCRAPED AT THE CONCLUSION OF EXCAVATION.
 - 8) A 40 FOOT PERIMETER AROUND THE EXCAVATION WILL BE CLOSED TO THE PUBLIC.

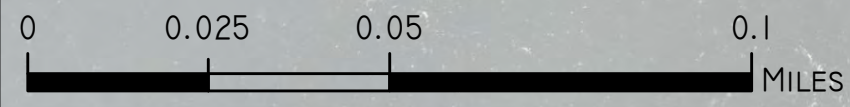


Exhibit 3
3-19-0344

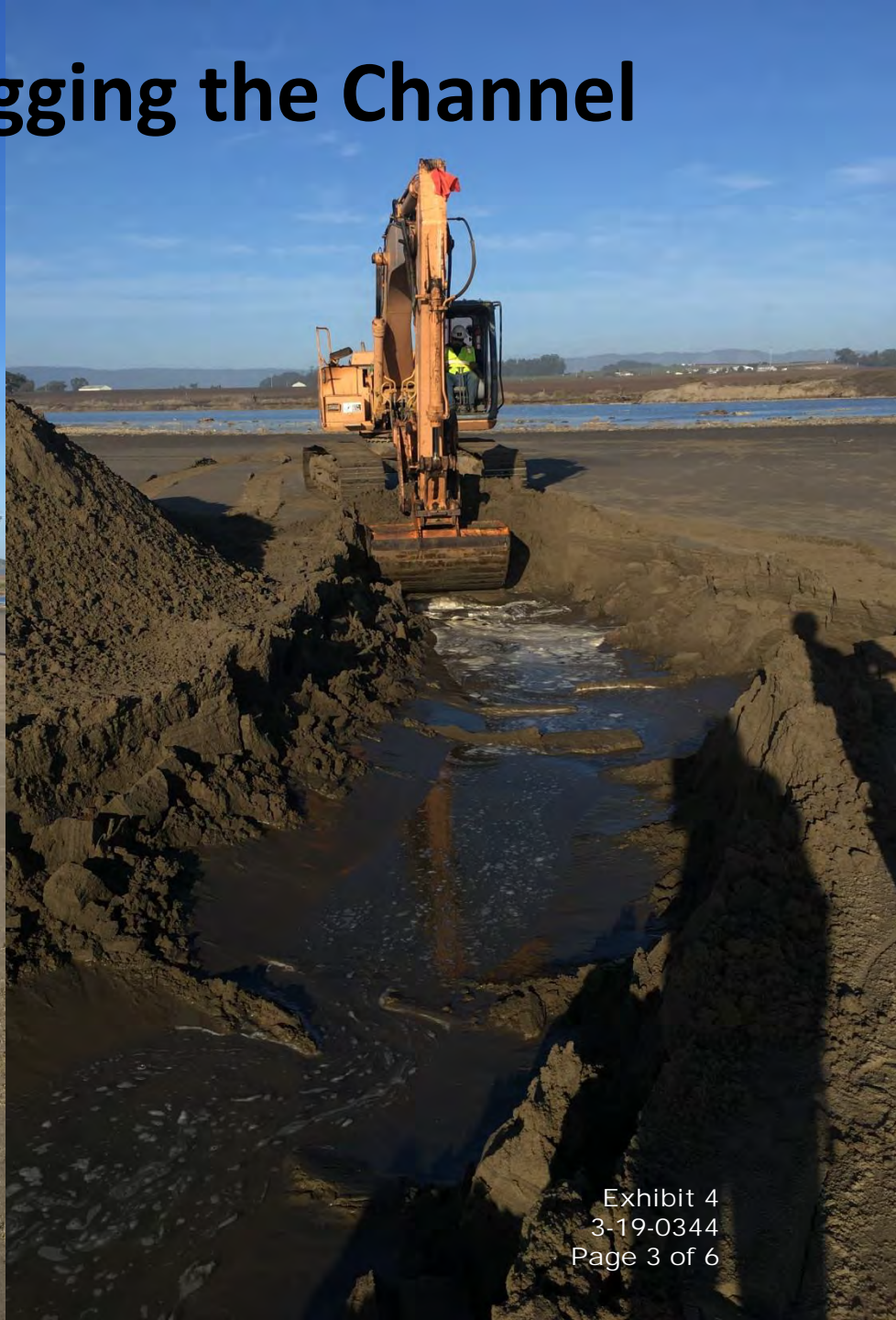
Excavator Beginning to Dig the Channel



Excavator Digging the Channel



Excavator Digging the Channel



Excavator Digging the Re-Angled Channel to Prevent Rapid Draining of the Lagoon



Re-Angled Channel



Excavating the Lagoon Plug



Lagoon De-Watering



Lagoon Slowly De-Watering



Technical Memorandum

date November 27, 2018

to Antonella Gentile

cc Mark Strudley, Ph.D. and Rusty Barker, M.S., P.E.

from James Jackson, P.E. and Bob Battalio, P.E.

subject Pajaro Dunes and Lagoon Flood Vulnerability Assessment (ESA Ref# 180065.00)

This memorandum presents findings of the Pajaro Dunes and Lagoon Flood Vulnerability Assessment, which is a first step to understanding flooding vulnerability at a local level for the Pajaro Dunes community. Ground and below-water (bathymetry) elevation surveys¹ were conducted and combined with publicly available elevation data to create a digital terrain model of lower Watsonville Slough that was used to develop still water flooding extents using Geospatial Information Software (GIS). The produced flooding extents, along with a ground survey of important community features, enable the County and Pajaro Dunes communities to better understand the risk of inundation for a range of water levels representing potential flooding under existing conditions. The digital terrain model and flooding threshold survey data produced for this study will enable future assessments of flooding vulnerability that include hydrodynamic modeling of the Watsonville Slough, sea level rise, and effects of potential adaptation actions for the Pajaro Dunes communities.

Several appendices included in this memorandum present the data collected and created for this study:

Appendix A: Flooding Threshold Feature Maps (aerial maps showing 2016 imagery, parcel boundaries and flooding threshold locations identified for this study).

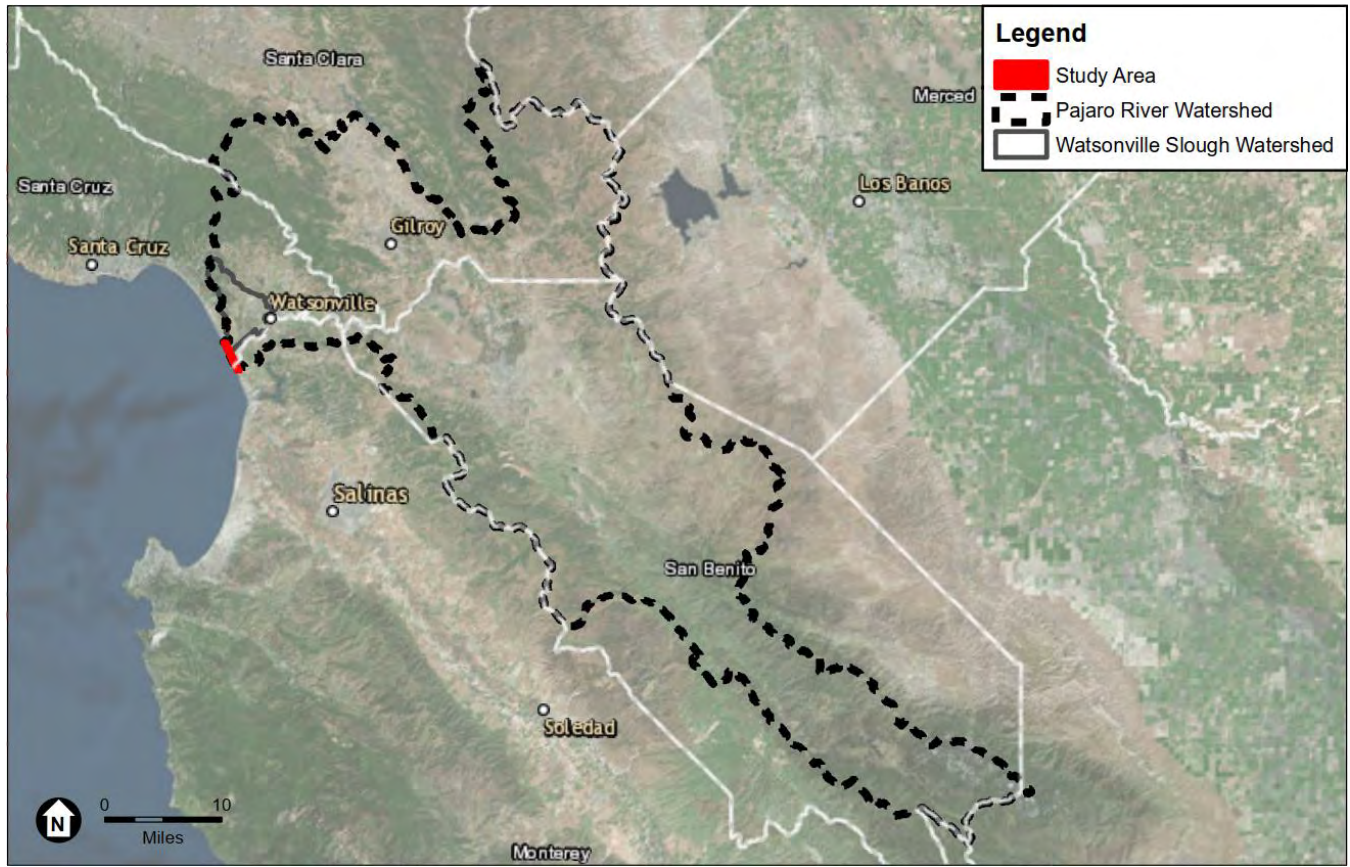
Appendix B: Combined Topo-Bathy Digital Elevation Model Maps (aerial maps showing topography derived from existing LiDAR and ESA survey data and flooding threshold locations).

Appendix C: Flood Mapping and Feature Data (Digital Elevation Model of surface used for flood mapping; GIS shapefiles depicting flooding extent for a range of elevations; GIS shapefile of flooding threshold locations).

¹ ESA performs land surveys and collects hydrographic data to augment traditional surveying services for the purposes of geomorphic interpretation, monitoring of project performance, and other specific uses consistent with Geologic and Landscape Surveys as defined in the Professional Land Surveyors' Act (California Business and Professions Code), and the Policy on Incidental Surveying Practice (Washington Board of Registration for Professional Engineers and Land Surveyors, Board Journal). ESA does not provide traditional land survey services such as property boundaries and maps for general use by others. ESA recommends that these traditional surveying services be accomplished by a licensed, professional land surveyor either under direct contract with the client or as a sub-consultant to ESA.

1. Background

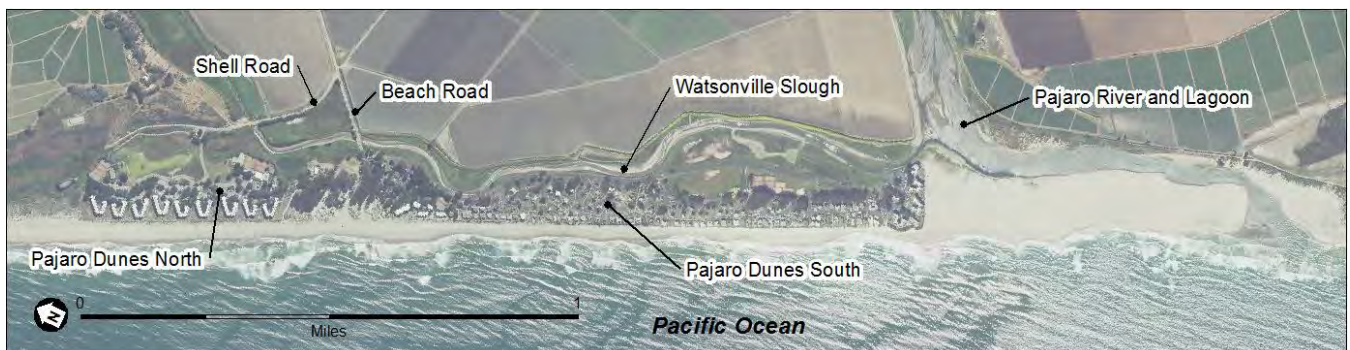
The study area consists of the Pajaro Dunes communities (North and South) in southern Santa Cruz County. The flooding sources in the area are the Watsonville Slough, Pajaro River and Lagoon estuary and tributaries (totaling 1300 square miles). Figure 1 shows the study area at the downstream end of the Pajaro River watershed. Figure 2 shows a closer view of the study area.



SOURCE: ESRI, Santa Cruz County

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 1
Study Location Map

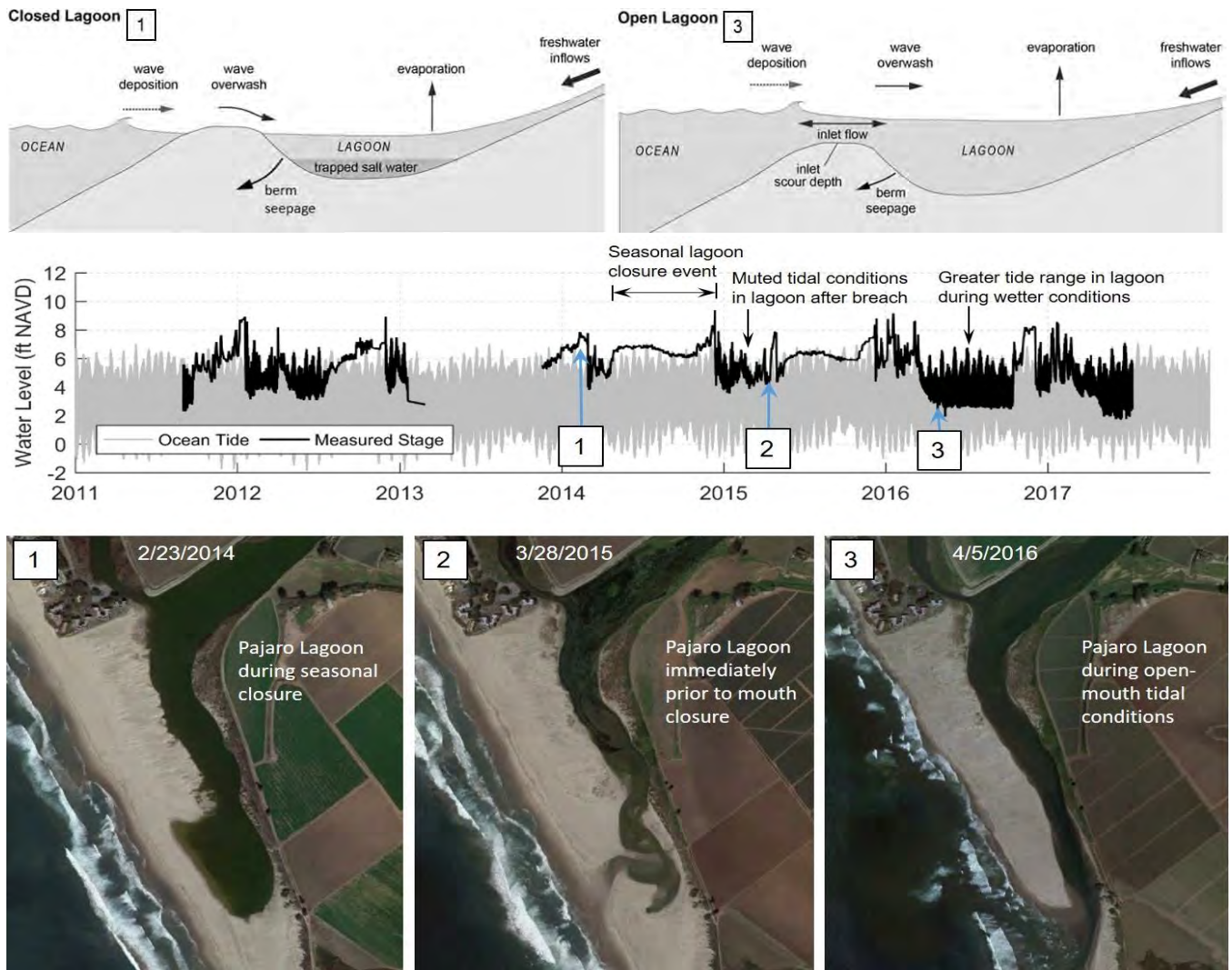


SOURCE: ESRI

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 2
Study Vicinity Map

The hydrology and water quality of the lower Pajaro River watershed are affected by the beach built by wave-driven sand transport. During low river flows, the beach elevation aggrades by wave action, and backwater can rise to flood stage. Inflows that raise the lagoon levels can come from wave run-up overtopping the beach and from watershed runoff. Wave overtopping affects the lagoon in several ways, including adding salt which can be considered a degradation from an agricultural and water supply perspective. Pajaro lagoon mouth morphology is illustrated in Figure 3, including cross sections for open and closed lagoon conditions, a timeseries of ocean tide and water levels (feet NAVD²) in Pajaro Lagoon and aerial imagery showing various lagoon mouth conditions. Note that the closed condition includes a beach berm that is built sand transported onshore by wave runup. This beach berm rises in elevation over time, until the lagoon water level rises high enough to breach the berm, scouring a new mouth, or excavation is applied to induce a “mechanical breach” (Battalio et al. 2006; Ladier et al. 2011; Behrens et al. 2015).



SOURCE: ESA, Moss Landing Marine Labs, PVWMA & Balance Hydrologics

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 3
Lagoon Cycle

² NAVD (North American Vertical Datum of 1988) is a fixed reference for elevations determined by geodetic leveling. The datum was derived from a general adjustment of the first-order terrestrial leveling nets of the United States, Canada, and Mexico.

Historically, many of California's lagoon-estuaries have been mechanically breached to limit flooding. Recently, mechanical breaching is regulated to reduce negative effects to wildlife, and analysis is required to ascertain the appropriate level and mode of intervention, essentially striking a balance between the multiple objectives. While these challenges are widespread, each lagoon estuary is unique in its mix of forcing parameters (runoff, ocean and beach conditions, basin geometry, development, ecology) and response characteristics (mouth closure frequency and persistence, lagoon estuary hydrology and water quality). Consequently, new analysis techniques have been developed to inform management planning and implementation.

Future conditions such as sea-level rise can also be a consideration, generally increasing the management challenge in many locations. The State of California has funded hazard mapping for much of the state, including the coast in the vicinity of the Pajaro, the lower reaches of Watsonville Slough, the Pajaro Dunes development and agricultural lands (see Previous Analyses below). The resulting maps and GIS files are intended to inform coastal land use planning (ESA PWA 2014; TNC Coastal Resilience) and therefore provide an indication of exposure under future sea-levels. More detailed analyses are recommended for project feasibility assessments.

ESA understands that there are local concerns about flooding of roads that may impede ingress and egress during an emergency in the Pajaro Dunes community. As a first step to address this access concern, this study presents a simplified analysis of flooding vulnerability by mapping the inundation extents of static water levels in the area.

1.1. Previous analyses

The Pajaro Dunes area was included in a regional study: *Monterey Bay Sea Level Rise Vulnerability Assessment* (ESA PWA 2014). With funding from the California Coastal Conservancy, the Natural Capital Project, and the City of Capitola, ESA modeled projected climate change impacts to the coast of Monterey Bay at a scale suitable for planning purposes. By using a variety of sea-level rise and wave climate scenarios, ESA produced maps of projected future coastal hazards, which include an integrated approach of stepping through time, eroding the coast, and flooding newly eroded areas through hydraulic connectivity. The project was advised by a Monterey Bay region-wide technical advisory group comprised of research institutions (UCSC, Naval Postgraduate School, Moss Landing, CSUMB and USGS), local planning agencies (Santa Cruz, Monterey Counties, Cities of Monterey, Santa Cruz, Seaside, Sand City, Capitola), and other technical experts. The study included coastal erosion and wave run-up hazards for the open coast portion of the Pajaro Dunes and mapped flooding potential in Lower Watsonville Slough resulting from elevated beach berm at the Pajaro River mouth. To estimate the potential worst-case scenario of a closed Pajaro Lagoon (see Figure 3 above) a maximum beach berm elevation of 16 feet NAVD was considered for the Pajaro River mouth. This elevation represents the flood risk associated with an unmanaged mouth that is allowed to naturally aggrade and close under existing conditions (no sea-level rise). The chosen elevation was based on geomorphic interpretation of sediment grain size characteristics, beach slopes and wave exposure. For future conditions with sea-level rise, the beach berm elevation was assumed to rise with sea-level in order to project future flooding extents associated with the seasonally closed lagoon. Hazard maps produced for the study can be viewed and downloaded from TNC's Coastal Resilience website³.

The *Pajaro Dunes Sea Level Rise Study Group Final Report* was published by a joint committee of both North and South Pajaro Dunes homeowners and management (Pajaro Dunes Sea Level Rise Study Group 2017). The report examines the potential effects of sea level rise on the livability of the Pajaro Dunes and presents

³ Coastal Resilience website, Monterey Flood and erosion mapping. <http://maps.coastalresilience.org/california/>

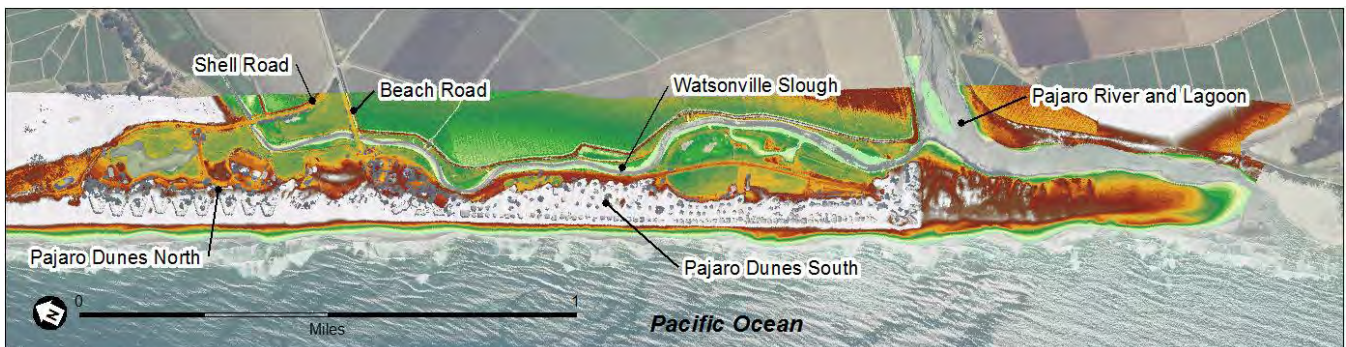
information on historical flooding events in the area. Potential impacts to community features are based on sea level rise projections of 8 to 10 inches by 2050 and 4 feet by 2100.

2. Data Collection

In order to conduct the flood vulnerability assessment, ESA downloaded available topographic data for the study area, worked with the County to collect pertinent information on important community features and flood thresholds, and performed a field survey in which identified features were verified and additional topographic and bathymetric data were collected.

2.1. Digital Elevation Model

ESA downloaded and reviewed publicly available digital elevation models (DEMs)⁴ for the study area. The most recent DEM was created from a LiDAR⁵ flight of the west coast after the 2016 El Nino (USGS 2016). The DEM is shown in Figure 4 below and presented in Appendix B of this memorandum. The LiDAR-based DEM was updated with topographic and bathymetric survey data collected by ESA in 2018 (see below for more information).



SOURCE: USGS 2016, NAIP 2012

NOTE: This Figure is not an official map and its use is intended only for this study.

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 4

Digital Elevation Model from 2016 LiDAR

2.2. Features Identified for Flooding Thresholds

The County contacted multiple groups with potential features that may be affected by flooding in and around the Pajaro Dunes community with a focus on existing flooding vulnerabilities. These features were selected because they have either flooded in the past or were perceived to be exposed due to their elevation and location, and are hence also representative of “flood thresholds” and “damage thresholds”. Table 1 lists the features identified for this vulnerability assessment and surveyed in the field by ESA. Features are mapped in Appendix A. Parcel data was also obtained from the County GIS website to enable a flood inundation assessment of properties (discussed below).

⁴ DEM is Digital Elevation Model which is essentially a map of elevations in a geometric grid.

⁵ LiDAR is Light Detection and Ranging or sometimes Light Imaging Detection and Ranging, and refers to a mapping technique using light emissions. In this case the LiDAR was employed from airplanes and is publically available (https://coast.noaa.gov/htdata/lidar2_z/geoid12b/data/6259/)

**TABLE 1
FEATURES IDENTIFIED FOR VULNERABILITY ASSESSMENT**

ID	Name	Location	Source
Pajaro Dunes South			
1	Staff gauge	Confluence, Watsonville Slough and Pajaro River	site visit
2	Puffin Ln sewage pump station (#3)	River Road at Puffin Lane	PDA and CoW
3	Dunes Hall	at Sandpiper Center	PDA
4	Drainpipe at playfield	between Sandpiper and Willets	PDA
5	Sanderling Cir sewage pump station (#2)	River Rd @ Sanderling Cir	PDA and CoW
6	PG&E Transformer T 1693	River Rd near Firehouse	PDA
7	South Gatehouse	2661 Beach Rd Bldg 1	PDA
8	Cable box w electrical	next to gatehouse sewage pump station	PDA
9	Gatehouse sewage pump station (#1)	entrance to River Road	PDA and CoW
Outside of Pajaro Dunes			
10	Telephone box	North side Beach Rd @ River Rd	PDA
11	Park Ranger manufactured home south	Palm Beach State Park	PDA
12	Park Ranger manufactured home north	Palm Beach State Park	PDA
13	Staff gauge	Watsonville Slough @ Beach Rd	SCC
14	Beach Rd at Watsonville Slough	Beach Rd at Watsonville Slough	PDA
15	Agricultural property	South of Beach Road and Shell Road intersection	PDA
16	Drain inlet @ intersection	Beach Rd and Shell Drive	PDA
17	Coastal Distribution System Station	East Corner of Beach and Rio Boca	PVWMA
18	Stage gauge	Watsonville Slough at Shell Rd	PVWMA
19	Flapgates	Watsonville Slough at Shell Rd	site visit
20	Shell Drive at Watsonville Slough	Watsonville Slough at Shell Rd	PDA
21	Watsonville Slough pumphouse	Watsonville Slough at Shell Rd	SCC
22	Pumphouse staff gauge	Watsonville Slough at Shell Rd	site visit
23	Well 13 (Drinking Water)	600 Shell Road	CoW
24	Sunset Booster Station (Drinking Water)	800 Shell Road	CoW
Pajaro Dunes North			
25	North Gatehouse	101 Shell Drive	PDN
26	Road at lagoon culvert	PD North	PDN
27	Staff gauge	PD North Lagoon	PDN
28	Cypress House	South end of PD North	PDN
29	Storm drain	Front of Rental Agency and Sales Office	site visit
30	North sewage pump station (#4)	next to 105 Shell Road	PDA and CoW
31	Shed Village	PD North	PDN
32	History Center	At T-junction in PDN	site visit
33	Roadway within Pajaro Dunes North	PD North	PDN
34	Lagoon House	PD North	PDN
35	Low point culvert	PD North	ESA\PDN
NOTES: CoW=City of Watsonville, PDA=Pajaro Dunes Association, PDN=Pajaro Dunes North, SCC=Santa Cruz County			

3. Field Survey

ESA conducted a field survey⁶ of the Pajaro Dunes, lower Watsonville Slough and surrounding area on June 19-20, 2018. During the field survey the team collected the following data using a combination of RTK GPS and Total Station⁷:

- Topographic and bathymetric survey of lower Watsonville Slough from Shell Road crossing to the confluence with the Pajaro River estuary.
- Geolocation and vertical control for features identified in Table 1 of this memorandum, including:
 - Spot checks for LiDAR on roadways
 - Established elevations to determine exposure thresholds of specific features.
 - Surveyed staff water level gauges to establish reference of staff readings to NAVD88⁸.

Following the topographic survey, ESA updated the 2016 LiDAR DEM to include bathymetric⁹ survey cross sections of the slough channel. ESA first created a DEM of the bathymetric portion of the channel using tools in ArcGIS and HEC-RAS 2D, then combined the resulting DEM with LiDAR portions of the 2016 DEM. The resulting combined topo-bathy DEM is shown in Appendix B to this memorandum.

3.1. Staff Gauges (Plates)

One goal of the field survey was to relate staff water level gauges in the vicinity to a consistent datum. A total of five gauges were identified and surveyed in the field. Table 2 below lists each staff gauge (and Feature ID in this memo) with the conversion required to convert readings (in feet) on the staff gauge to elevations in the North American Vertical Datum of 1988 (NAVD88) used in this study as well as NGVD 1929 (NGVD29) for reference. NAVD88 is similar to the average of lower low tides (mean lower-low water, MLLW) which is about 6 feet below mean higher-high water (MHHW) and 3 feet below mean tide level (MTL) based on the Monterey Bay tide gauge operated by NOAA¹⁰.

⁶ ESA performs land surveys and collects hydrographic data to augment traditional surveying services for the purposes of geomorphic interpretation, monitoring of project performance, and other specific uses consistent with Geologic and Landscape Surveys as defined in the Professional Land Surveyors' Act (California Business and Professions Code), and the Policy on Incidental Surveying Practice (Washington Board of Registration for Professional Engineers and Land Surveyors, Board Journal). ESA does not provide traditional land survey services such as property boundaries and maps for general use by others. ESA recommends that these traditional surveying services be accomplished by a licensed, professional land surveyor either under direct contract with the client or as a sub-consultant to ESA.

⁷ RTK is short for real time kinematics, a GPS receiver capable of RTK takes in the normal signals from the Global Navigation Satellite Systems along with a correction stream to achieve 2.5cm positional accuracy; Total Station is an electronic measuring device configured to locate distant points, typically by sighting a prism on a stadia rod.

⁸ North American Vertical Datum of 1988, a fixed reference for elevations determined by geodetic leveling. The datum was derived from a general adjustment of the first-order terrestrial leveling nets of the United States, Canada, and Mexico.

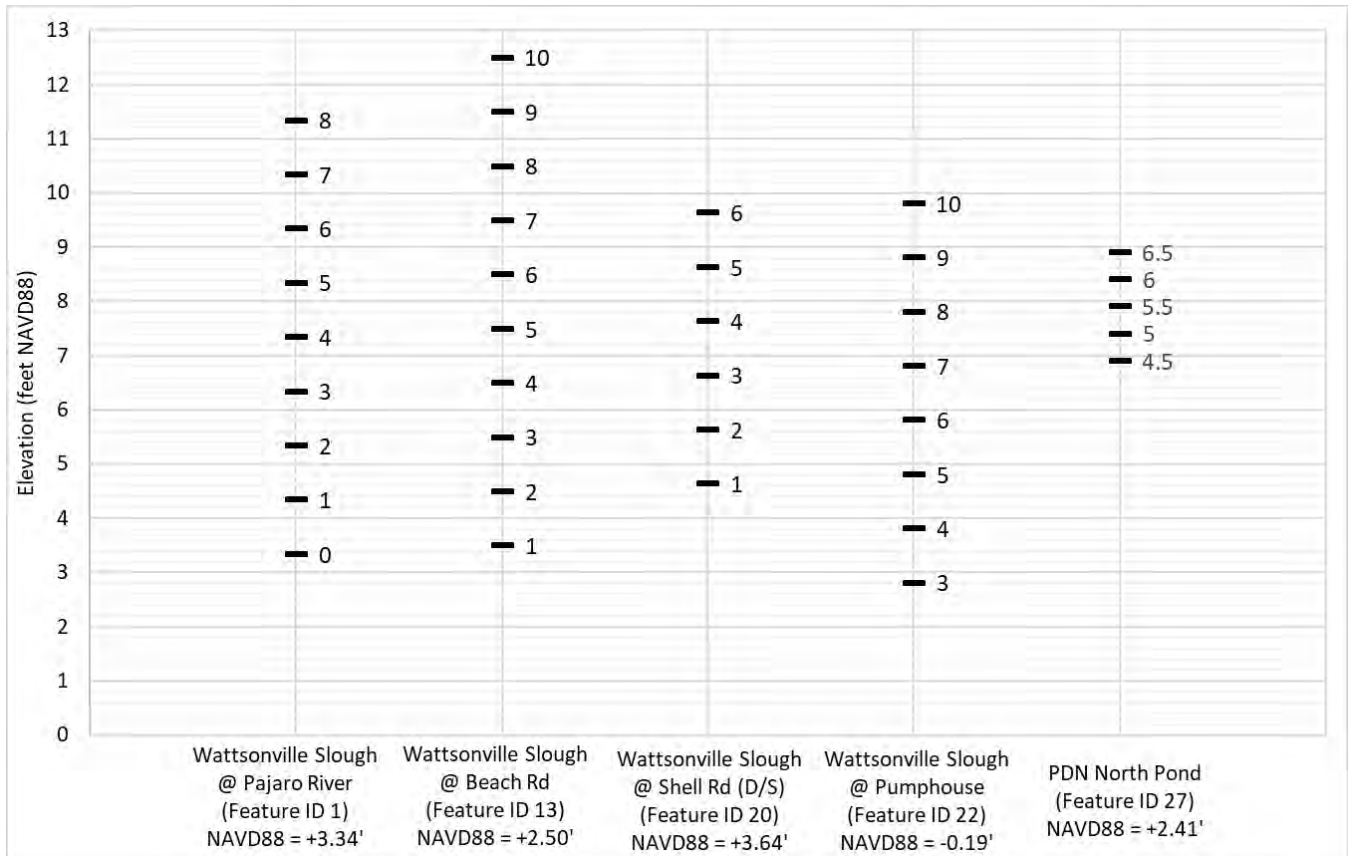
⁹ Bathymetric refers to under-water topography (vs above water which is topographic).

¹⁰ Tidal Datums for Monterey Station 9413450 are available at <https://tidesandcurrents.noaa.gov/datums.html?id=9413450>

TABLE 2
STAFF GAUGE ELEVATION CONVERSIONS TO THE NORTH AMERICAN VERTICAL DATUM OF 1988

Feature ID	Description	Staff Gauge Conversion to NAVD 88 (used in this study)	Staff Gauge Conversion to NGVD 29 (for reference)
1	Staff gauge at Watsonville Slough near confluence with Pajaro River	+ 3.34'	+ 0.65'
13	Staff gauge at Watsonville Slough near Beach Road crossing	+ 2.50'	- 0.19'
18	Staff gauge at Watsonville Slough on downstream culverts of Shell Rd crossing	+ 3.64'	+ 0.95'
22	Staff gauge at Pumphouse	- 0.19'	- 2.88'
27	Staff gauge at PDN pond	+ 2.41'	- 0.28'

For additional reference, staff gauge datums are referenced to NAVD88 in Figure 5 below. Elevations on each of the five staff gauges are labeled and plotted in reference to the North American Datum of 1988 on the y-axis. The elevation range shown for Feature ID 1, 20, and 27 were estimated.



SOURCE: ESA, Santa Cruz County.

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 5
Staff Gauge Datums Referenced to NAVD88

3.2. Flooding Thresholds

Features identified for this study were surveyed by ESA to establish flooding elevation thresholds. Each flooding threshold is listed in Table 3 below; multiple thresholds are listed for some features. Staff gauges are included in the table for completeness, the readings measured were chosen at the most convenient whole foot increment on the staff gauge (e.g. 3.0' reading refers to the 3' mark on the gauge).

**TABLE 3
FLOODING THRESHOLDS FOR VARIOUS FEATURES IN AND AROUND PAJARO DUNES**

ID	Name	Flooding Threshold (ft at Beach Rd gauge)	Flooding Threshold (ft NAVD88)	Surveyed Feature	Location
1	Staff gauge	3.84	6.34	3.0' reading	Watsonville Slough & Pajaro River
2	Puffin Ln sewage pump station (#3)	7.1	9.60	Adjacent hatch	River Road at Puffin Lane
		7.13	9.63	Electrical Box	
		8.97	11.47	Top of flood barrier	
3	Dunes Hall	7.62	10.12	Door threshold	at Sandpiper Center
4	Drainpipe at playfield	4.12	6.62	Top of culvert pipe	between Sandpiper and Willets
5	Sewage pump station (#2)	8.18	10.68	Adjacent hatch	River Rd @ Sanderling Cir
		8.35	10.85	Door threshold	
		8.52	11.02	Electrical box	
6	PG&E Transformer T 1693	6.48	8.98	Electrical Box	River Rd near Firehouse
		6.9	9.40	Adjacent hatch	
7	South Gatehouse	6.87	9.37	Door threshold	2661 Beach Rd Bldg 1
8	Cable box w electrical	8.18	10.68	Top of flood barrier	next to gatehouse pump station
		6.34	8.84	Ground within barrier	
9	Gatehouse sewage pump station (#1)	6.48	8.98	Door threshold	entrance to River Road
		7.46	9.96	Raised hatch	
10	Telephone box	6.24	8.74	Top of conc. footing	North side Beach Rd @ River Rd
11	Park Ranger residence south	6.6	9.10	Driveway	Palm Beach State Park
12	Park Ranger residence north	6.55	9.05	Driveway	Palm Beach State Park
13	Staff gauge	6	8.50	6.0' reading	Watsonville Slough @ Beach Rd
14	Beach Rd at Watsonville Slough	6	8.50	Center of road	Beach Rd at Watsonville Slough
15	Agricultural property	7.21	9.71	Berm Crest	South of Beach Rd
16	Drain inlet @ intersection	5.52	8.02	Grate	Beach Rd and Shell Drive
17	Coastal Distribution System Station	5.38	7.88	Ground at system	East Corner of Beach & Rio Boca
18	Stage gauge	4.14	6.64	3.0' reading	Watsonville Slough at Shell Rd
19	Flapgates	2.87	5.37	Top of lowest flapgate	Watsonville Slough at Shell Rd
20	Shell Drive at Watsonville Slough	6.37	8.87	Road Center	Watsonville Slough at Shell Rd
21	Watsonville Slough pumphouse	6.31	8.81	Pumphouse Deck	Watsonville Slough at Shell Rd
22	Pumphouse staff gauge	6.31	8.81	9.0' reading	Watsonville Slough at Shell Rd
23	Well 13 (Drinking Water)	7.78	10.28	Ground next to well	600 Shell Road
24	Sunset Booster Station (Drinking Water)	7.44	9.94	Ground next to well	800 Shell Road
25	North Gatehouse	8.19	10.69	West door threshold	101 Shell Drive
26	Road at lagoon culvert	6.93	9.43	Road center	PD North
27	Staff gauge	5.91	8.41	3.0' reading	PD North Lagoon
28	Cypress House	7.55	10.05	Ground outside door	South end of PD North
29	Storm drain	5.63	8.13	Grate	Front of Rental/Sales Office
		7.85	10.35	Door threshold	
30	North sewage pump station (#4)	8.06	10.56	Adjacent hatch	next to 105 Shell Road
		7.85	10.35	Door threshold	
31	Shed Village	6.76	9.26	Asphalt	PD North
32	History Center	6.74	9.24	Door threshold	At T-junction in PDN
33	Roadway within Pajaro Dunes North	6.56	9.06	Road Center	PD North
34	Lagoon House	8.09	10.59	Deck outside door	PD North
35	Low point culvert	5.26	7.76	Path center low point	PD North

4. Flood Elevation Mapping

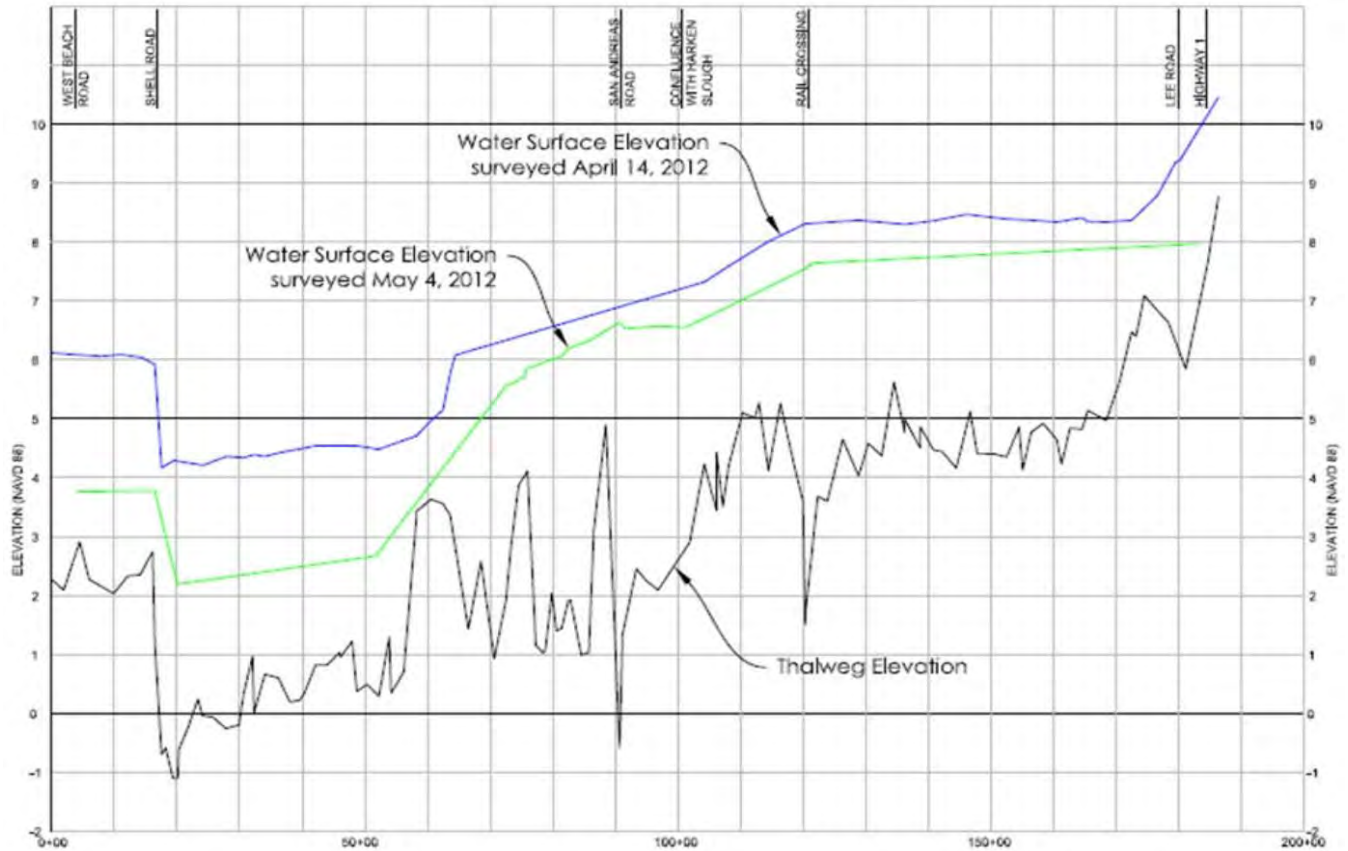
The selection of water surface elevations to be mapped was determined with County staff to capture the range of flooding elevations possible under existing conditions. The low end flood elevation is based on the lowest feature which is the grate and intersection of Shell Road and Beach Road. The grate floods at 5 feet on the Beach Road staff gauge (7.5 feet NAVD88). Flooding extents were mapped from 7.5 to 14 feet NAVD in 0.5-foot increments using the updated topo-bathy DEM described above. Flood maps (shapefiles¹¹) for each static flooding elevation are included in Appendix C to this document.

4.1. Stage-Storage in Lower Watsonville Slough and Pajaro Lagoon

To evaluate whether horizontal (static) flooding extents adequately characterize flood vulnerability of property and infrastructure in the lower Watsonville Slough, ESA examined stage-storage and observed flow data of the lower Watsonville Slough and Pajaro River systems. Stage-storage curves relate the volume of a basin to the water surface elevation and are based on the topography and bathymetry of the basin. While this study analyzed flood thresholds based on a static flooding elevation, the flood profiles of the Watsonville Slough and Pajaro River are typically sloped during significant flow events, meaning flood elevations increase with distance upstream for a given flow event. Based a review of several flood models, it was determined that the flood flows in the vicinity of the project site do not have a large slope. Hence the horizontal (static) flood elevations produced for this study provide a useful approximate indicator of the extent of over-land flooding.

For example, see Figure 6 showing the observed water surface elevations along Watsonville Slough at two dates in 2012. Note the April 2012 water surface profile in Figure 6, which shows that flow from upstream overtopped the Shell Road water control structures. At the same time, water backed up from the lower Watsonville Slough from the Pajaro River (which can include rainfall runoff from upstream and/or wave overwash at the Pajaro River mouth). The Pajaro Dunes study area is located downstream of Shell Road, approximately Station 8+00 in Figure 6. Note that the water level in the study area is nearly horizontal, unlike the water level farther upstream. This is because of the large storage volume of the Pajaro Lagoon relative to the flowrate in Watsonville Slough.

¹¹ Shapefile is the name used to designate a shape in Geographic Information System (GIS) mapping. In this case, each flood extents map is a shapefile which can be used in GIS.



SOURCE: Balance 2014.

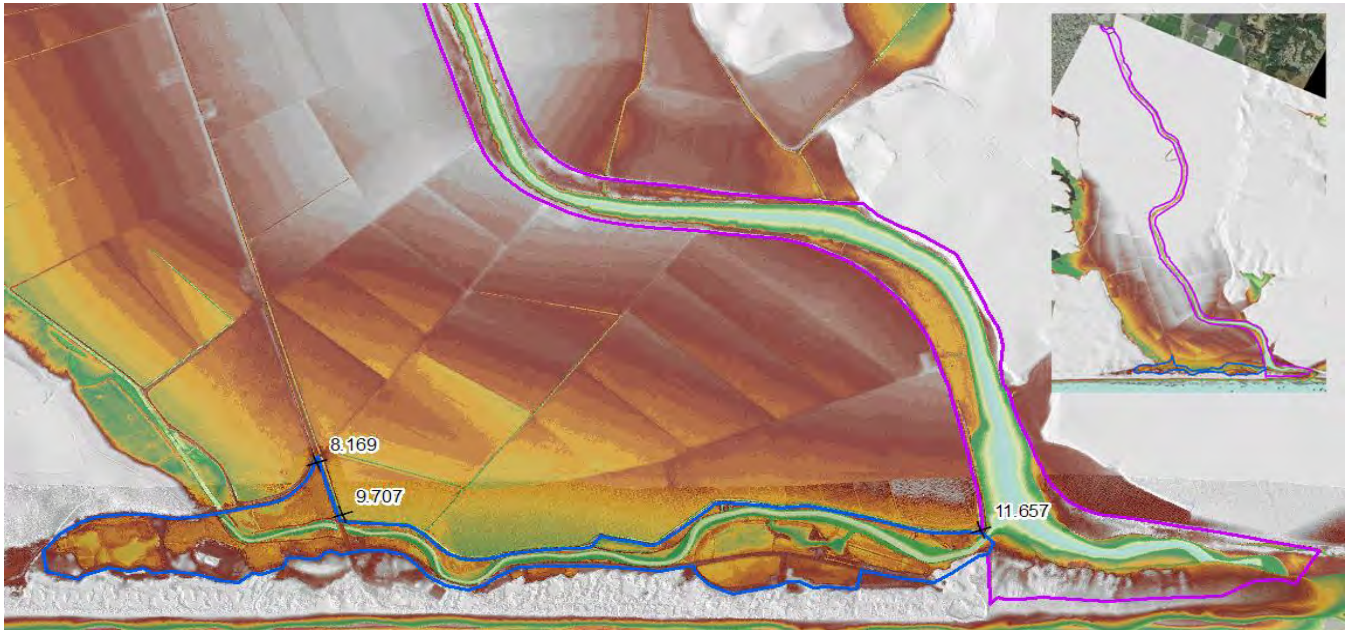
Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 6
Flood Profile of Watsonville Slough Channel with observed water surface elevations on April 14 and May 4, 2012

The stage-storage curve of lower Watsonville Slough and Pajaro River was developed using the updated topobathy DEM created by ESA for Watsonville Slough and Pajaro River 2010 LiDAR (NOAA 2012) modified to include bathymetry of the lower River (see Figure 7 below). The stage-storage curve shown in Figure 8 indicates that flood volumes above 660 acre-feet entering the Pajaro-Watsonville system (with Pajaro mouth-closed) would cause ponding at the Shell Rd-Beach Rd intersection (8.2 ft NAVD) and volumes above 960 acre-feet would cause levee overtopping and flooding of adjacent farmland south of Beach Road and east of lower Watsonville Slough (Feature ID 15, perimeter berm crest is overtopped at 9.7 ft NAVD). Because Shell Road serves as a water control structure on the lower Watsonville Slough, the primary source of flooding during regular events is dominated by runoff from the Pajaro River. Note that the storage volume within the Watsonville Slough channel upstream of Shell Road is not included in the stage-storage curve used in this study; with additional survey, this additional storage volume could be added.

We found that even low river flow events such as an annual or 2-year recurrence in the Pajaro River can supply volumes to the combined lagoon system well beyond the in-levee capacity and cause the water surface to raise and overtop the Pajaro mouth (assuming mouth is maintained around 9 feet NAVD, consistent with recent breaching records). If the Pajaro River mouth accretes above 10 feet NAVD, adjacent farmland, roads and some property could be subject to flooding from a typical (i.e. 2-year) rainfall event in the Pajaro and/or Watsonville watershed. Flood water levels in the Pajaro Dunes area would remain relatively horizontal during such an event.

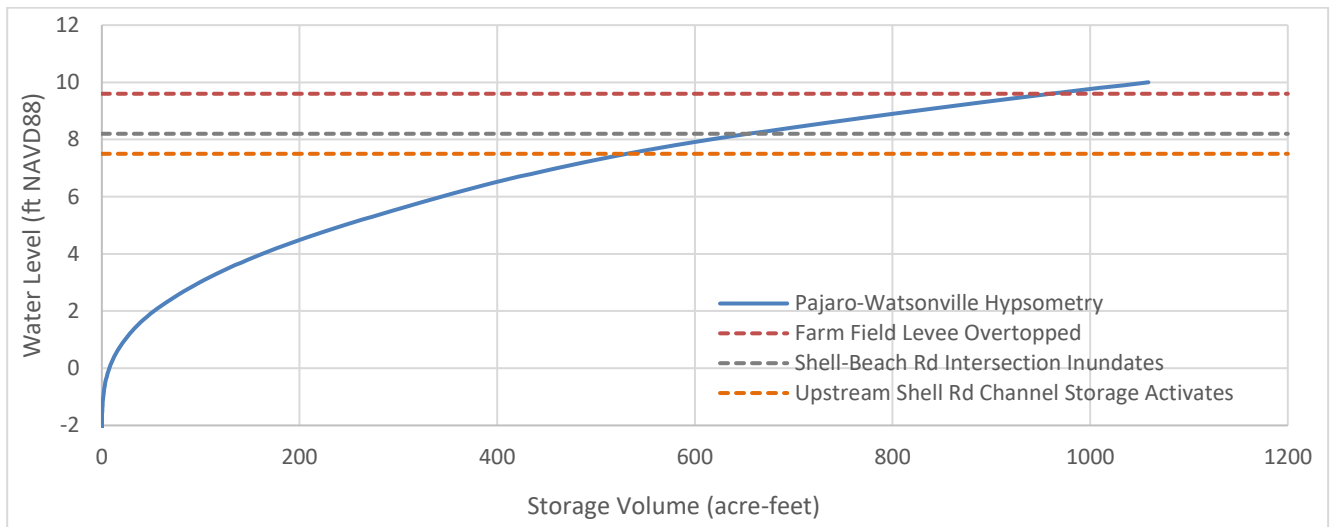
The relatively small storage volume in the lower Watsonville Slough and Pajaro River (collectively, the Pajaro Lagoon) compared to a typical runoff volume combined with levee overtopping threshold of about 10 ft NAVD indicate that the water surface profile may remain nearly horizontal during flow events. Hence a horizontal (static) water level around 10 feet approximately characterizes the potential flooding vulnerabilities in the Pajaro Dunes area.



SOURCE: NOAA 2012, USGS 2016; ESA 2018
 NOTE: This Figure is not an official map and its use is intended only for this study.

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 7
 Lower Watsonville Slough (blue) and Pajaro River (purple) Hypsometry Extents



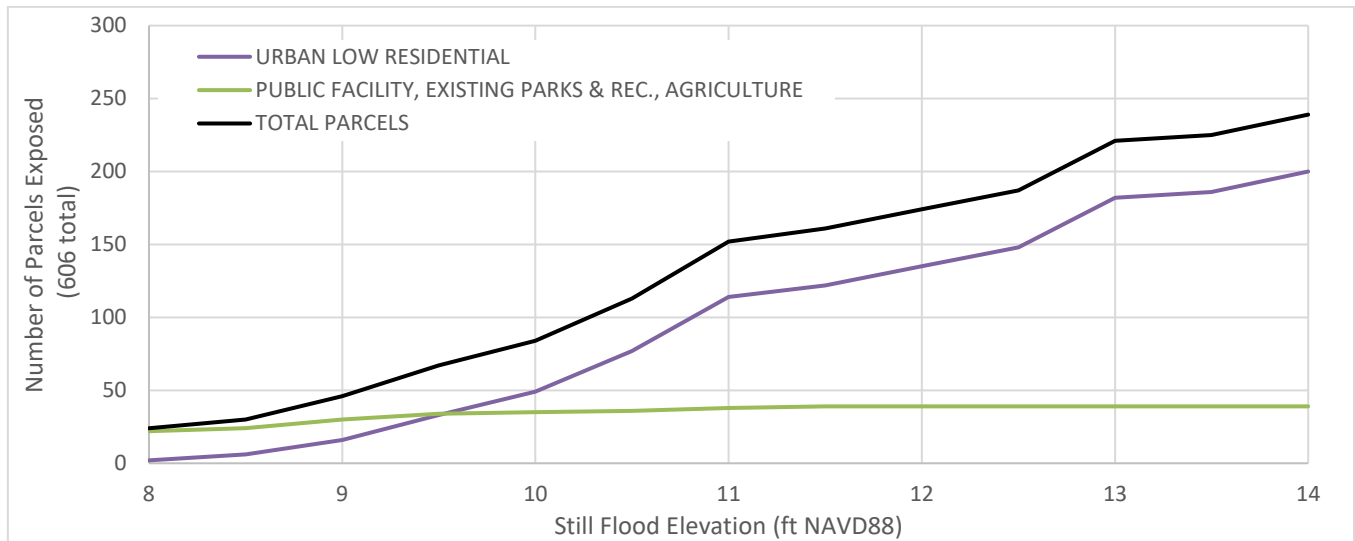
SOURCE: ESA

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 8
 Combined Stage-Storage (hypsometry) curve for Lower Watsonville Slough and Pajaro River

5. Initial Flood Exposure and Vulnerability Assessment

Using the combined digital terrain model and flooding extent maps described above, ESA conducted a GIS overlay analysis to assess flooding vulnerability to parcels and surveyed features in the Pajaro Dunes study area. Parcel and feature exposures to still water flooding in our study area on the landward side of Pajaro Dunes are shown in Figure 9 and Figure 10 below. Figure 9 presents the total number of parcels (by land use type and total, in percent of total) that are exposed to increasing flood levels in lower Watsonville Slough. Note that most public, parks and agriculture parcels (green line) are flooded at all elevations above 8 ft NAVD so the parcel count does not increase significantly with flood elevation. Also, a number of agricultural parcels are flooded in the valley at higher elevations but are outside of the study area. Figure 10 presents the number of features surveyed by ESA exposed to increasing flood levels. The feature totals shown in Figure 10 do not include some features that were identified for the survey but are not damaged by flooding: staff gauges (4), flap gates (1), and culvert into the drain field (1). See Table 3 above for specific flood elevation thresholds for features identified for this study.

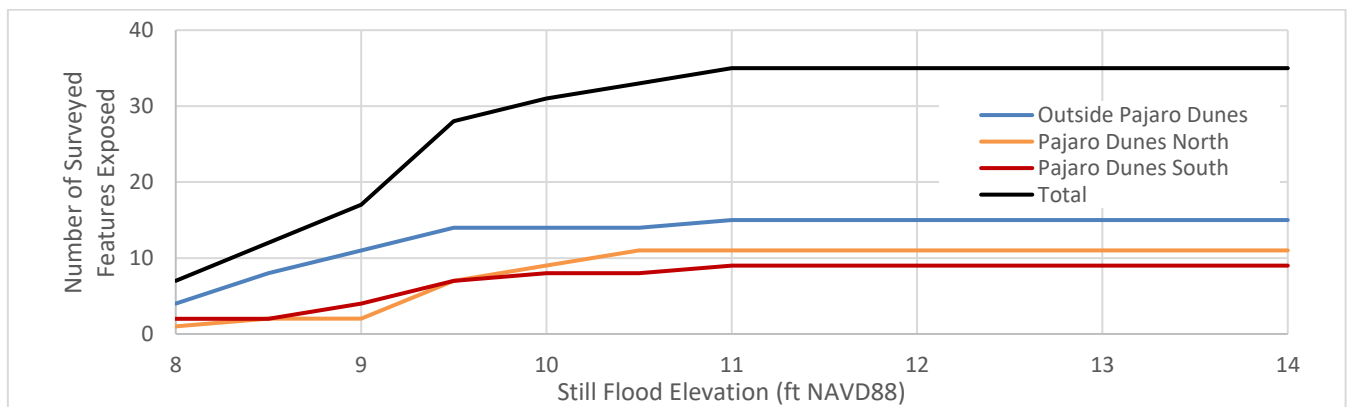


SOURCE: ESA, Santa Cruz County

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 9

Parcels Exposed by Still Water Flooding Elevations in the Study Area



SOURCE: ESA

Pajaro Dunes and Lagoon Flood Vulnerability Assessment

Figure 10

Count of Surveyed Features Exposed by Various Still Water Flooding Elevations

6.Future Work

This study produced maps of static flooding extents to gain a first-order understanding of flood vulnerability in the Pajaro Dunes community, but in reality flooding can be dynamic (changing in time and location) during more extreme events. Flooding vulnerabilities around the Pajaro Dunes area during more significant rainfall-runoff events (e.g. 10-year to 100-year) can be further analyzed with a combined hydrodynamic model of the lower Watsonville Slough and Pajaro Lagoon. The following general applications would be possible with the development of a hydrodynamic model that includes lower Watsonville Slough and Pajaro River/Lagoon.

- *Modeling to support flood management:* Use hydrodynamic model to test potential adaptation options and assess impacts to flood extents. By creating a hydrodynamic model for the lower Wattsonville Slough and Pajaro River/Lagoon, the community and County will gain a better understanding of the potential flooding extents under various extreme events (e.g. 10- 20- or 100-year recurrence). The hydrodynamic model could then be used to analyze options to reduce existing flood risks in the community as well as options of adapting to sea-level rise and climate change in the future.
- *Climate-Influenced Flood Hydraulics:* Use hydrodynamic model to analyze flooding vulnerabilities considering sea-level rise and expected increases in precipitation intensity, and test adaptation approaches. Flooding vulnerabilities to the Pajaro Dunes community and surrounding area will worsen as sea-level rises and rainfall events become more severe. A hydrodynamic model would enable the community to better understand future flooding hazards affected by climate change as well as to test various adaptation options.
- *Lagoon Management:* Apply ESA's existing quantified conceptual model (QCM)¹² for Pajaro River to study Pajaro Lagoon functions and management strategies. For example, the QCM could assess the mouth management requirements and resulting water levels for existing conditions, with higher sea levels, and with measures to maintain flood protection with sea-level rise. The QCM can also be used to define the ocean boundary conditions (river mouth geometry) for modeling of flood hydraulics.
- *Refine Coastal Resilience Mapping:* Apply information gained in this study to update the Coastal Resilience hazard maps, to support future adaptation planning. This study has produced more accurate mapping of potential flood extents and clarified the lagoon mouth management and associated lagoon water levels: This information can be used to improve the Coastal Resilience mapping of future flooding with sea-level rise.

¹² The QCM is a hydrologic/geomorphic model of the Pajaro River Lagoon and beach developed for the Pajaro Valley Water Management Agency (PVWMA) to assess the potential effects of upstream water management projects on lagoon hydrologic conditions. The model applies an interconnected water balance for the lagoon and sediment balance of the beach and lagoon mouth, which together allow users to understand how changes to hydrology can influence seasonality of lagoon conditions that result from seasonally shifting coastal and fluvial conditions.

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BIOLOGICAL OPINION

ACTION AGENCY: U.S Army Corps of Engineers, San Francisco District

ACTION: Issuance of a Rivers and Harbors Act Section 10 permit and a Clean Water Act Section 404 permit for Pajaro River Sandbar Breaching activities in Santa Cruz County, California

CONSULTATION

CONDUCTED BY: National Marine Fisheries Service, West Coast Region

TRACKING NUMBER: SWR-2007-7780

DATE ISSUED: June 23, 2015

I. CONSULTATION HISTORY

On March 13, 1998, the U.S. Army Corps of Engineers' San Francisco District (Corps) requested initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). The Corps proposed to permit the County of Santa Cruz Department of Public Works (County) to breach the sandbar at the mouth of the Pajaro River for flood control purposes. On July 7, 1999, NMFS issued a non-jeopardy biological opinion to the Corps for their proposed permit. The Corps issued their permit on August 19, 2002, which was valid until September 30, 2007 (Permit No. 223670S). The County conducted two breaching events (December 10, 2002, and December 5, 2003) in accordance with the Corps' permit between 2002 and 2007.

On November 15, 2007, the Corps extended their permit (Permit No. 223670S) to September 1, 2008. On November 19, 2007, the Corps requested reinitiation of consultation for proposed breaching activities. The Corps proposed a 10-year reauthorization of their current permit. NMFS received the Corps' request on November 28, 2007, and the lagoon was mechanically breached by the County on December 19, 2007.

On January 24, 2008, NMFS responded to the Corps' request for initiation by letter stating we had not received an adequate initiation package. Our letter included the information we would need in order to initiate consultation. Between February 2008, and September 2009, we received additional information from the County, though still not adequate for initiation of consultation.

On December 11, 2008, the Corps extended their permit for one year after discussions with NMFS. The lagoon was mechanically breached on January 22, 2009, under an emergency extension of Permit No. 223670S.

In October and December 2009, the County requested the Corps issue a time extension to their permit in order to allow time to complete the section 7 consultation on the reauthorization of the permit. The County requested the extension to compile information we requested in our January 24, 2008, letter to the Corps and so the County would not be breaching without a permit if flooding occurred. On June 10, 2010, the Corps granted the request and extended the permit to December 1, 2010. No mechanical breaches occurred in 2010 (or 2011).

In July 2010, NMFS, the U.S. Fish and Wildlife Service, and the County held a meeting to discuss the project and the status of the information requested by NMFS. The Corps was invited but was unable to attend. At the meeting, the County described refinements to their breaching methods, but did not provide, in writing, a new project proposal. In general, breaching further to the south on the beach was discussed.

On January 17, 2012, after utilizing the ESA section 7 emergency consultation regulations (50 CFR 402.05) the Corps issued an emergency permit to the County to conduct a breach; the sandbar was mechanically breached by the County on January 18, 2012, using the method NMFS recommended to the County at the July 2010, meeting. Consultation for this proposed project was also initiated on January 17, 2012, the date NMFS received written confirmation the County would modify their breaching method. However, between January 2012 and summer/fall 2012, NMFS and the County had several discussions regarding water quality monitoring and steelhead sampling, which the County opted not to include in their project description.

On November 28, 2012, the County requested Corps authorization to conduct an emergency breach, and on November 29, 2012, the Corps issued their authorization to the County. However, a mechanical breach was not conducted because the sandbar breached naturally on November 30, 2012.

On January 30, 2014, after utilizing the ESA section 7 emergency consultation regulations (50 CFR 402.05), the Corps issued an emergency permit to the County to conduct a breach. The Corps' emergency authorization was valid for seven days, but lagoon water surface levels never rose to such a height that mechanical breaching was needed. However, on February 28, 2014, again after utilizing the ESA section 7 emergency consultation regulations (50 CFR 402.05), the Corps issued an emergency permit to the County to conduct a breach; the sandbar was mechanically breached by the County on February 28, 2014, using the method NMFS recommended to the County.

On December 9, 2014, after utilizing the ESA section 7 emergency consultation regulations (50 CFR 402.05), the Corps issued a *Notice of Intent To Issue Emergency Permit to Santa Cruz County* to conduct a breach. On December 12, 2014, the sandbar was mechanically breached by the County using the method NMFS recommended to the County.

During this formal consultation, NMFS noted the number of breaches proposed under the proposed permit was much greater than the number of breaches that occurred historically. NMFS shared the concern with the County that the greater number of breaches were likely to lead to additional impacts to steelhead and/or their habitat. NMFS and the County discussed how the proposed project should reflect what was most likely to occur. On April 29, 2014,

NMFS received via email the County's modified project description. The Corps was kept informed of the modification and agreed to these changes to the project description. In June, the County requested and received a copy of the draft project description that would be part of the biological opinion. In August, NMFS received minor editorial comments from the County regarding the project description. On June 23, 2014, NMFS received via email the County's consultant's *Biological and Water Quality Monitoring Report – Pajaro Lagoon Breach 2/28/2014* (Kittleson Environmental Consulting 2014).

II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to issue a permit to the County to place fill in waters of the United States for the breaching of the sandbar at the mouth of the Pajaro River in Santa Cruz County, California for flood control purposes. The permit is a 10-year reauthorization of the County's current Corps permit pursuant to the provisions of Section 404 of the Clean Water Act (33 U.S.C. Section 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403). The sandbar is located on Sunset State Beach owned by the California Department of Parks and Recreation (CDPR) and the lagoon is adjacent to the residential community of Pajaro Dunes and agricultural properties. Sandbar breaching is proposed to occur up to two times per year between October 15 and March 1. No more than six breaches will occur in 10 years. In no more than one year will there be two breaches; if and when that does occur, these breaches will count as two of the proposed six breaches. NMFS does not anticipate any interrelated or interdependent actions associated with the proposed action.

A. Description of Proposed Work

1. Program Background

The Pajaro River lagoon is located behind a large barrier beach. In some years, due to a decrease in flows from the Pajaro River and natural coastal processes, a sandbar forms at its mouth, where the Pajaro River discharges to the Pacific Ocean. The formation of the sandbar closes the mouth of the river, preventing outflow to the ocean, and forms a lagoon. When the sandbar is in place, water levels can rise in the lagoon and its associated sloughs and marshes.

The sandbar generally forms in the late summer or early fall. Natural breaches often occur during the early winter. When natural breaches occur, the lagoon typically stays open until late summer or early fall. However during some years, ocean wave action and/or river flow is not sufficient to naturally breach the sandbar before flooding may occur. High water levels in the lagoon can cause localized flooding in the agricultural and residential areas (*e.g.*, Pajaro Dunes Residential Community) that surround the lagoon and adjacent sloughs. Flooding can threaten farmlands, Santa Cruz county roads, emergency access to and from Pajaro Dunes, the sewage collection and delivery network for Pajaro Dunes, as well as electrical infrastructure and property within the community. To prevent this localized flooding, the County initiated a mechanical breaching program in the 1950s. Prior to this time, local area residents were known to perform breaching activities individually (California Coastal Commission 2006).

2. Breaching activities

Breaching activities consist of two stages, mobilization and breaching, described below.

a. Mobilization

Water levels at the Watsonville slough staff gage are monitored daily during periods of high flow in the Pajaro River during the rainy season and biweekly during the dry season. From October 15 through March 1, when the gage shows the water level has reached an elevation of approximately +3.5 feet Mean Sea Level (MSL) and is rising, mobilization to breach the sandbar will begin. Prior to mobilization, the County will notify the Corps, NMFS, the U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, California Coastal Commission, C DPR, and Pajaro Dunes Homeowners Association.

A hydraulic excavator will be brought to the sand bar site on a rubber-tired vehicle to construct the channel to breach the sandbar. The hydraulic excavator and support vehicles will access the sand bar via an access route currently used by C DPR rangers for patrolling Sunset State Beach. From Sunset State Beach, breaching equipment and support vehicles will be mobilized along the beach below the High Tide Line where the beach is un-vegetated. A staging area, measuring approximately 50 feet by 50 feet, will be set up adjacent to the breaching location.

b. Breaching

During the rainy season described above, breaching of the sand bar will occur when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, or when flooding is evident on Beach or Shell Roads. Mechanical breaching of the sand bar will be timed to take place under the following conditions: after high tide has peaked and receded (to allow sufficient time for the river flow to widen and deepen the new breach enough so it remains open through subsequent high tides so that flood control is achieved while maintaining habitat), and during daylight hours (when large waves would be visible so that danger to County staff operating on the sandbar is minimized). During mobilization and breaching activities, the County will control access to the breaching site.

To avoid flooding, when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, the County will excavate an outlet channel from the lagoon that begins near the southern end of the lagoon (depth and width of the outlet channel to be determined on the ground). The outlet channel will be angled diagonally to the south and be located behind the barrier beach crest. After a sufficient distance (to be determined on the ground), the outlet channel will be excavated in a direct line to, and through, the barrier beach crest to the ocean. Channel excavation will begin from the ocean side of the sandbar and work towards the lagoon. A sand plug will be left in place between the ocean and lagoon. Approximately 5-10 feet inland from the barrier beach crest, the outlet channel will be fanned out mechanically to reduce scour of the outlet channel. The angle, length, slope, width and depth of the outlet channel will be based on lagoon elevation, flow, and other parameters. The sand plug will be removed when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, or when flooding is evident on Beach or Shell Roads.

The proposed breaching methodology differs from the previous methodology where the breaching location was determined based on where the lagoon was deepest and where the least amount of excavation would be necessary. Creating and maintaining the outlet channel under the proposed methodology will likely require the County to conduct more sandbar management activities than occurred in the past. The County will perform sand bar management by incorporating actual hydrological conditions of the lagoon during storm events. Outlet channel configurations will adopt an adaptive management approach in determining the length and slope of the channel.

By conducting breaching in this manner, the County intends to minimize extensive scouring of the outlet channel and evacuation of the lagoon. A wide (*i.e.*, 10 feet), shallow (*i.e.*, 3 feet) outlet channel is proposed to minimize scouring, maintain lagoon habitat, and meet flood control purposes.

After breaching is completed, the County will notify the agencies a breach has occurred. If the sandbar should reform and further work is deemed necessary, the County will notify all the agencies and all follow-up work will adhere to the procedures identified for the initial breach.

B. Description of the Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action (50 CFR 402.2). The action area for this project is defined as the tidally influenced portion of the Pajaro River (*i.e.*, from the mouth to the vicinity of the Highway 1 bridge, approximately five miles), the sandy beach area between the lagoon and the Pacific Ocean, and the surf zone where the outlet channel enters the Pacific Ocean, southwest of Watsonville in Santa Cruz County, California. The Pajaro River forms the Santa Cruz/Monterey County line border.

III. ANALYTICAL FRAMEWORK

A. Jeopardy Analysis

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the South-Central California Coast (S-CCC) steelhead Distinct Population Segment's (DPS) range-wide conditions, the factors responsible for that condition, and the species' likelihood of both survival and recovery; (2) the Environmental Baseline, which evaluates the condition of this listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the likelihood of both survival and recovery of this listed species; (3) the Effects of the Action, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on this species in the action area; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on this species.

The jeopardy determination is made by adding the effects of the proposed Federal action and any Cumulative Effects to the Environmental Baseline and then determining if the resulting changes

in species status in the action area are likely to cause an appreciable reduction in the likelihood of both the survival and recovery of this listed species in the wild.

The jeopardy analysis in this biological opinion places an emphasis on the range-wide likelihood of both survival and recovery of this listed species and the role of the action area in the survival and recovery of this listed species. The significance of the effects of the proposed Federal action is considered in this context, taken together with cumulative effects, for purposes of making the jeopardy determination. We use a hierarchical approach that focuses first on whether or not the effects on salmonids in the action area will impact their respective population. If the population will be impacted, we assess whether this impact is likely to affect the ability of the population to support the survival and recovery of the DPS.

B. Adverse Modification Determination

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02, which was invalidated by *Gifford Pinchot Task Force v. USFWS*, 378 F.3d 1059 (9th Cir. 2004), amended by 387 F.3d 968 (9th Cir. 2004). Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of critical habitat for the S-CCC steelhead DPS in terms of primary constituent elements (PCEs – sites for spawning, rearing, and migration), the factors responsible for that condition, and the intended conservation value of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of critical habitat in the action area, the factors responsible for that condition, and the conservation value of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs in the action area and how that will influence the conservation value of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the conservation value of affected critical habitat units.

For purposes of the adverse modification determination, we add the effects of the proposed Federal action on S-CCC steelhead critical habitat in the action area, and any Cumulative Effects, to the Environmental Baseline to determine if there are resulting changes to the conservation value of critical habitat in the action area. If the proposed action will reduce the conservation value of critical habitat in the action area we then assess whether or not the conservation value of the DPS critical habitat designation as a whole is likely to be appreciably reduced.

C. Use of Best Available Scientific and Commercial Information

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports.

Additional information regarding the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, the biological assessment for this project, and project meeting notes if applicable. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the proposed sand bar breaching program on threatened S-CCC DPS steelhead (*Oncorhynchus mykiss*, 71 FR 834) and their designated critical habitat. This DPS includes steelhead in coastal California streams from the Pajaro River down to, but not including, the Santa Maria River. On September 2, 2005, NMFS designated critical habitat for S-CCC steelhead; critical habitat includes the Pajaro River and its lagoon (70 FR 52488).

A. Species Description and Life History

Steelhead are anadromous fish, meaning they are born in fresh water, migrate to the ocean where most of their growth occurs, and then eventually return to fresh water to spawn. It is widely acknowledged that steelhead life history strategies are the most variable of all salmonids (Shapovalov and Taft 1954, Barnhart 1986, Busby *et al.* 1996, McEwan 2001). Steelhead are iteroparous, capable of spawning multiple times in their lives, but sampling indicates that most (sometimes nearly all) spawn only once (Quinn and Myers 2004). In a review of California steelhead populations, 81.5 percent were first time (maiden) spawners (Busby *et al.* 1996). Steelhead that spawn multiple times, 70 to 85 percent spawn only twice (Barnhart 1986). During the upstream migration to spawning sites, adults may swim an average of approximately five miles per day (NMFS 2003). According to Fukushima and Lesh (1998) the timing of adult migration in the Pajaro River is November through February. Based on adult steelhead migration data from nearby watersheds (Waddell Creek in Santa Cruz County [Shapovalov and Taft 1954] to the north, and Carmel River in Monterey County [Dave Dettman, Monterey Peninsula Water Management District, unpublished data]) to the south, the peak likely occurs in mid-March. Shapovalov and Taft (1954) found that a smaller portion of the steelhead run entered Waddell Creek with the first storms, especially if these occur early. NMFS infers the case is similar in the Pajaro River, due to their close geographic proximity.

Studies of coastal *O. mykiss* populations in central and southern California reveal three principal life-history groups, which NMFS has designated as fluvial-anadromous, lagoon-anadromous, and freshwater resident (Boughton *et al.* 2007, Smith 1990, Hayes *et al.* 2004, Bond 2006). Both anadromous groups classify as winter steelhead, in that adults migrate during the winter rainy season. Fluvial-anadromous juveniles usually spend one to three years in fresh water, then smolt and migrate to the ocean, using an estuary only for acclimation to saltwater and as a migration corridor (a smolt is a young steelhead that is undergoing physiological changes in preparation for entering the ocean). According to Fukushima and Lesh (1998) the timing of smolt migration in the Pajaro River is January through June with the peak being March through May. They usually

spend one to four years in the ocean, and then return to fresh water to spawn (McEwan and Jackson 1996). Lagoon-anadromous fish spend either their first or second summer as juveniles in a seasonal lagoon at the mouth of a stream (Boughton *et al.* 2006).

In addition to transforming into individuals capable of survival in the ocean, younger juveniles or those which have not entered the smolt stage may disperse downstream and rear in mainstem, estuarine, and lagoon habitats. This is thought to be an integral phase of salmonid life history at a time when physiological adaptation, foraging, and refugia from predators are critical (Healey 1982, Simenstad *et al.* 1982). Because rearing juvenile steelhead often migrate downstream in a search for available habitat (Bjornn 1971), significant percentages of the juvenile population can end up rearing in coastal lagoons and estuaries (Zedonis 1992, Shapavalov and Taft 1954). Seasonal lagoons are important rearing areas for many juvenile fish and invertebrates. Often viewed as nursery habitats, estuaries are productive waters offering high growth potential likely due to a complex invertebrate prey community and warmer water temperatures that cannot be found in freshwater tributaries (Boehlert and Yoklavich 1983, Macdonald *et al.* 1987, Shreffler *et al.* 1993). Estuaries/lagoons may also provide a habitat where young salmonids can avoid predation because visual predators may be limited by the potentially turbid nature of estuarine waters (Simenstad *et al.* 1982, Gregory 1993, Thorpe 1994). Although estuaries might comprise a small portion of the watershed area, they are critical nursery habitat, as estuary-reared juvenile steelhead can make a disproportionate contribution to the numbers of adults returning to spawn (Bond 2006). Estuaries/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond *et al.* 2008). For steelhead in the S-CCC and Southern California Steelhead DPSs, it is hypothesized that the most limiting habitat in terms of amount is over-summering habitat (Boughton *et al.* 2006).

B. Species and Critical Habitat Status

In this opinion, NMFS assesses four population viability parameters to help us understand the status of S-CCC steelhead and the population's ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany *et al.* 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of each DPS.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

1. S-CCC Steelhead

Populations of S-CCC steelhead throughout the DPS have exhibited a long-term negative trend since the mid-1960s. In the mid-1960s, total spawning populations were estimated at 17,750 individuals (Good *et al.* 2005). Available information shows S-CCC steelhead population abundance continued to decline from the 1970s to the 1990s (Busby *et al.* 1996) and more recent data indicate this trend continues (Good *et al.* 2005). Current S-CCC steelhead run-sizes in the five largest systems in the DPS (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) are likely greatly reduced from 4,750 adults in 1965 (California Department of Fish and Game 1965) to less than 500 returning adult fish in 1996. More recent estimates for total run-size do not exist for the S-CCC steelhead DPS (Good *et al.* 2005).

Recent analyses conducted by NMFS (NMFS 2006, Boughton *et al.* 2007) indicate the S-CCC steelhead DPS consists of 12 discrete sub-populations representing localized groups of interbreeding individuals, and none of these sub-populations currently meet the definition of viable. Most of these sub-populations are characterized by low population abundance, variable or negative population growth rates, and reduced spatial structure and diversity. The sub-populations in the Pajaro River and Salinas River¹ watersheds are in particularly poor condition (relative to watershed size) and exhibit a greater lack of viability than many of the coastal subpopulations.

Although steelhead are present in most streams in the S-CCC DPS (Good *et al.* 2005), their populations are small, fragmented, and unstable (more subject to stochastic events) (NMFS 2006a). In addition, severe habitat degradation and the compromised genetic integrity of some populations pose a serious risk to the survival and recovery of the S-CCC steelhead DPS (Good *et al.* 2005). On January 5, 2006, NMFS confirmed the listing of S-CCC steelhead as threatened under the ESA (71 FR 834). In the most recent status update (NMFS 2011, Williams *et al.* 2011), NMFS concluded there was no evidence to suggest the status of the S-CCC steelhead DPS has changed appreciably since the publication of the previous status review (Good *et al.* 2005) and therefore S-CCC steelhead remain listed as threatened. In the 2008/09 and 2009/10 winters, adult returns in many streams within the DPS were considerably reduced relative to higher returns at the beginning of the decade. This was likely attributed largely to poor ocean conditions along the eastern Pacific Ocean (Lindley *et al.* 2009). However, during the winter of 2010/11, adult returns appeared to rebound toward the low numbers seen at the beginning of the decade, based on a significant increase in adult returns counted at San Clemente Dam on the Carmel River², and a notable increase in the number of observed adults in Uvas Creek of the Pajaro Watershed (Jon Ambrose, NMFS, personal communication, May 2011).

The Pajaro River watershed steelhead population is one of several that constitutes the foundation of the recovery of the S-CCC DPS and is a Core 1 population (NMFS 2012). Core 1 populations are those populations identified by NMFS as the highest priority for recovery based on a variety

¹ The Technical Review Team only identified multiple populations in the Salinas River system for purposes of DPS viability analysis. However, for the purposes of threat analysis (and corresponding recovery actions), the Pajaro River was broken into the Uvas Creek tributary and the remainder of the Pajaro River system (which includes the mainstem and other tributaries). Uvas Creek was singled out because of its importance and the large number of threats.

² <http://www.mpwmd.dst.ca.us/fishcounter/fishcounter.htm>.

of factors. A critical component of NMFS' recovery strategy is to secure this extant population (NMFS 2012). Critical recovery actions for the Pajaro River population are to identify, protect, and where necessary, restore estuarine and freshwater rearing habitats (NMFS 2012). Additionally, a DPS-wide recovery action is to manage the artificial breaching and/or draining of coastal estuaries consistent with habitat and life history requirements of steelhead (including rearing juveniles and migrating adults)(NMFS 2012).

2. S-CCC Steelhead Critical Habitat

In designating critical habitat, NMFS considers, among other things, the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing offspring; and, generally, 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on PCEs and/or essential habitat features within the designated area that are essential to the conservation of the species and that may require special management considerations or protection.

PCEs for S-CCC steelhead and their associated essential features within freshwater and estuaries include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. Freshwater rearing sites with:
 - a. Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
 - b. Water quality and forage supporting juvenile development; and
 - c. Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
4. Estuarine areas free of obstruction with:
 - a. Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
 - b. Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and
 - c. Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (70 FR 52488).

The condition of critical habitat for S-CCC steelhead, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations.

NMFS has determined the present depressed population conditions are, in part, the result of the following human-induced factors affecting PCEs of critical habitat: agriculture, grazing, and mining activities, urbanization, stream channelization, construction of dams and other migration impediments, wetland loss, and water resource development, including unscreened diversions for irrigation, and recreational harvest. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, alteration of riparian vegetation communities, water extraction and stream desiccation, and fish passage constraints (Busby *et al.* 1996, Casagrande *et al.* 2003, 70 FR 52488). A widespread trend observed in the DPS is severe to very severe degradation of habitat conditions along the mainstem of impaired watersheds, while the tributaries (above and below dams) retain relatively high habitat values for steelhead (NMFS 2012).

Depletion and storage of natural river and stream flows have drastically altered natural hydrologic cycles in many of the streams in the S-CCC steelhead DPS, including the Salinas River (Casagrande *et al.* 2003, Good *et al.* 2005, NMFS 2007). Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to steelhead. Overall, the current condition of S-CCC steelhead critical habitat is degraded, and likely cannot provide the conservation value necessary for the recovery of the species absent habitat restoration efforts.

C. Factors Responsible for Steelhead Population Declines

NMFS cites many reasons (primarily anthropogenic) for the decline of steelhead (Busby *et al.* 1996, Good *et al.* 2005). The foremost reason for the decline in S-CCC steelhead populations is the degradation and/or destruction of freshwater and estuarine habitat. Good *et al.* (2005) noted numerous land- and water-use activities which have contributed to the degradation of salmonid habitat within the S-CCC steelhead DPS. The human-induced factors affecting critical habitat described above have facilitated the decline of the S-CCC steelhead DPS.

Artificial propagation and inter-basin transfer of steelhead has persisted at various times and in various locations within the S-CCC steelhead DPS, resulting in adverse effects to the genetic composition of existing stocks (Waples 1991, Sundermeyer 1999, Titus *et al.* 2010). Sundermeyer (1999) found many steelhead in the Pajaro River watershed genetically indistinguishable from steelhead in the San Lorenzo River (which is included in the CCC steelhead DPS) due to the long history of hatchery transfers between these two systems. Many other watersheds in the DPS have also had inter-basin transfers but little genetic information is available to assess the effects of these past practices.

Additional factors contributing to the decline of these populations include: natural stochastic events, marine mammal predation (Hanson 1993, NMFS 1999), reduced marine-derived nutrient transport (Bilby *et al.* 1996, Bilby *et al.* 1998, Gresh *et al.* 2000), and recent poor ocean conditions (Lindley *et al.* 2009).

D. Global Climate Change

Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). Snow melt from the Sierra Nevada has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013).

Modeling of climate change impacts in California suggests average summer air temperatures are expected to increase (Lindley *et al.* 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007, Schneider 2007). The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled (Luers *et al.* 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers *et al.* 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 to 200 percent) while other models show decreases of 15 to 30 percent (Hayhoe *et al.* 2004). Many of these changes are likely to further degrade salmonid habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002). In marine environments, ecosystems and habitats important to sub adult and adult salmonids are likely to experience changes in temperatures, circulation and chemistry, and food supplies (Feely *et al.* 2004, Brewer 2008, Osgood 2008, Turley 2008). The projections described above are for the mid to late 21st Century. In shorter time frames natural climate conditions are more likely to predominate (Cox and Stephenson 2007, Smith *et al.* 2007).

V. ENVIRONMENTAL BASELINE

The environmental baseline is the current status of species and critical habitat in the action area based on analysis of the effects of past and ongoing human and natural factors. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal Projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

A. Status of the Species and Critical Habitat in the action area

A multitude of anthropogenic activities have diminished the functional value of critical habitat PCEs in the geographical area inhabited by the S-CCC steelhead DPS, as described above. Historically, spawning grounds apparently existed all along the Pajaro River, whereas today they

are confined to a few isolated tributaries (Snyder 1913, Moyle 1982, Smith 2007). The most recent estimates of adult steelhead population size indicate the Pajaro River population has declined significantly. In 1996, Busby *et al.* (1996) estimated adult steelhead returns at less than 100 in the Pajaro River watershed based on the findings of Nehlsen *et al.* (1991) and Reavis (1991). In 1991, Nehlsen *et al.* (1991) estimated adult steelhead escapement at less than 200. These numbers were estimated during the drought years of the late 1980s to early 1990s. No other quantitative information on the adult lifestages is available for the Pajaro River. Additionally, recent sampling of juveniles in Uvas Creek in 2005, 2006, and 2007, indicates juvenile density has decreased considerably since the early 1970s (J. Smith, personal communication with J. Ambrose 2007).

The migration of juvenile steelhead to lagoons occurs throughout the year, but is concentrated in the late spring/early summer and in the late fall/early winter period (Zedonis 1992, Shapovalov and Taft 1954). However, likely due to limited opportunities for juvenile steelhead to enter the Pajaro River lagoon due to low stream flow in the Pajaro River and its tributaries and degraded habitat in the lagoon and Pajaro River, surveys conducted in 1991, 1992, 2012, and 2013 have failed to document juvenile steelhead rearing in the lagoon.

Steelhead currently use the action area, the Pajaro River lagoon and nearshore environment adjacent to the lagoon, as a migration corridor. Smolts pass through the lagoon during their seaward migration, as do adults after they have spawned upstream. Adults also use the lagoon during their migration to upstream spawning sites. Smolts and adults pass through the nearshore environment as they enter and exit the lagoon. Because of low and warm summer streamflows, the lagoon provides almost no potential summer rearing habitat for steelhead (Smith 2002), although in years of higher stream flows resulting in substantial conversion to freshwater, conditions for steelhead rearing might be good (Smith 1993). Unsuitable habitat between upstream spawning areas and the lagoon or habitat blocked by dry reaches in late spring or early summer apparently impairs juvenile steelhead use of the lagoon. Conversely, in the 1960s, the Pajaro River lagoon was characterized as having year-round fishery importance due in part to its function of providing a holding area for downstream steelhead migrants (Becker and Reining 2008). The Pajaro River lagoon has experienced some of the largest physical modification across the DPS with approximately 15 percent of the historical habitat remaining (NMFS 2012). As a result of the physical modification, PCEs for S-CCC steelhead, such as water quality, cover, and forage, are degraded.

Only a few fish surveys have been conducted in the lagoon in the last few decades. In 1991 and 1992, the only steelhead collected in the lagoon were holdover hatchery smolts (Smith 1993). In October 2012 and 2013, fish seining in the lagoon yielded zero steelhead (Don Alley, personal communication, October 18, 2012, October 21, 2013). Some have reasoned that steelhead do not rear in the lagoon because spawning areas are “far upstream” within Pajaro River tributaries (Becker and Reining 2008); “good spawning areas in Corralitos Creek are more than seven miles upstream of the lagoon” (Smith 1993). Juvenile steelhead are able to migrate more than seven miles (*e.g.*, Hayes *et al.* 2011) provided there is sufficient stream flow. Assuming adult steelhead migrate five miles per day, two days of sufficient passage flows would be needed for adult steelhead to reach Corralitos Creek from the ocean or lagoon. The lagoon provides

potentially important feeding habitat in spring for outmigrating smolts (Becker and Reining 2008).

The Pajaro River tends to remain open with a progressively smaller opening all summer, apparently due to insufficient sand to close the mouth. The partially open mouth gradually moves south along the coast (Smith 2009). At the typical summer lagoon gage height of four feet mean sea level, the deepest parts of the lagoon are approximately seven feet deep. Most of the banks in the lagoon are vertical, and some are rip-rapped. When the sandbar is in place there is little shallow water, except near the upstream side of the sandbar or in the upstream portions of the lagoon. Most of the substrate in the lower portion of the lagoon is fine silt; the upstream portion is mostly sandy-bottomed. The upstream portion of the lagoon is typically stratified in the summer, but in years of earlier sandbar closure (mid-May to early July), the lagoon is probably less saline at time of closure, reducing the time it takes to convert to freshwater.

The downstream portion of the lagoon has high winds that can mix the brackish water when the lagoon is closed or partially closed. Despite the brackish conditions, the mixed lagoon can be relatively cool (with abundant cooling at night). Also, despite eutrophic conditions due to abundant agricultural return flows, the mixed lagoon usually has good dissolved oxygen levels (Smith 2009).

B. Factors Affecting the Species Environment in the Action Area

The lower Pajaro Valley is a valuable agricultural area accounting for an important part of the local economy. Strawberries, artichokes, lettuce, celery, and other crops, are commonly grown on the valley floor and adjacent to the Pajaro River and lagoon. These agricultural activities have direct impacts on stream channels, riparian function, and stream flow.

Loss of vegetation and soil compaction can increase runoff, peak flows, and flooding in the lagoon during wet seasons. Reduced infiltration and the rapid routing of water from croplands may also lower the water table, resulting in lower summer base flows and higher water temperatures in the lagoon. Additionally, seawater intrusion in the Pajaro Basin, a result of groundwater overdraft, was first documented in 1953 and the problem has become more severe (Carollo Engineers 2013). The Pajaro Valley groundwater basin is in severe overdraft, causing groundwater elevations to drop below sea level and leading to seawater intrusion (Carollo Engineers 2013). Any direct effects to the lagoon from seawater intrusion are likely minor, such as a potential increase in salinity. However, overdraft can cause loss of stream flow, which can reduce inflow to the lagoon, thereby reducing water quality and quantity within the lagoon.

C. Previous mechanical breaches conducted by the County

To prevent localized flooding, the County initiated a mechanical breaching program in the 1950s. Since 1988, the County has mechanically breached the sandbar in 14 years (out of 27 years), including three of the last five years, and five of the last 10 years (Table 1; staff gage level at Watsonville slough not included).

Table 1. Breaching dates at Pajaro River lagoon, Santa Cruz, County, California, 1988-2014.

Year	Dates and Action Taken
1988/89	May 6, 1988 – Breach November 26, 1988 - Breach
1989/90	None
1990/91	March 1, 1991 – Breach May 13, 15, 16, 1991 – Attempted to close river mouth June 3, 1991 – Closed the river mouth
1991/92	January 23, 1992 – Breach January 31, 1992 – Breach February 1, 1992 - Breach
1992/93	October 29, 1992 – Breach December 7, 1992 - Breach
1993/94	December 9, 1993 – Breach January 24, 1994 - Breach
1994/95	December 27, 1994 – Breach
1995/96	None
1996/97	None
1997/98	November 14, 1997 - Breach
1998/99	None
1999/2000	None
2000/01	January 4, 2001 – Mobilization only
2001/02	November 20, 2001 – Mobilization only
2002/03	December 10, 2002 - Breach
2003/04	November 21, 2003 – Mobilization only December 5, 2003 - Breach
2004/05	None
2005/06	None
2006/07	None
2007/08	December 19, 2007 - Breach
2008/09	December 18, 2008 – Mobilization only January 22, 2009 - Breach
2009/10	None
2010/11	None
2011/12	January 19, 2012 - Breach
2012/2013	November 30, 2012 – Mobilization only; natural breach occurred on November 30.
2013/2014	February 28, 2014 - Breach
2014/2015	December 12, 2014 – Breach

1. Water quality monitoring

As part of their breaching program, the County conducted water quality sampling in the lagoon in October 2006 (mouth open), November 2007 (mouth closed), December 2007 (mouth open), October and December 2008 (mouth closed), January 2009 (mouth open), January 2014 (mouth closed), and March 2014 (mouth open). Monitoring locations were located approximately every 1,500 feet, beginning near the river mouth and ending near McGowan Road, approximately 2.6 miles upstream of the river mouth.

During years when the river mouth remains open (no mechanical breach, *i.e.*, winter 2006-2007), conditions in the Pajaro lagoon are generally typical of an estuary, with strong saline conditions near the mouth of the river that extend upstream in a “salt wedge” pattern. Because salt water is denser than fresh water, salinity remains higher near the bottom of the water column, and is fresher in the upper water column. The water is also fresher throughout the water column as distance from the ocean increases. When the mouth is open, maximum depth ranges from 2.7 feet to 7.2 feet, with average maximum depth approximately 4.0 feet (H.T. Harvey & Associates, 2007). When the mouth is closed (*i.e.*, November 2007), maximum depth ranged from 4.7 feet to 9.8 feet, with average maximum depth approximately 5.8 feet, or 1.8 feet higher than in October 2006 (H.T. Harvey & Associates 2007a). In 2014, maximum depth at the 10 sampling sites was 6.2 feet (Kittleston Environmental Consulting 2014).

In October 2006, when the mouth was open, temperature remained fairly consistent among sampling sites, ranging from 14.0 degrees Celsius ($^{\circ}$ C) to 17.1 $^{\circ}$ C. Warmer temperatures were associated with higher-density, more saline waters near the bottom at upstream stations. Ocean-derived salinity was detected upstream approximately 1.5 miles from the sandbar. Salinity in the lower lagoon was similar to sea water (*i.e.*, greater than 30 parts per thousand), while salinities in the middle/upper portion of the lagoon were intermediate between sea water and freshwater; the upper most station was predominantly fresh water (0.7 ppt) without any stratification. (H.T. Harvey & Associates, 2007).

Dissolved oxygen (DO) was high throughout the sampling area. Levels were greater than 20 milligrams per liter (mg/l) near the mouth. Dissolved oxygen levels at all other stations were greater than 10 mg/l, with the exception of samples near the bottom at some stations (*i.e.*, 4.5 mg/l and 7.0 mg/l) (H.T. Harvey & Associates, 2007).

In November 2007, when the mouth was closed, the salinity in the lagoon and Pajaro River reach of the lagoon (approximately 2.7 miles upstream of the mouth) was notably lower than in October 2006 (H.T. Harvey & Associates 2007a). Salinity in the lagoon ranged between 6.3 and 7.2 ppt and the Pajaro River reach of the lagoon ranged between 5.9 and 6.9 ppt. The northern transects (*i.e.*, upstream) tended to be less saline than the southern portions of the river, however salinity levels were relatively consistent throughout. Temperature was fairly consistent among sites, ranging from 13.9 $^{\circ}$ C to 17.3 $^{\circ}$ C, with the slightly warmer temperatures recorded in the stagnant upstream waters. Dissolved oxygen was highest in the lower reaches of the lagoon and very low in the upper transects of the river (*i.e.*, approximately 2.0-2.6 miles upstream of the mouth). Levels were greater than 20 mg/l near the mouth, where wind waves probably kept the

water well mixed and oxygenated despite a lack of tidal action. At some sampling stations, DO levels were higher near the surface and lowest (*i.e.*, 1.09 mg/l) at the bottom.

In December 2007, seven days after a mechanical breach, salinity in the lagoon ranged from 18.3 to 19.3 ppt. The Pajaro River samples ranged from 13.1 to 20.5 ppt. Water temperatures ranged from 8.5 to 10.7° C, with the lowest temperatures in the lagoon and at the upper sampling stations. At all sampling stations, at all depths, DO exceeded 20 mg/l. (H.T. Harvey & Associates, 2008).

In October 2008, when the mouth was closed, salinity was intermediate between previously measured artificially breached and unbreached conditions; salinity in the lagoon ranged between 12.8 and 14.1 ppt and the Pajaro River reach of the lagoon ranged between 11.5 and 24.8 ppt (H.T. Harvey & Associates, 2008a). Temperature was fairly constant among sites, ranging from 15.6 to 21.2° C, and DO was quite low throughout the lagoon and was relatively constant; DO levels were lowest in the lowest reach of the lagoon (1.08 to 2.45 mg/l) and somewhat higher throughout the rest of the channel. This is to be expected with unmixed conditions, as oxygen is depleted near the bottom (resulting from decomposition of organic matter) and is not quickly refreshed with oxygen-rich surface water (H.T. Harvey & Associates, 2007a). Even when the windy downstream areas of the lagoon are well mixed, the narrow, tree-lined and protected upstream two-thirds of the lagoon is strongly stratified for salinity, with warm water in the bottom layer, and suffers from periodic to persistent dissolved oxygen problems (Smith 2009).

In December 2008, when the mouth was still closed, water quality conditions differed significantly compared to those measured in October, likely as a result of cool, freshwater input and increased gas exchange between air and water from substantial winter rainstorms in early December (H.T. Harvey & Associates 2009). Water temperature ranged from 8.3 to 14.9° C, salinity ranged from 6.9 to 11.2 ppt, and DO ranged from 0.28 to 9.93 mg/l.

In January 2009, one day after a mechanical breach, temperature was relatively constant at the sampling sites, ranging from 11.8 to 14.3° C (H.T. Harvey & Associates 2009). Salinity ranged from 2.5 to 30.5 ppt (freshest at the upstream portion of the lagoon) and DO ranged from approximately 0 mg/l to 14.4 mg/l. One week after the breach, the temperature range was similar to one-day post breach, salinity increased, and DO ranges were also similar to those recorded one day post-breach (H.T. Harvey & Associates 2009).

In January 2014, when the mouth was closed, temperature was relatively constant at the sampling sites, ranging from 12.7 to 16.5° C (Kittleson Environmental Consulting 2014). Salinity ranged from 12.2 to 20.8 ppt (freshest at the upstream portion of the lagoon) and DO ranged from 0.34 to 20.65 mg/l (Kittleson Environmental Consulting 2014). Five days after the breach, temperature generally increased (range: 14.02 to 19.07° C), salinity increased in the lower reach of the lagoon (32.24 and 33.93 ppt at the surface of the two lowest sites) and decreased upstream (2.23 to 4.6 ppt at the surface at the five most upstream sites) with some salinity stratification. Dissolved oxygen measurements taken five days after the breach indicate DO generally decreased, and decreased from downstream to upstream, but all DO levels were between 4.49 (on the bottom) and 8.19 mg/l (Kittleson Environmental Consulting 2014). Loss of

depth at the 10 sampling sites five days after the breach ranged from 1.6 to 3.9 feet (Kittleson Environmental Consulting 2014).

Water quality monitoring indicates when the lagoon is open or closed in the fall or winter, temperature, salinity, and dissolved oxygen levels are all within the range of suitable conditions for adult and smolt migration, and juvenile rearing. As noted above, because of low and warm summer streamflows, the lagoon provides almost no potential summer rearing habitat for steelhead (Smith 2002), although in years of higher stream flows resulting in substantial conversion to freshwater, conditions for steelhead rearing might be good (Smith 1993).

2. Migration flows

The County delays breaching the sandbar as long as safely possible in the fall to avoid situations in which the sandbar is breached in response to a brief, early storm, and to the extent possible, the sandbar is not breached until seasonal rains are sufficient to maintain an open sandbar for the winter (California Coastal Commission 2006). Breaching a sandbar can create attraction flows resulting in adult steelhead entering the river.³ If a sandbar is breached when passage flows are unsuitable for upstream migration, steelhead can be delayed in their migration. Delayed fish may expend their stored energy necessary for successful migration, maturation and spawning before reaching their destination, resulting in weakened fish more disposed to disease, reduced spawning success (Berman and Quinn 1991, Geist *et al.* 2000) or pre-spawning mortality (Beiningen and Ebel 1970, Gray 1990). Salmonids may also be more exposed to poaching during unsuitable migration flows.

The Habitat Restoration Group (1997) estimated passage flows at four riffles for adult steelhead in the Pajaro River near Murphy Crossing. Murphy Crossing is approximately 11 miles upstream of the river mouth. The four Pajaro River riffles were estimated to be passable to adult steelhead at 16, 25, 35, and 45 cubic feet per second (cfs), respectively, downstream to upstream. Their estimates were based on a conservative approach necessary for passage throughout the migration period. To ensure passage, and based on existing information, NMFS assumes 45 cfs is the minimum flow necessary for adult steelhead passage near Murphy Crossing. These same riffles and their configuration may not exist from year to year, but the riffles chosen are probably typical of the worst riffles present in most years (The Habitat Restoration Group 1997). In the Pajaro River, shallow riffles are infrequent and short, reducing the cumulative effects of riffles on upstream or downstream passage (The Habitat Restoration Group 1997).

In order to evaluate the exposure of steelhead to unsuitable migration flows due to mechanical breaches and natural breaches that have occurred in the past, NMFS examined Pajaro River flow data (http://nwis.waterdata.usgs.gov/ca/nwis/dvstat/?search_site_no=11159000&agency_cd=USGS&referred_module=sw&format=sites_selection_links) on the day of the breach (n=18 winter breaches, see Table 1 above) and documented the number of days until Pajaro River stream flow was at least 45 cubic feet per second (cfs) for at least one day (Table 2). Based on breach dates, flow data, and estimated passage flows for adult steelhead, (described above), previous mechanical breaches in some years likely adversely affected migrating adults by

³ When a lagoon is drained, the water flowing out of the lagoon can be mistaken by salmonids as river flows suitable for migration.

exposing steelhead to unsuitable migration conditions. Based on the available data, the average number of days following a mechanical breach until Pajaro River stream flow was at least 45 cfs for at least one day was 14.8 days (range = 0-61 days). During the last 10 mechanical breaches (*i.e.*, since January 1994), the average number of days following a mechanical breach until Pajaro River stream flow was at least 45 cfs for at least one day was 6.2 days (range = 0-16 days).

Table 2. Breaching dates (1988-2014) at Pajaro River lagoon, Santa Cruz County, California and dates when stream flow was greater than or equal to 45 cubic feet per second (cfs) measured at USGS gage 11159000 (PAJARO, R.A. CHITTENDEN, CA).

Date of mechanical breach	Date when mean of daily mean stream flow was \geq 45 cfs	Number of days after breach until stream flow was \geq 45 cfs
November 26, 1988	December 25, 1988	29
March 1, 1991	March 4, 1991	3
January 23, 1992	February 12, 1992	20
January 31, 1992	February 12, 1992	12
February 1, 1992	February 12, 1992	11
October 29, 1992	December 29, 1992	61
December 7, 1992	December 29, 1992	22
December 9, 1993	January 23, 1994	45
January 24, 1994	January 25, 1994	1
December 27, 1994	January 5, 1995	9
November 14, 1997	November 26, 1997	12
December 10, 2002	December 14, 2002	4
December 5, 2003	December 11, 2003	6
December 19, 2007	January 4, 2008	16
January 22, 2009	February 4, 2009	13
January 19, 2012	January 19, 2012	0
November 30, 2012 (natural)	December 1, 2012	1
February 28, 2014	March 1, 2014	1
December 12, 2014	December 12, 2014	0

Most anadromous salmonids do not feed during the spawning migration (Greene 1926, Raleigh *et al.* 1986, Barnhart 1986), thus migration must be completed solely on energy reserves. Steelhead need to conserve energy during their migration to ensure they can reach spawning grounds and still have enough energy to successfully spawn. Fish that are delayed in their migration may expend their stored energy necessary for successful migration, maturation and spawning before reaching their destination, resulting in weakened fish more disposed to disease, reduced spawning success (Berman and Quinn 1991, Geist *et al.* 2000), or pre-spawning mortality (Beiningen and Ebel 1970, Gray 1990).

Assuming these mechanical breaches created attraction flows and adult steelhead entered the river shortly after the mechanical breach, adult steelhead were likely delayed in their migration and more disposed to disease, reduced spawning success or pre-spawning mortality. NMFS cannot quantify the number of steelhead affected nor the effects to spawning success, but it is likely that some adult steelhead did not spawn successfully. This likelihood is based on the severity of some the delayed migration periods (*e.g.*, 20 days, 22 days, 45 days) where the

disposition to potential adverse effects is increased. Since 1988, there have been four breaches where migration was assumed to have been delayed for more than 20 days (November 1988, October and December 1992, and December 1993).

D. Section 7 consultations and Section 10 permits in the action area

One section 7 consultation has been completed in the action area for another Federal agency action. On July 14, 2009, NMFS completed informal consultation with the Corps for the construction of a public access trail and canoe launch adjacent to the Pajaro River, approximately 2.5 miles upstream of the Pajaro River mouth (NMFS 2009). This proposed project included a short construction window, construction methods, and other measures to minimize and avoid adverse effects to listed fish species. NMFS does not expect long-term detrimental impacts to steelhead numbers in the Pajaro River lagoon from this project. Most of these activities contained some type of beneficial aspect, including for example, improved channel conditions and establishment of riparian vegetation.

Stream restoration actions under programmatic consultations occur in the S-CCC steelhead DPS and may take place in the action area. These programmatic consultations include the NOAA Restoration Center's (NMFS 2006b) restoration program and the Regional General Permit programmatic consultation (NMFS 2010). Both of these consultations authorize a limited amount of take for juvenile salmonids during instream work conducted in the summer months. NMFS does not expect long-term detrimental impacts. Implementation of restoration projects, if they occur, could help provide needed improvement to steelhead critical habitat in the Pajaro River lagoon.

NMFS has issued two section 10(a)(1)(A) research and enhancement permits: Permit 10094 to California Department of Fish and Wildlife Region 3 (NMFS 2008) and Permit 1044 to the NMFS Southwest Fisheries Science Center (NMFS 2007a). Both permits authorize scientific research on S-CCC steelhead throughout the Pajaro River watershed. Salmonid monitoring approved under these programs includes carcass surveys, smolt outmigration trapping, and juvenile density surveys. Separate section 7 consultations were conducted as part of the permit authorization process. Both permits contain measures to minimize and avoid the death and injury of steelhead, including annual limits on the number steelhead collected and unintentionally killed, and therefore NMFS expects impacts on the overall steelhead population related to these research activities in the Pajaro River lagoon will be minimal.

VI. EFFECTS OF THE ACTION

The purpose of this section is to identify the direct and indirect effects of the proposed action, and any interrelated or interdependent activities, on threatened CCC steelhead. Our approach was based on knowledge and review of the ecological literature and other relevant materials. We used this information to gauge the likely effects of the proposed project via an exposure and response framework that focuses on what stressors (physical, chemical, or biotic), directly or indirectly caused by the proposed action, that salmonids are likely to be exposed to. Next, we evaluate the likely response of salmonids to these stressors in terms of changes to salmonids

survival, growth, and reproduction, and changes to the ability of PCEs to support the value of critical habitat in the action area. PCEs include sites essential to support one or more life stages of the species. These sites for migration, spawning, and rearing in turn contain physical and biological features that are essential to the conservation of the species. Where data to quantitatively determine the effects of the proposed action on CCC steelhead and their critical habitat were limited or not available our assessment of effects focused mostly on qualitative identification of likely stressors and responses.

Sand bar breaching activities may occur when rearing juveniles, smolts, and adults are present in the action area.

A. Effects to Critical Habitat

Primary constituent elements of critical habitat within the action area include estuarine areas that provide uncontaminated water and substrates; food and nutrient sources to support growth and development; freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions supporting juvenile and adult mobility and survival; and connected shallow water areas and wetlands to cover and shelter juveniles.

1. Effects to Rearing Habitat

Sandbar breaching will occur between October 15 and March 1 up to two times. No more than six breaches will occur in 10 years. In no more than one year will there be two breaches; if and when that does occur, these breaches will count as two of the proposed six breaches. Only once (1993/1994) in last 20 years has the County mechanically breached the sandbar more than one time in a winter.

As described previously in *Description of the Proposed Action*, the County will excavate an outlet channel from the lagoon that begins near the southern end of the lagoon. As described below, NMFS expects the mechanical breaching will simulate a natural outlet as observed in other systems along the California coast and will prevent the lagoon from rapidly draining.

Following a mechanical breach, NMFS expects conditions in the Pajaro lagoon will be generally typical of an estuary, with the saline influence of the ocean strongest at the mouth of the river and extending upstream in a “salt wedge” pattern. When the mouth is open, maximum depth ranges are expected to range from approximately 2.7 feet to 7.2 feet, with average maximum depth approximately 4.0 feet (H.T. Harvey & Associates, 2007).

Freshwater rearing habitat will be reduced following breaching. Based on our evaluation of modified breaching methods adopted by the County for the January 18, 2012, and February 28, 2014, mechanical breaches (the proposed methods for future breaches), and observations of conditions following the November 30, 2012, natural breach, we do not expect the lagoon will drain completely. Two days following the mechanical breach, gage height was 1.4 feet, compared to 6.22 feet at the time of the breach. Five days following the natural breach, gage height was 1.94 feet, compared to 6.5 feet at the time of the breach. NMFS expects mechanical breaches will result in a similar reduction in water surface elevation. A 4.56 to 4.82-foot

decrease in water surface elevation (*i.e.*, reduction in depth) and loss of water quantity (*i.e.*, reduction in volume) is expected to result in some loss of freshwater and rearing space. NMFS expects this loss of habitat space will have adverse effects on rearing habitat for steelhead by reducing the amount of steelhead the habitat can support. These adverse effects are likely to be limited, as mechanical breaches are designed to mimic natural breaches.

Based on information gathered from previous breaches which indicate the lagoon does not completely evacuate, NMFS does not expect rapid dewatering of the lagoon. Based on the elevation of the lagoon, we do not expect exposure to seawater of formerly freshwater inundated areas of the lagoon following breaching which would decrease the availability of estuarine prey species for steelhead (*e.g.*, benthic and epibenthic forage species such as amphipods, isopods, *Corophium* spp., and mysids). There will likely be some reduction in prey numbers, and although NMFS cannot predict the specific amount of reduction in food without more information than is currently available, the reduction in prey numbers is likely to only minimally adversely affect critical habitat. This expectation is based on the mechanical breach mimicking a natural breach that would otherwise likely occur.

The Pajaro River mouth tends to remain open with a progressively smaller opening all summer, apparently due to insufficient sand to close the mouth and the partially open mouth gradually moves south along the coast (Smith 2009). Because the mouth tends to stay open, the County does not breach the sandbar every year. In the last 27 years, the County has mechanically breached the sandbar in 14 years. Additionally, the lagoon provides almost no potential summer rearing habitat for steelhead (Smith 2002), although in years of substantial conversion to freshwater, conditions for steelhead rearing might be good (Smith 1993). Nonetheless, the mechanical breach is expected to mimic a natural breach that would likely otherwise occur during the proposed breaching time period (October 15 – March 1) because high flows from storms would likely overtop the sandbar, and because conditions in the lagoon would naturally change to the same or similar conditions once flows overtop the sandbar, the conservation value of rearing PCEs in the lagoon will be minimally affected.

2. Effects to Migration Habitat

Based on Pajaro River flow data and a conservative approach to estimating adult steelhead migration flows, as described above in *Previous mechanical breaches conducted by the County*, breaching the sandbar two times per year is expected to degrade migration habitat for adult steelhead in some years by creating conditions that draw them into the Pajaro River and then delay their migration to spawning grounds.

As described above in the *Environmental Baseline*, based on existing information, 45 cfs is the minimal flow needed in the Pajaro River for steelhead to reach their spawning grounds. In the last 10 years (2005/2006-2014/2015), there were five mechanical breaches. During those breaches, the number of days following a mechanical breach until Pajaro River stream flow was at least 45 cfs for at least one day was 0 (January 19, 2012 [breach date]), 0 (December 12, 2014), 1 (February 28, 2014), 13 (January 22, 2009), and 16 (December 19, 2007). For this biological opinion, using a worst case scenario, we expect a significant delay between lagoon migration habitat and river migration habitat for adult steelhead will occur in three of the next 10

years. The rationale for three out of ten years is as follows: the Corps is proposing to issue a 10-year permit and no more than six breaches will occur in those 10 years. Recent history shows that half the breaches resulted in migration delay of more than one day. Half of six years of breaching is three years. However, since the County began implementing NMFS's recommended breaching methodology in 2012, there has been very minimal delay (*i.e.*, 1 day) in the availability of steelhead migration habitat. Further, because the County will breach no more than six times in 10 years, we expect the County to be more conservative in their breaching approach than what historically occurred. Therefore, we expect few breaches where there will be significant delays to steelhead migration. For smolt migration habitat, we do not expect breaches will result in adverse effects because we do not expect breaches to decrease the availability of this PCE. Breaches may increase the availability of smolt migration habitat from the lagoon to the ocean.

This delay in the availability of riverine migration habitat degrades the value of critical habitat in the action area by drawing steelhead into lagoon and riverine habitat where they are more vulnerable to predators and loss of energy reserves before they can reach their spawning grounds. Adverse effects to steelhead from this delay are described in greater detail below.

The County acknowledges NMFS' concern that a greater number of breaches were likely to lead to additional impacts to steelhead and/or their habitat. The County reduced the number of breaches proposed in the next 10 years (six breaches) and reduced the number of years in which two breaches could occur (one year). Additionally, the County intends to minimize the likelihood that mechanical breaches will result in delayed migration for adult steelhead. The County delays breaching the sandbar as long as safely possible in the fall to avoid situations in which the sandbar is breached in response to a brief, early storm, and to the extent possible, the sandbar is not breached until seasonal rains are sufficient to maintain an open sandbar for the winter (California Coastal Commission 2006). However, some delayed migration is likely to occur, based on previous mechanical breaches and the assumption that 45 cfs is the minimum flow necessary for adult steelhead passage near Murphy Crossing.

3. Effects to Marine Habitat

The immediate nearshore marine environment will likely experience a minor, localized and short-term increase in turbidity, likely similar to what occurs following a natural breach. The elevated levels of turbidity are expected to disperse with stream flow and tidal activity resulting in only minor and temporary effects to nearshore habitat used by steelhead.

B. Effects to Steelhead

1. Adult Migration

As described above, the proposed breaching is likely to create unsuitable migration flows in 3 out of ten years. A small portion of the Pajaro River steelhead run will likely be exposed to these unsuitable migration flows if adult steelhead enter the river following a mechanical breach. This expectation is based on Shapovalov and Taft (1954) who documented a small portion of the steelhead run enters with the first storm and with each succeeding storm, and on Carmel River

adult steelhead migration data [Dave Dettman, Monterey Peninsula Water Management District, unpublished data]) which generally shows a bell-shaped curve of the number of adult steelhead migrating over time.

As described above in the *Environmental Baseline* section, adult steelhead migration must be completed solely on energy reserves. Steelhead need to conserve energy during their migration to ensure they can reach spawning grounds and still have enough energy to successfully spawn. Fish that are delayed in their migration may expend their stored energy necessary for successful migration, maturation and spawning before reaching their destination, resulting in weakened fish more disposed to disease, reduced spawning success (Berman and Quinn 1991, Geist *et al.* 2000), or pre-spawning mortality (Beiningen and Ebel 1970, Gray 1990). It is likely a small percentage of the early portion of the steelhead run will experience spawning failure while the majority will have the opportunity for successful spawning within the Pajaro River. Some fish may enter Corralitos Creek instead of migrating further up the Pajaro River, some fish may stage in the lagoon until there are sufficient migration flows, and some fish may exit the lagoon and stray into another system. Based on previous water quality monitoring (described above in *Previous mechanical breaches conducted by the County*) NMFS expects lagoon water temperature, dissolved oxygen levels, and salinity levels will be suitable for adult steelhead entering the lagoon following a mechanical breach.

2. Smolt Migration

As stated above, we do not expect breaches will result limits to migration habitat availability. Because the timing of smolt migration in the Pajaro River is January through June with the peak being March through May (Fukushima and Lesh 1998), smolts may be moving downstream when stream flow is filling the lagoon, but not necessarily to such an extent that a natural or mechanical breach is likely to imminently occur. In this case, smolts may be delayed in entering the ocean, but the delay would not be caused by the County's action as the County does not manage Pajaro River stream flow. If smolts – who are undergoing physiological changes in preparation for entering the ocean and are therefore capable of being exposed to salt water– are present in the lagoon, a mechanical breach (that mimics a natural breach that would eventually happen) would allow smolts to enter the ocean. Additionally, a portion of the smolt population is unlikely to be exposed to the proposed action because mechanical breaches will not occur after March 1.

3. Steelhead in the Nearshore Marine Environment

Due to the temporal scale and the likely similarity to a natural breach, the increase in turbidity is not expected to result in behavioral or physical impacts to steelhead in the nearshore environment.

4. Adult Steelhead in the Lagoon

Based on previous water quality monitoring (described above in *Previous mechanical breaches conducted by the County*) NMFS expects lagoon water temperature, dissolved oxygen levels, and salinity levels will be suitable for adult steelhead entering the lagoon following a mechanical

breach. This expectation is based on, for example, January 2009 water quality monitoring data. In January 2009, one day after a mechanical breach, temperature was relatively constant at the sampling sites, ranging from 11.8 to 14.3° C (H.T. Harvey & Associates 2009). Salinity ranged from 2.5 to 30.5 ppt and DO ranged from approximately 0 mg/l to 14.4 mg/l. One week after the breach, the temperature range was similar to one-day post breach, salinity increased, and DO ranges were also similar to those recorded one day post-breach (H.T. Harvey & Associates 2009).

5. Juvenile steelhead in the Lagoon

The migration of juvenile steelhead to lagoons occurs throughout the year, but is concentrated in the late spring/early summer and in the late fall/early winter period (Zedonis 1992, Shapovalov and Taft 1954). However, likely due to limited opportunities for juvenile steelhead to enter the lagoon due to low stream flow in the Pajaro River and its tributaries and loss of habitat, surveys conducted in 1991, 1992, 2012, and 2013 have failed to document juvenile steelhead rearing in the lagoon. Until juvenile steelhead are documented to rear in the lagoon, which would be likely to occur if stream flows were increased (*e.g.*, potentially during very wet years or significant decrease in water diversions), we do not expect juvenile steelhead to be exposed to the adverse effects of mechanical breaching.

If juvenile steelhead are present in the lagoon in the winter, the proposed action has potential to adversely affect rearing juvenile steelhead. Adverse effects could occur primarily through a reduction of rearing habitat because each time the lagoon is mechanically breached, the amount of freshwater rearing habitat is reduced. Water quality monitoring (described above in *Previous mechanical breaches conducted by the County*) indicates when the lagoon is open or closed in the fall or winter, temperature, salinity, and dissolved oxygen levels are all within the range of suitable conditions for juvenile rearing.

As described above, there will likely be some reduction in prey numbers for juvenile steelhead, but this reduction is likely to only minimally adversely affect critical habitat and is therefore not expected to affect the fitness of any juvenile fish. Therefore NMFS does not expect adverse effects to individual juvenile steelhead if they are present in the lagoon.

6. Construction Activities

Adult steelhead are unlikely to be exposed to contact with construction equipment during construction of the outlet channel because when the lagoon is closed, construction equipment will operate on the sand bar, not in nearshore waters where adults may be present. Adults will be unable to enter the lagoon until the plug in the outlet channel is removed and enough flows occur in the outlet channel to attract adults into the lagoon. Construction equipment will not be reaching into the outlet channel when these flows occur. Mechanical breaches are likely to expose adult steelhead (which may enter the lagoon following a mechanical breach) to unsuitable migration conditions in some years as described above. If juvenile steelhead are eventually found to be rearing in the lagoon in the next 10 years, we do not expect them to be affected by construction activities, for reasons described above for adult steelhead.

VII. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Potential non-federal actions affecting the action area in the future could include State angling regulation changes, discharge of stormwater and agricultural runoff, and building of private roads. Due to the productivity and value of private lands and a strong agricultural tradition in Santa Cruz and Monterey Counties, row crop farming and other agricultural activities are likely to continue in the area. Other than the impacts of the on-going activities described above in *Environmental Baseline*, and climate change, described below, NMFS is unaware of future State, tribal, local, or private actions reasonably certain to occur that will affect the action area.

Climate change is a cumulative effect that will occur world-wide, including the action area. Climate change is likely to be expressed in California with warmer air temperatures and changes in precipitation patterns (Kiparsky and Gleick 2003, Cayan *et al.* 2006) and is anticipated to affect aquatic habitat across the landscape through increased water temperatures and reduced streamflows during the dry season, including an increase in drought years. These effects may occur in the Pajaro River watershed and the action area.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

Populations of S-CCC steelhead throughout the DPS have exhibited a long-term negative trend since the mid-1960s. Recent analyses conducted by NMFS (NMFS 2006, Boughton *et al.* 2007) indicate the S-CCC steelhead DPS consists of 12 discrete sub-populations which represent localized groups of interbreeding individuals, and none of these sub-populations currently meet the definition of viable. Most of these sub-populations can be characterized by low population abundance, variable or negative population growth rates, and reduced spatial structure and diversity. The sub-populations in the Pajaro River watershed are in particularly poor condition (relative to watershed size) and exhibit a greater lack of viability than many of the coastal subpopulations. A multitude of anthropogenic activities have diminished the value of critical habitat PCEs in the geographical area inhabited by the S-CCC steelhead DPS.

As described above, coastal lagoons and estuaries often play an important role in steelhead populations. Rearing in lagoons and estuaries is thought to be an integral phase of salmonid life history and significant percentages of the juvenile population can end up rearing in coastal lagoons and estuaries (Zedonis 1992, Shapavalov and Taft 1954). For steelhead in the S-CCC and Southern California Steelhead DPSSs, it is hypothesized that the most limiting habitat in terms of amount is over-summering habitat (Boughton *et al.* 2006). Juvenile steelhead may use the Pajaro River lagoon for rearing, however summer rearing is unlikely due to poor habitat conditions in the summer (Smith 2002) as evidenced by the failure to detect juveniles during past summer-fall sampling efforts. Smolts pass through the lagoon during their seaward migration and pass through the nearshore environment as they enter and exit the lagoon. Smolts are unlikely to experience adverse effects from mechanical breaching as described above. Based on

previous breaching dates and stream flow data, and under a worst case scenario, a small portion of adult steelhead (which may enter the lagoon following a mechanical breach) may be exposed to significant migration delay in some years that is likely to reduce their spawning success. However, the majority of the Pajaro steelhead run will have the opportunity for successful spawning within the Pajaro River. Some Pajaro fish, if delayed by lack of flows in the Pajaro, may enter Corralitos Creek and spawn instead of migrating further up the Pajaro River, some fish may stage in the lagoon until there are sufficient migration flows, and some fish may exit the lagoon and stray into another system. Because only a small portion of the adult steelhead run in the Pajaro may be exposed to migration delay, and some of these fish may spawn successfully (either in the Pajaro River watershed or nearby streams) any impact on the Pajaro River steelhead population would be minimal and unlikely to appreciably reduce their future survival and recovery. Following mechanical breaches between October 15 and March 1 as proposed, NMFS expects lagoon water temperature, dissolved oxygen levels, and salinity levels will be suitable for steelhead migration and rearing. Because the mechanical breach is expected to mimic a natural breach that would otherwise likely occur, mechanical breaching as proposed is expected to minimally affect the conservation value of rearing PCEs in the action area. We do not expect one winter with two mechanical breaches in 10 years will affect the fitness of any juvenile fish in the action area, nor have any long-term impacts on any juvenile fish that use the action area.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that Pajaro River sand bar breaching activities are not likely to jeopardize the continued existence of threatened S-CCC steelhead.

After reviewing the best available scientific and commercial data, the current status of the S-CCC critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that Pajaro River sand bar breaching activities are not likely to adversely modify or destroy critical habitat for S-CCC steelhead.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to

and not the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

A. Amount or Extent of Take

A small number of adult migrants will be harmed in three out of ten years when mechanical breaches draw them into the lagoon prior to migration flows being available upstream in the Pajaro River. These conditions will limit the ability of these adult migrants to reach suitable spawning areas in the Pajaro River watershed. NMFS anticipates that incidental take of these steelhead will be difficult to detect. Evidence of incidental take in the form of dead or injured fish is unlikely because adults that fail to spawn will be difficult to find in the approximate 100 miles of suitable spawning habitat (Joel Casagrande, personal communication 2015) in the Pajaro river upstream of the lagoon prior to their being eaten by predators or scavengers. Therefore, NMFS will use habitat conditions as surrogates for the number of fish harmed or killed, as described below.

Anticipated take will be exceeded if the sandbar is mechanically breached: (1) in more than six years of 10 years between October 15 and March 1; or (2) more than two times in more than one year between October 15 and March 1; or (3) more than four times in the next 10 years when greater than 20 days elapse between the day of the mechanical breach and when stream flows are at least 45 cfs at the Chittenden gage (USGS gage 11159000 PAJARO R A CHITTENDEN CA).

B. Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to S-CCC steelhead or adverse modification to designated critical habitat.

C. Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of S-CCC steelhead.

1. To confirm the assessed exposure of juvenile steelhead to the effects of mechanical breaching, pre-breach steelhead surveys must be conducted in the lagoon.

2. To assess the habitat parameters that affect steelhead use of the lagoon, pre-breach water quality monitoring must be conducted in the lagoon.
3. To confirm our assessment that the mechanical breaches are not expected to adversely affect migrating adult steelhead, the County must conduct a critical riffle assessment in the Pajaro River.
4. Removal of the sand plug must be timed to minimize loss of rearing habitat.

D. Terms and Conditions

The Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and define the reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions implement Reasonable and Prudent Measure 1.

1. The County must develop a steelhead survey plan, which includes the following:
 - a. A steelhead survey plan must be developed by the County which includes survey methods, timing, frequency, and personnel. A goal of the steelhead surveys is to document presence, distribution, abundance, and condition of S-CCC steelhead in the Pajaro River lagoon that might be affected by the County's breaching activities.
 - b. The County must coordinate the development of a steelhead survey plan with NMFS and with the U.S. Fish and Wildlife Service regarding the effects to tidewater goby.
 - c. A draft steelhead survey plan must be provided to NMFS within 90 days of the date of the signed biological opinion. The draft monitoring plan must be finalized within 120 days of the date of the signed biological opinion.
 - d. The final steelhead survey plan must meet NMFS' approval.
 - e. An annual report which is generated from the steelhead survey performed for each calendar year must be provided to NMFS by March 1 of the following calendar year.
 - f. The draft and annual report must be sent to:

North-Central Coast Office Supervisor
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404
Attention: Central Coast Branch Supervisor

The following terms and conditions implement Reasonable and Prudent Measure 2.

1. The County must develop a pre-breach water quality monitoring plan, which includes the following:

- a. A pre-breach water quality monitoring plan must be developed by the County which includes methodology, timing, frequency, and personnel. A goal of the water quality monitoring plan is to assess the habitat parameters that affect steelhead use of the lagoon.
- b. A draft pre-breach water quality monitoring plan must be provided to NMFS within 90 days of the date of the signed biological opinion. The draft monitoring plan must be finalized within 120 days of the date of the signed biological opinion.
- c. The final pre-breach water quality monitoring plan must meet NMFS' approval.
- d. An annual report which is generated from the water quality monitoring performed for each calendar year must be provided to NMFS by March 1 of the following calendar year.
- e. The draft and annual report must be sent to the address listed above.

The following terms and conditions implement Reasonable and Prudent Measure 3.

1. The County must develop a critical riffle assessment plan, which includes the following:

- a. A critical riffle assessment plan must be developed by the County which includes methods, location, frequency, passage criteria, and personnel. A goal of the critical riffle assessment plan is to identify critical riffles to ensure sandbar breaching does not expose adult steelhead to unsuitable migration conditions. NMFS is available to work with the County on developing the plan.
- b. A draft critical riffle assessment plan must be provided to NMFS within 90 days of the date of the signed biological opinion. The draft plan must be finalized within 120 days of the date of the signed biological opinion.
- c. The final critical riffle assessment plan must meet NMFS' approval.
- d. The draft and final plan must be sent to the address listed above.

The following term and condition implements Reasonable and Prudent Measure 4.

To minimize the loss of rearing habitat in the lagoon caused by a mechanical breach, the County must remove the sand plug at the breach site during an incoming tide. This is in addition to the project description (the sand plug will be removed when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, or when flooding is evident on Beach or Shell Roads).

XI. CONSERVATION RECOMMENDATIONS

Section 7 (a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information.

1. The Corps should work with the County towards implementing alternatives to mechanical breaching (e.g., see *Pajaro Lagoon Breaching, Alternatives Analysis and Work Program, County of Santa Cruz*. Prepared by: Schaaf & Wheeler, Santa Clara, California. February 28, 2007. 54p.)

XII. REINITIATION NOTICE

This concludes formal consultation of the Corps' permitting of the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation must be reinitiated immediately.

XIII. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect Essential Fish Habitat (EFH). The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if

such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the descriptions of EFH for Pacific coast groundfish (Pacific Fishery Management Council [PFMC] 2005) and coastal pelagic species (PFMC 1998) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

A. Essential Fish Habitat Affected by the Project

Effects of the proposed project will impact EFH for various federally managed fish species within the Pacific Coast Groundfish (PFMC 2005) and Coastal Pelagic Species (PFMC 1998) FMPs. Furthermore, the project area is located in an estuary Habitat Areas of Particular Concern for various federally managed fish species within the Pacific Coast Groundfish FMP.

Species that are federally managed under the Pacific Groundfish FMP and Coastal Pelagic Species FMP may depend on the natural function of the sandbar at the mouth of the Pajaro River. The Pajaro River lagoon may provide habitat for Groundfish FMP species during project implementation. Some Groundfish FMP species' juvenile stages are estuary dependent, such as starry flounder (*Platichthys stellatus*) that utilize riverine habitat near the mouth in and around the Monterey Bay Area (Orcutt 1950, Kukowski 1972, Hughes *et al.* 2014). It is possible that other groundfish may use the lagoon as nursery habitat, although the function and value of the habitat may be limiting to some groundfish when the sandbar is closed.

B. Adverse Effects on Essential Fish Habitat

Mechanical opening of the sandbar for flood control purposes has the potential to adversely affect EFH by decreasing lagoon water volume and causing a short-term increase in turbidity in the immediate nearshore marine environment. Potential adverse effects to the quantity and quality of lagoon EFH from the breach of Pajaro River sandbar are described above in *VI. Effects of the Action*. Mechanical opening of the sandbar may also prematurely expose juvenile Groundfish FMP species, such as juvenile starry flounder, to the risk of predation by larger marine species. Adverse effects are anticipated to be short term, as the mechanical sandbar breaching is intended to mimic a natural sandbar breach which also allows Groundfish FMP and Coastal Pelagic species direct access to marine and estuarine habitat. These adverse effects would be minimized by implementation of the County's measures to protect water quality and quantity in the lagoon (*i.e.*, conducting no more than six breaches in 10 years [and in no more than one year will there be two breaches] and a breaching methodology that is expected to minimize extensive scouring of the outlet channel and evacuation of the lagoon.

C. Essential Fish Habitat Conservation Recommendations

The proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. Therefore, NMFS has no additional EFH Conservation Recommendations to provide.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
08EVEN00-2016-F-0101

January 6, 2016

Tori White, Acting Chief
Regulatory Division, San Francisco District
U.S. Army Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Subject: Biological Opinion for Sandbar Breaching at the Mouth of the Pajaro River, Santa Cruz County, California

Dear Ms. White:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Army Corps of Engineers (Corps) proposed issuance of permits pursuant to the provisions of section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act to the Santa Cruz County Department of Public Works (County) for breaching of the sandbar at the mouth of the Pajaro River and its effects on the federally threatened western snowy plover (*Charadrius nivosus nivosus*), the federally endangered tidewater goby (*Eucyclogobius newberryi*), and designated critical habitat for both of these species, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). We received your request for formal consultation on November 23, 2015.

We have based this biological opinion on information that accompanied your November 23, 2015, request for consultation, including your description of: the project, scope of analysis, and project effects. We also considered information provided by the County (various meeting notes and electronic mail messages, as discussed specifically later in this document), the National Marine Fisheries Service (NMFS) (their biological opinion on the project; NMFS 2015), and the California Department of Fish and Wildlife (CDFW) (their streambed alteration agreement; CDFW 2014). We can make available a complete record of this consultation at the Ventura Fish and Wildlife Office.

You also requested our concurrence that the federally threatened California red-legged frog (*Rana draytonii*) is not likely to be adversely affected by the proposed action. The Pajaro River and Watsonville Slough system are occupied by this species (CNDDDB 2015). However, the species has not been observed at the Pajaro Lagoon and extensive surveys have not revealed breeding within the lower Pajaro River or lower Watsonville Slough (Kittleson, in litt. 2014, CNDDDB 2015). The closest known breeding site is off-channel on the Monterey County side of the Pajaro River and approximately 0.75 mile upstream from the Lagoon (Kittleson, in litt.

2014). Because we do not expect this species to occur on the beach adjacent to the Lagoon, where breaching activities would be conducted, and we do not expect it to breed in areas that would be affected by changes in water levels resulting from breaching activities, we concur that this species is not likely to be adversely affected.

Consultation History

We issued a biological and conference opinion (1-8-98-F/C-32) on effects to the tidewater goby, western snowy plover, and proposed critical habitat for the western snowy plover, of your authorization of the County's breaching of the Pajaro River on September 15, 1999. Your authorization subsequently expired and you requested reinitiation of consultation on November 19, 2007. You issued a public notice for the proposed project on November 26, 2007 (Corps 2007). Between 2007 and the present, there have been numerous discussions between the Corps, County, Service, NMFS, CDFW, and other agencies and the County has made several changes to the proposed breaching program relative to the program permitted in 1999 and that proposed in the 2007 public notice. Also, since 2007, new critical habitat that would be affected by the proposed action has been designated for both species. Because your previous authorization to the County has expired and the action proposed to be addressed in the new authorization is different from the previous action, a new formal consultation (rather than a reinitiation of the previous consultation) is appropriate. We therefore recommended that you request a new formal consultation, rather than a reinitiation of the 1999 consultation. We received your request for new consultation on November 23, 2015,. This biological opinion is a result of the new consultation and completely supersedes biological opinion 1-8-98-F/C-32.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to issue a permit to the County to place fill in waters of the United States for the breaching of the sandbar at the mouth of the Pajaro River in Santa Cruz County, California for flood control purposes. The permit is a 10-year authorization pursuant to the provisions of Section 404 of the Clean Water Act (33 U.S.C. Section 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403). The sandbar is located on lands owned by the California Department of Parks and Recreation (CDPR) and the lagoon is adjacent to the residential community of Pajaro Dunes and agricultural properties. Sandbar breaching is proposed to occur up to two times per year between October 15 and March 1. No more than six breaches will occur in 10 years. In no more than one year will there be two breaches; if and when that does occur, these breaches will count as two of the proposed six breaches.

The Pajaro River lagoon is located behind a large barrier beach. In some years, due to a decrease in flows from the Pajaro River and natural coastal processes, a sandbar forms at its mouth, where the Pajaro River discharges to the Pacific Ocean. The formation of the sandbar closes the mouth of the river, preventing outflow to the ocean, and forms a lagoon. When the sandbar is in place, water levels can rise in the lagoon and its associated sloughs and marshes.

The sandbar generally forms in the late summer or early fall. Natural breaches often occur during the early winter. When natural breaches occur, the lagoon typically stays open until late summer or early fall. However during some years, ocean wave action and/or river flow is not sufficient to naturally breach the sandbar before flooding may occur. High water levels in the lagoon can cause localized flooding in the agricultural and residential areas (e.g., Pajaro Dunes Residential Community) that surround the lagoon and adjacent sloughs. Flooding can threaten Santa Cruz county roads, emergency access to and from Pajaro Dunes, the sewage collection and delivery network for Pajaro Dunes, as well as electrical infrastructure and property within the community. To prevent this localized flooding, the County initiated a mechanical breaching program in the 1950s. Prior to this time, local area residents were known to perform breaching activities independently (California Coastal Commission 2006).

Breaching activities would consist of two stages, mobilization and breaching, as described below:

Water levels at the Watsonville slough staff gage are monitored daily during periods of high flow in the Pajaro River during the rainy season and biweekly during the dry season. From October 15 through March 1, when the gage shows the water level has reached an elevation of approximately +3.5 feet Mean Sea Level (MSL) and is rising, mobilization to breach the sandbar would begin. Prior to mobilization, the County will notify the Corps, NMFS, the U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, California Coastal Commission, CDPR, and Pajaro Dunes Homeowners Association.

A hydraulic excavator would be brought to the sand bar site on a rubber-tired vehicle to construct the channel to breach the sandbar. The hydraulic excavator and support vehicles would access the sand bar via an access route currently used by CDPR rangers for patrolling Sunset State Beach. From Sunset State Beach, breaching equipment and support vehicles would be mobilized along the beach below the High Tide Line where the beach is un-vegetated. A staging area, measuring approximately 50 feet by 50 feet, would be set up adjacent to the breaching location.

Breaching of the sand bar would occur when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, or when flooding is evident on Beach or Shell Roads. Mechanical breaching of the sand bar would be timed to take place under the following conditions: after high tide has peaked and receded (to allow sufficient time for the river flow to widen and deepen the new breach enough so it remains open through subsequent high tides so that flood control is achieved while maintaining habitat), and during daylight hours (when large waves would be visible so that danger to County staff operating on the sandbar is minimized). During mobilization and breaching activities, the County would control access to the breaching site.

To avoid flooding, when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, the County would excavate an outlet channel from the lagoon that begins near the southern end of the lagoon (depth and width of the outlet channel to be determined on the ground). The outlet channel would be angled diagonally to the south and be located behind the barrier beach crest. After a sufficient distance (to be determined on the ground), the outlet channel would be excavated in a direct line to, and through, the barrier beach crest to the

ocean. Channel excavation would begin from the ocean side of the sandbar and work towards the lagoon. A sand plug would be left in place between the ocean and lagoon. Approximately 5-10 feet inland from the barrier beach crest, the outlet channel would be fanned out mechanically to reduce scour of the outlet channel. The angle, length, slope, width and depth of the outlet channel would be based on lagoon elevation, flow, and other parameters. The sand plug would be removed when the staff gage at Watsonville slough reads +4.5 MSL and substantial river flows are forecast, or when flooding is evident on Beach or Shell Roads.

The proposed breaching methodology differs from the previous methodology where the breaching location was determined based on where the lagoon was deepest and where the least amount of excavation would be necessary. Creating and maintaining the outlet channel under the proposed methodology would likely require the County to conduct more sandbar management activities than occurred in the past. The County would perform sand bar management by incorporating actual hydrological conditions of the lagoon during storm events. Outlet channel configurations would adopt an adaptive management approach in determining the length and slope of the channel.

By conducting breaching in this manner, the County intends to minimize extensive scouring of the outlet channel and evacuation of the lagoon. A wide (i.e., 10 feet), shallow (i.e., 3 feet) outlet channel is proposed to minimize scouring, maintain lagoon habitat, and meet flood control purposes.

After breaching is completed, the County will notify the agencies a breach has occurred. If the sandbar should reform and further work is deemed necessary, the County will notify all the agencies and all follow-up work would adhere to the procedures identified for the initial breach.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

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

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide conditions of the western snowy plover and tidewater goby, the factors responsible for those conditions, and their survival and recovery needs; (2) the Environmental Baseline, which analyzes the conditions of the western snowy plover and tidewater goby in the action area, the factors responsible for those conditions, and the relationship of the action area to the survival and recovery of the western snowy plover and tidewater goby; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the

western snowy plover and tidewater goby; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the western snowy plover and tidewater goby.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the western snowy plover and tidewater goby, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the western snowy plover and tidewater goby in the wild by reducing the reproduction, numbers, and distribution of the species.

Adverse Modification Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of designated critical habitat. This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied on the statutory provisions of the Act to complete the analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which describes the range-wide condition of designated critical habitats for the western snowy plover and tidewater goby in terms of primary constituent elements (PCEs), the factors responsible for those conditions, and the intended recovery functions of the critical habitats overall; (2) the Environmental Baseline, which analyzes the condition of the critical habitats in the action area, the factors responsible for those conditions, and the recovery roles of the critical habitats in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the PCEs and how that will influence the recovery roles of the affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future non-Federal activities, that are reasonably certain to occur in the action area, on the PCEs and how that will influence the recovery roles of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the critical habitats of the western snowy plover and tidewater goby are evaluated in the context of the range-wide conditions of the critical habitats, taking into account any cumulative effects, to determine if the critical habitats range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve their intended recovery roles for the western snowy plover and tidewater goby.

STATUS OF THE SPECIES AND ITS CRITICAL HABITAT

Western Snowy Plover

The Pacific coast population of the western snowy plover was federally listed as threatened on March 5, 1993 (58 FR 12864). Critical habitat for the western snowy plover was designated in 1999 (64 FR 68508 68544) and redesignated in 2005 (70 FR 56970 57119) and again in 2012 (77 FR 36727 36869). The Service issued a recovery plan for the western snowy plover in September 2007 (Service 2007a).

The western snowy plover, a small shorebird in the family Charadriidae, weighs from 1.2 to 2 ounces and ranges in length from 5.9 to 6.6 inches (Page et al. 1995). It is pale gray-brown above and white below, with a white hindneck collar and dark lateral breast patches, forehead bar, and eye patches. The bill and legs are blackish. In breeding plumage, males usually have black markings on the head and breast; in females, usually one or more of these markings are dark brown. Early in the breeding season, a rufous crown may be evident on breeding males, but it is not typically seen on females. In non-breeding plumage, sexes cannot be distinguished because the breeding markings disappear. Fledged juveniles have buffy edges on their upper parts and can be distinguished from adults until approximately July through October, depending on when in the nesting season they hatched. After this period, molt and feather wear makes fledged juveniles indistinguishable from adults. Individual birds 1 year or older are considered to be breeding adults. The mean annual life span of western snowy plovers is estimated at about 3 years, but at least one individual was at least 15 years old when last seen (Page et al. 1995).

Western snowy plovers are primarily visual foragers, using the run-stop-peck method of feeding typical of *Charadrius* species. They forage on invertebrates in the wet sand and amongst surf-cast kelp within the intertidal zone, in dry sand areas above the high tide, on salt pans, on spoil sites, and along the edges of salt marshes, salt ponds, and lagoons. Western snowy plovers sometimes probe for prey in the sand and pick insects from low-growing plants. Their food sources consist of immature and adult forms of aquatic and terrestrial invertebrates. Little quantitative information is available on food habits.

The Pacific Coast population of western snowy plovers nests near tidal waters along the mainland coast and offshore islands from Damon Point, Washington, to Bahía Magdalena, Baja California, Mexico. Most nesting occurs on unvegetated to moderately vegetated, dune-backed beaches and sand spits. Other less common nesting habitats include salt pans, dredge spoils, and salt pond levees. Nests consist of a shallow scrape or depression, sometimes lined with beach debris (e.g., small pebbles, shell fragments, plant debris, and mud chips); nest lining increases as incubation progresses. Nests are usually located within 328 feet of water, but can be farther away when there is no formative vegetative barrier between the nest and water (Page and Stenzel 1981). The majority of western snowy plovers are site-faithful (returning to the same breeding area in subsequent breeding seasons); some also disperse within and between years (Warriner et al. 1986, Stenzel et al. 1994).

The nesting season of the western snowy plover typically extends from early March through late September. Generally, the breeding season may be 2 to 4 weeks earlier in southern California

than in Oregon and Washington. The earliest nests on the California coast typically occur during the first week of March in some years and by the third week of March in most years (Page et al. 1995). A single February nest was found on February 23, 2015, in Monterey County, California (Neumann, in litt 2015). Peak initiation of nesting is from mid-April to mid-June (Warriner et al. 1986; Powell et al. 1997). On the Oregon coast, nesting may begin as early as mid-March, but most nests are initiated from mid-April through mid-July (Wilson-Jacobs and Meslow 1984). Peak nest initiation occurs from mid-May to early July (Stern et al. 1990). On the Washington coast, most adults arrive during late April, with maximum numbers present from mid-May to late June.

The typical clutch size of western snowy plovers is three with a range from two to six (Warriner et al. 1986, Page et al. 1995). Both sexes incubate the eggs, which take about 27 days to hatch, with the female tending to incubate during the day and the male at night (Warriner et al. 1986). After losing a clutch or brood or successfully hatching a nest, western snowy plovers may re-nest at the same site or move up to several hundred kilometers to nest at other sites (Stenzel et al. 1994, Powell et al. 1997). Re-nesting occurs 2 to 14 days after failure of a clutch, and up to five re-nesting attempts have been observed for a pair (Warriner et al. 1986).

Western snowy plover chicks are precocial (capable of a high degree of independence from birth), feeding on their own within hours of hatching. However, they are unable to fly until 1 month after hatching. Females generally desert males and broods by the sixth day, and thereafter the chicks are typically accompanied by only males. Females obtain new mates and initiate new nests while males rear the broods (Page et al. 1995).

During the non-breeding season western snowy plovers may remain at breeding sites or may migrate to other locations. In western North America, the western snowy plover winters mainly in coastal areas from southern Washington to Central America (Page et al. 1995); however, the majority of birds winter south of Bodega Bay, California (Page et al. 1986). Many birds from the interior population winter on the central and southern coast of California. In winter, western snowy plovers are found on many of the beaches used for nesting, as well as some beaches where they do not nest. They also occur in man-made salt ponds and on estuarine sand and mud flats. In California, most wintering western snowy plovers congregate on sand spits and dune-backed beaches. Some also occur on urban and bluff-backed beaches, which are rarely used for nesting (Page et al. 1986). Both coastal and inland-breeding western snowy plovers are very site-faithful to wintering sites.

Historical records indicate that nesting western snowy plovers were once more widely distributed and abundant in coastal Washington, Oregon, and California. Prior to 1970, western snowy plovers bred at 53 coastal locations in California. Between 1970 and 1981, western snowy plovers stopped breeding in parts of San Diego, Ventura, and Santa Barbara counties, most of Orange County, and all of Los Angeles County (Page and Stenzel 1981).

On the Washington coast, western snowy plover populations appear to have increased overall since the early 1990s, although consistent, intensive surveys have been conducted only since the mid-1990s (Service 2007a). In Oregon, western snowy plovers historically nested at more than 20 sites on the coast, but only seven core nesting sites are consistently used (Lauten et al. 2006).

Populations reached a low from 1991 to 1993 but generally increased after 1994 due to the implementation of management actions for the benefit of western snowy plovers and California least terns, including predator management and protection and restoration of suitable habitat (Service 2007a).

Western snowy plover habitat is subject to erosion and accretion and is highly susceptible to degradation by mechanized beach cleaning; construction of seawalls, breakwaters, jetties, piers, homes, hotels, parking lots, access roads, trails, bike paths, day-use parks, marinas, ferry terminals, recreational facilities, and support services that may cause direct and indirect losses of breeding and wintering habitat for the western snowy plover. Urban development has permanently eliminated valuable nesting habitat on beaches in southern Washington (Brittell et al. 1976), Oregon (Oregon Department of Fish and Wildlife 1994), and California (Page and Stenzel 1981). Increased development increases human use of the beach, thereby increasing disturbance to nesting plovers. Human activities such as walking, jogging, fishing, fireworks, unleashed pets, horseback riding, and off-road vehicles can destroy the western snowy plover's nests and chicks.

In addition to causing direct loss of habitat, urban development can result in additional adverse effects to western snowy plovers. Human activities can interfere with foraging activities by disrupting the ability of adults and chicks to get to the wet beach to feed and return to the dunes or their nest (Burger and Fry 1993). Chicks can also become separated from their parents as a result of human disturbance of broods. Such disturbance could cause or contribute to chick mortality by interfering with essential chick-rearing behaviors or by causing intolerable stresses directly to the chicks (Cairns and McLaren 1980). For example, separation of chicks and their parent can lead to lethal exposure to wind and cold temperatures or disturbance that interferes with foraging could result in the starvation of western snowy plover chicks. In some instances, disturbance associated with these types of recreational activities is expected to temporarily flush western snowy plovers and not affect the birds in such a substantial manner. In other cases, such disturbance could interfere with the metabolism and thermoregulation of western snowy plover chicks and migrating or wintering adults such that they starve or egg production is impaired during the subsequent nesting season (Cairns 1982).

Predator density is an important factor affecting the quality of western snowy plover nesting habitat (Stenzel et al. 1994). The presence of humans near western snowy plover nesting areas can increase the presence of predators due to improper disposal of trash. Predation can result in the loss of adults, chicks, or eggs. Predators can also separate chicks from adults, which can lead to chick mortality. Predation by both native and non-native species limits western snowy plover reproductive success at many Pacific Coast sites. Non-native predators include eastern red foxes (*Vulpes vulpes regalis*), domestic and feral cats (*Felis catus*) and dogs (*Canis lupus familiaris*), and Virginia opossums (*Didelphis virginiana*). Coyotes (*Canis latrans*), raccoons (*Procyon lotor*), American crows (*Corvus brachyrhynchos*), common ravens (*Corvus corax*), American kestrels (*Falco sparverius*), loggerhead shrikes (*Lanius ludovicianus*), and several gull species (*Larus* spp.) are native predators of the western snowy plover. Common ravens have expanded in range and numbers over the past several decades and have become an important predator of western snowy plover eggs. The threat of predation by domestic cats intensifies when housing is constructed near western snowy plover breeding habitat. In addition, unnatural habitat features

such as landscaped vegetation (e.g., palm trees), telephone poles, transmission towers, fences, buildings, and landfills near western snowy plover nesting areas attract both native and non-native predators (Service 2007a).

Habitat loss for coastal breeding western snowy plovers has also resulted from the encroachment of non-native plant species that tend to stabilize dunes and grow too densely to accommodate their nesting. These include European beachgrass (*Ammophila arenaria*), American beachgrass (*Ammophila breviligulata*), Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), South African iceplant (*Carpobrotus edulis*), pampas grass (*Cortaderia selloana*), jubata grass (*Cortaderia jubata*), iceplant (*Mesembryanthemum* sp.), and other non-native weed species (Service 2007a). These species may also reduce the diversity and abundance of western snowy plover food sources (Slobodchikoff and Doyen 1977), and provide habitat for western snowy plover predators that historically would have been largely precluded by the lack of cover in the dune community (Stern et al. 1990). Shore pine (*Pinus contorta*) is a native plant species that has invaded coastal dunes and resulted in similar impacts to western snowy plovers (Schwendiman 1975, California Native Plant Society 1996, Powell 1996).

The Pacific Coast population of western snowy plovers has experienced widespread loss of nesting habitat and reduced reproductive success at many nesting locations. The reasons for the decline and degree of threats vary by geographic location; however, the primary threat is habitat destruction and degradation. Habitat loss and degradation can be primarily attributed to human disturbance, urban development, introduced plants, and expanding predator populations. Natural factors, such as inclement weather, have also affected the quality and quantity of western snowy plover habitat (Service 1993).

Recovery Plan for the Western Snowy Plover

The primary objective of the recovery plan (Service 2007a) is to remove the Pacific coast population of the western snowy plover from the list of endangered and threatened wildlife and plants by:

1. Increasing population numbers distributed across the range of the Pacific coast population of the western snowy plover;
2. Conducting intensive ongoing management for the species and its habitat and developing mechanisms to ensure management in perpetuity; and
3. Monitoring western snowy plover populations and threats to determine success of recovery actions and refine management actions.

Critical Habitat for the Western Snowy Plover

Critical habitat for the western snowy plover was designated in 1999 (64 FR 68508 68544) and redesignated in 2005 (70 FR 56970 57119) and again in 2012 (77 FR 36727 36869). The current (2012) designation includes 60 critical habitat units totaling 24,527 acres in Washington,

Oregon, and California. The primary constituent elements (PCEs) (77 FR 367474) of critical habitat for the western snowy plover include:

- (1) Areas that are below heavily vegetated areas or developed areas and above the daily high tides;
- (2) Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or lowwater flow and annual high tide or highwater flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, that are essential food sources;
- (3) Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PCE 2 for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults; and
- (4) Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and or normal behavior.

Tidewater Goby

The tidewater goby was listed as endangered on March 7, 1994 (59 FR 5494). On June 24, 1999, the Service proposed to remove the populations occurring north of Orange County, California, from the endangered species list (64 FR 33816). In November 2002, the Service withdrew this proposed delisting rule and determined it appropriate to retain the tidewater goby's listing as endangered throughout its range (67 FR 67803). A recovery plan for the tidewater goby was completed on December 12, 2005 (Service 2005). A 5-Year Review for the tidewater goby was completed in September 2007 (Service 2007b). A proposed rule to downlist the tidewater goby was published on March 13, 2014 (79 FR 14339).

Detailed information on the biology of the tidewater goby can be found in Wang (1982), Irwin and Soltz (1984), Swift et al. (1989), Worcester (1992), and Swenson (1995). Much of the information in this status section is based on these sources.

The tidewater goby is endemic to California and typically inhabits coastal lagoons, estuaries, and marshes, preferring relatively low salinities of approximately 12 parts per thousand (ppt). Tidewater goby habitat is characterized by brackish estuaries, lagoons, and lower stream reaches where the water is fairly still but not stagnant. Tidewater gobies tend to be found in the upstream portions of lagoons. They can withstand a range of habitat conditions and have been documented in waters with salinity levels that range from 0 to 60 ppt, temperatures from 46 to 77 degrees Fahrenheit, and depths from approximately 10 inches to 6.5 feet. Tidewater gobies feed on small invertebrates, including mysids, amphipods, ostracods, snails, aquatic insect larvae, and particularly chironomid larvae; however, tidewater gobies of less than 0.30 inch in length probably feed on unicellular phytoplankton or zooplankton, similar to many other early stage larval fishes.

The tidewater goby is primarily an annual species in central and southern California, although some variation in life history has been observed. If reproductive output during a single season fails, few (if any) tidewater gobies survive into the next year. Reproduction typically peaks from late April or May to July and can continue into November or December depending on the seasonal temperature and amount of rainfall. Males begin the breeding ritual by digging burrows (3 to 4 inches deep) in clean, coarse sand of open areas. Females then deposit eggs into the burrows, averaging 400 eggs per spawning effort and males remain in the burrows to guard the eggs. Male tidewater gobies frequently forego feeding, which may contribute to the mid-summer mortality observed in some populations. Within 9 to 10 days, larvae emerge and are approximately 0.20 to 0.27 inch in length. Tidewater gobies live in vegetated areas until they are 0.60 to 0.70 inch long. When they reach this life stage, they become substrate-oriented, spending the majority of time on the bottom rather than in the water column. Both males and females can breed more than once in a season, with a lifetime reproductive potential of 3 to 12 spawning events. Vegetation is critical for over-wintering tidewater gobies because it provides refuge from high water flows.

Historically, the tidewater goby occurred in at least 135 California coastal lagoons and estuaries, from Tillas Slough near the Oregon border south to Agua Hedionda Lagoon in northern San Diego County. The southern extent of its distribution has been reduced by approximately 8 miles. The species is currently known to occur in about 112 locations, although the number of sites fluctuates with climatic conditions. Some of these locations presumed to be occupied have not been surveyed in over 10 years. Currently, the most stable populations are in lagoons and estuaries of intermediate size (5 to 124 acres) that are relatively unaffected by human activities. Tidewater gobies that are found upstream of lagoons in summer and fall tend to be juveniles. The highest densities of tidewater gobies are typically present in the fall.

Tidewater gobies enter the marine environment when sandbars are breached during storm events. The species' tolerance of high salinities (up to 60 ppt) for short periods of time enables it to withstand marine environment conditions where salinities are approximately 35 ppt, thereby allowing the species to re-establish or colonize lagoons and estuaries following flood events. However, genetic studies indicate that individual populations rarely have contact with other populations so natural recolonization may be rare. In Santa Barbara County during the fall of 1994, tidewater gobies were reported as common in the Santa Ynez River 4 miles upstream from the lagoon (Swift et al. 1997); however, by January 1995, they were absent at the upstream sites.

Native predators are not known to be important regulators of tidewater goby population size in the lagoons of southern California. Rather, population declines are attributed to environmental conditions. During high flows, lagoon barriers are breached; exposing tidewater gobies to strong tidal conditions. As a result, tidewater goby populations plummet. Populations typically recover quickly in summer, with recorded mean densities of 54 to 323 fish per square foot. Tidewater goby densities are greatest among emergent and submerged vegetation (Moyle 2002).

The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands, lagoons, and estuaries. Some extirpations are believed to be related to pollution, upstream water diversions, and the introduction of non-native predatory fish species [most notably, centrarchid

sunfish (*Lepomis* spp.) and bass (*Micropterus* spp.)]. These threats continue to affect some of the remaining populations of tidewater gobies.

The 5-year review for the tidewater goby, completed in 2007, stated that the recovery plan reflects up-to-date information; however, the 5-year review reconsidered the downlisting and delisting criteria in the recovery plan. The 5-year review stated that other, currently available information on the species may also be used to determine the appropriate listing status of the species under the Act. These include the current number of occupied localities, current laws and regulations that act to protect the species, and our current understanding of threats and their impact on the tidewater goby. The 5-year review recommended that we reclassify the tidewater goby from endangered to threatened because we concluded that the species was not in imminent danger of extinction. The main reason for this recommendation was that the number of localities known to be occupied had more than doubled since listing. The 5-year review also concluded that the tidewater goby may be more resilient in the face of severe drought events than believed at the time of listing. The 5-year review also stated that threats identified at the time of listing had been reduced or were not as serious as thought. Although numerous threats to the tidewater goby have been identified (e.g., non-native predation and competition, pollution, cattle grazing), information on the degree of impact these threats may have on the tidewater goby is generally lacking. According to the 5-year review, the increase in occupied localities indicated that these threats appeared to not be having a major impact on the tidewater goby.

On May 18, 2010, we received a petition from The Pacific Legal Foundation, requesting that the tidewater goby be reclassified as threatened under the Act. Included in the petition was reference to the 5-year review. We published a 90-day finding on January 19, 2011 (76 FR 3069), stating our conclusion that the petition presented substantial scientific or commercial information indicating that the petitioned action (reclassification of the tidewater goby) may be warranted. A proposed rule to downlist the tidewater goby was published on March 13, 2014 (79 FR 14339).

Recovery Plan for the Tidewater Goby

The goal of the tidewater goby recovery plan is to conserve and recover the tidewater goby throughout its range by managing threats and perpetuating viable metapopulations within each recovery unit while maintaining morphological and genetic adaptations to regional and local environmental conditions. The decline of the tidewater goby is attributed primarily to habitat loss or degradation resulting from urban, agricultural, and industrial development in and around coastal wetlands. The recovery plan identifies 6 recovery units: North Coast Unit, Greater Bay Unit, Central Coast Unit, Conception Unit, Los Angeles/Ventura Unit, and South Coast Unit.

The recovery plan specifies that the tidewater goby may be considered for downlisting when:

1. Specific threats to each metapopulation (e.g., coastal development, upstream diversion, channelization of rivers and streams, etc.) have been addressed through the development and implementation of individual management plans that cumulatively cover the full range of the species.

2. A metapopulation viability analysis based on scientifically credible monitoring over a 10-year period indicates that each recovery unit is viable. The target for downlisting is for individual sub-units within each recovery unit to have a 75 percent or better chance of persistence for a minimum of 100 years.

The tidewater goby may be considered for delisting when downlisting criteria have been met and a metapopulation viability analysis projects that all recovery units are viable and have a 95 percent probability of persistence for 100 years.

Critical Habitat for the Tidewater Goby

We originally designated critical habitat for the tidewater goby on November 20, 2000 (65 FR 69693). In January 2008, we finalized a revised designation of critical habitat (73 FR 5920). On October 19, 2011, another revision to critical habitat was proposed (76 FR 64996), and on February 6, 2013, a final rule designating revised critical habitat for the tidewater goby was published (78 FR 8745).

Under the Act and its implementing regulations, we are required to identify the physical and biological features essential to the conservation of the tidewater goby in areas occupied at the time of listing, focusing on the features' primary constituent elements. We consider primary constituent elements to be the physical and biological features that, when present in the appropriate quantity and spatial arrangement to provide for a species' life-history processes, are essential to the conservation of the species. The primary constituent element specific to the tidewater goby include:

Persistent, shallow (in the range of approximately 0.3 to 6.6 feet), still-to-slow-moving water in lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following:

- Substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction;
- Submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus*, *Ruppia maritime*, *Typha latifolia*, and *Scirpus* spp., that provides protection from predators and high flow events; or
- Presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity.

In total, approximately 12,156 acres fall within the boundaries of the 2013 final revised critical habitat designation. The revised critical habitat is located in Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties, California.

ENVIRONMENTAL BASELINE

Action Area

The implementing regulations for section 7(a)(2) of the Act define the “action area” as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion is: 1) Zmudowski and Sunset State Beaches immediately adjacent to the Pajaro Lagoon, which would be affected by breaching activities and outflow from the Lagoon following breaching activities; 2) Approximately 1.8 miles of Zmudowski and Sunset State Beaches (including the area described in item 1) between the southern end of the Pajaro Lagoon and the equipment access point (near the seaward end of Beach Road), which would be affected by people and equipment driving on the beach to access the Lagoon; and, 3) the Pajaro Lagoon, lower Pajaro River, and associated sloughs, which would be affected by changes in water conditions resulting from breaching activities.

Habitat Characteristics of the Action Area

The northern beach portion of the action area (approximately 1.1 miles in length and mostly in Santa Cruz County) consists of a narrow (less than 0.1 mile wide) sandy beach, which is backed by residential development. Recreational use of this area is heavy and vegetation is sparse. The southern beach portion of the action area is generally wider (ranging from approximately 0.1 to 0.25 mile and mostly in Monterey County), more vegetated, and is backed by the Pajaro River/Lagoon. Near its mouth, the Pajaro River runs generally to the southwest until it reaches the beach, at which point it turns more to the south and runs behind the beach for approximately 0.6 mile before emptying to the ocean. Thus, when the river mouth is open, a sandspit is formed with the river to its east and the ocean to its west. It should be noted that this is the current configuration of the action area, as described from recent aerial photos, but given the dynamic nature of beach and lotic environments, the width of the beach and location of the river mouth will vary during the permit term.

The Pajaro River forms the boundary between Santa Cruz and Monterey Counties. The lower Pajaro River, within the action area, is constricted within a narrow (approximately 0.1 mile) and mostly levee-bounded corridor. The surrounding floodplain has been developed, primarily for intensive row-crop agriculture. The extent of estuarine conditions varies seasonally and annually and can extend at least 3 miles upstream when the Lagoon is closed (Alley 2012). The available tidewater goby habitat encompasses approximately 125 to 150 acres (Service 2005). Flows in the Pajaro River vary widely with high flows occurring after winter storms and low flows during dry periods. Watsonville Slough flows into the Pajaro River from the north, joining the River at the point where it turns south to run behind the beach. An additional 25 acres of tidewater goby habitat is found within Watsonville Slough (Service 2005).

Previous Consultations in the Action Area

We consulted with the Corps on your authorization of a prior version of the breaching program and issued a biological and conference opinion (1-8-98-F/C-32) on effects to the tidewater goby,

western snowy plover, and proposed critical habitat for the western snowy plover on September 15, 1999. We determined that the proposed action was not likely to jeopardize the continued existence of the western snowy plover or tidewater goby or adversely modify proposed critical habitat for the western snowy plover.

On July 2, 2012, we issued a non-jeopardy biological opinion to the Corps on the effects of the Pajaro River Bench Excavation Project (8-8-12-F-27) on the California red-legged frog. This project involved the removal of sediment from inside the leveed portion of the Pajaro River with a goal of increasing flood capacity. Direct project activities were implemented outside and upstream of the action area of the current breaching project, but biological opinion 8-8-12-F-27 recognized that downstream areas would receive sediment due to bench excavation activities.

Condition (Status) of the Species in the Action Area

Western Snowy Plover

Western snowy plovers nest at Sunset and Zmudowski State Beaches, including the sandbar at the mouth of the Pajaro River. From 2010 through 2014, an average of 109 nests were laid and 31 chicks were fledged in the nesting areas adjacent to the Pajaro Lagoon (summarized from Point Blue Conservation Science unpublished data 2010-2014). A large flock of wintering western snowy plovers is also regularly found at the Pajaro River mouth (Service 2007a, appendix B).

Tidewater Goby

The action area is occupied by tidewater gobies. Alley (2012) found the species in both the Pajaro River and Watsonville Slough, with the highest abundance observed at the most upstream site sampled, which was within the Pajaro River approximately 2.9 miles above the confluence with Watsonville Slough. As discussed in the status of the species section, the life history of the tidewater goby is such that its abundance and location within the action area vary seasonally and annually.

Recovery

Western Snowy Plover

The Pajaro River mouth is identified in the Recovery Plan for the Pacific Coast Population of the Western Snowy Plover as a site that is important to the recovery of the species, with up to 48 breeding adults and a wintering flock of up to 85 individuals observed there (Service 2007a, appendix B). The action area is within recovery unit 4, which extends along the coast of California from Sonoma through Monterey Counties, exclusive of the San Francisco Bay (which constitutes recovery unit 3).

Tidewater Goby

The action area is within sub-unit GB10 of the Greater Bay Area recovery unit for the tidewater goby. The Pajaro River is the only drainage within this sub-unit and is considered isolated from other tidewater goby localities. The Pajaro River provides a large area of habitat for the tidewater goby (approximately 125-150 acres plus an additional 25 acres within Watsonville Slough) and is identified in the Recovery Plan as in need of restoration due to erosion, channelization, and poor water quality. Tidewater gobies within the Pajaro drainage may be genetically unique and therefore especially important to the recovery of the species.

Condition (Status) of Critical Habitat in the Action Area

Western Snowy Plover

The action area overlaps unit CA20 of designated critical habitat for the western snowy plover (77 FR 36728). The critical habitat rule (77 FR 36765) indicates that: “The unit (CA20) includes the following habitat physical or biological features essential to the species: Areas of sandy beach above and below the high-tide line with occasional surf-cast wrack supporting small invertebrates, and generally barren to sparsely vegetated terrain. The physical or biological features essential to the conservation of the species may require special management considerations or protection to address the main threats from nonnative vegetation, human disturbance, development, horses, OHV use, pets, predators, and habitat changes resulting from exotic vegetation. Control of nonnative vegetation and enforcement of existing human-use regulations are needed to ensure the suitability of the unit. With time, we anticipate that the lower portions of this unit will be inundated with sea-level rise associated with climate change.” This assessment is accurate for the portion of unit CA20 within the action area. Under current management, this area is a productive breeding and important wintering area for the western snowy plover and it will require ongoing special management to remain so.

Tidewater Goby

The action area overlaps unit SC-8 of designated critical habitat for the tidewater goby (78 FR 8746). The critical habitat rule indicates that: “PCE 1a and 1b occur throughout the unit, although their precise location during any particular time period may change in response to seasonal fluctuations in precipitation and tidal inundation.” PCE 1a and 1b are as follows: “(1) Persistent, shallow (in the range of approximately 0.3 to 6.6 ft (0.1 to 2 m)), still-to-slow-moving lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following: (a) Substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction; (b) Submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus*, *Ruppia maritima*, *Typha latifolia*, and *Scirpus* spp., that provides protection from predators and high flow events...” The critical habitat rule further states that: “On an intermittent basis, SC-8 possesses a sandbar across the mouth of the lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, and thereby provides relatively stable conditions (PCE 1c).”

EFFECTS OF THE ACTION

Effects of the Proposed Action on the Western Snowy Plover

Due to the proposed season of work (October 15 to March 1), eggs or chicks of the western snowy plover are unlikely to be present. Breeding western snowy plovers have been thoroughly monitored along Monterey Bay for many years by Point Blue Conservation Science, California State Parks, and the Service. There has only been one nest found that was initiated prior to March 1 (February 23) and that was in the southern Monterey Bay area (at Fort Ord Dunes State Park). We therefore expect that only adults and juveniles would be directly affected by the proposed action. Adults and juveniles may be crushed by vehicles or heavy equipment or have their behavior disrupted by equipment and foot traffic associated with mobilization and breaching activities. Adults and juveniles that are disturbed during breaching activities (e.g., roosting birds that are flushed) may be more vulnerable to predation. In addition, areas of beach habitat that are disturbed by heavy equipment or by outflow of the breached lagoon would likely be rendered less suitable for use by nesting birds in the subsequent breeding season. However, because breaching activities would be : 1) restricted to the non-nesting season (thus protecting the less mobile egg and chick life stages), 2) would be limited in number (no more than 6 breaching events in 10 years), 3) would be limited in area (the precise area disturbed by each breaching event is dependent on local conditions at the time of the breach and therefore is unknown, but is expected to be small relative to the amount of habitat available surrounding the Pajaro Lagoon), and 4) the effects of each breaching event on habitat would be temporary; we expect adverse effects to this species to be limited.

Effects of the Proposed Action on Critical Habitat of the Western Snowy Plover

Use of heavy equipment and outflow from the breached lagoon would disturb areas of sandy beach above and below the high-tide line with occasional surf-cast wrack supporting small invertebrates, and generally barren to sparsely vegetated terrain. However, we expect that such disturbance would be limited in area and temporary in nature as discussed regarding effects to the species.

Effects of the Proposed Action on the Tidewater Goby

Tidewater gobies may occur in burrows within the sandbar and may be dug up and thereby killed during breaching operations. Tidewater gobies may be swept out to sea and thereby killed as Lagoon waters evacuate due to mechanical breaching. Tidewater gobies may be stranded (in burrows or on the substrate) and thereby killed along the Lagoon margin as water levels drop due to mechanical breaching. The amount of habitat available to tidewater gobies may be reduced as water levels drop following breaching events. However, the proposed breaching channel is designed (location, angle, and dimensions) to evacuate the Lagoon slowly and incompletely, which would reduce these effects relative to a rapid and complete evacuation. Also, the season of work avoids the peak breeding times of the tidewater goby, which would reduce the potential for stranding within burrows, relative to a spring or summer breach. Furthermore, because the tidewater goby habitat in the Pajaro drainage is large and complex (with tidewater gobies known to use areas within Watsonville Slough and at least 2.9 miles upstream within the Pajaro River),

we expect that sufficient habitat will be available for the species to persist in the system even if the total amount of habitat is periodically reduced and some mortality occurs. As discussed in the status of the species section, tidewater goby populations naturally fluctuate widely within and between years, and we expect that the population within the Pajaro system would be able to rebound from losses caused by the proposed mechanical breaching events.

Effects of the Proposed Action on Critical Habitat of the Tidewater Goby

Depending on the timing of implementation, the proposed action may result in the Lagoon's sandbar being open at times when it would naturally be closed (especially if a fall opening is necessary early in the season of work). This would reduce the stability of Lagoon conditions and thereby degrade PCE 1c. However, we expect this effect to be temporary and intermittent throughout the Permit term. There would also be some loss of substrate (PCE 1a) due to excavation during mechanical breaching and erosion of the breach channel. However, we expect this effect to be small relative to the amount of substrate available in the system. There may be some loss of aquatic vegetation (PCE 1b), if areas of aquatic vegetation dry out and die due to reduced water levels following a breach. However, we expect this effect to be small relative to the total amount of aquatic vegetation present in the lower Pajaro system. In summary, we expect adverse effects to tidewater goby critical habitat, but we expect them to be limited in geographic and temporal scope.

Effects on Recovery of the Western Snowy Plover

As discussed regarding effects to the species and critical habitat, we expect the effects of the proposed action on the western snowy plover to be generally small. At worst, the proposed action could cause mortality of a few individuals and periodic reduced suitability of some unquantified, but relatively small, area of habitat. Even if these worst-case effects occur, we do not expect that the proposed action would prevent the management and monitoring prescribed in the western snowy plover's recovery plan to affect the population increase needed for recovery.

Effects on Recovery of the Tidewater Goby

As discussed regarding effects to the species and critical habitat, we expect the proposed action to result in mortality of tidewater gobies and periodic reductions in the amount and quality of habitat in the action area. However, we expect that effects to habitat would be temporary and that the tidewater goby population would persist despite periodic reductions caused by the proposed action. As discussed in the status of the species section, tidewater goby populations naturally fluctuate widely within and between years, and we expect that the population within the Pajaro system would be able to rebound from losses caused by the proposed mechanical breaching events. We do not expect the proposed action to prevent the habitat restoration actions identified in the tidewater goby's recovery plan for the Pajaro River or to result in permanent reduction of the potentially unique population there.

Summary of Effects

Western Snowy Plover

The proposed action may result in occasional mortality of adult or juvenile western snowy plovers if they are crushed by vehicles or heavy equipment or flushed from roosting sites and eaten by predators. We expect such mortality to occur rarely. We also expect the proposed action to result in temporary adverse effects to areas of nesting habitat that would be disturbed during breaching activities and by outflow from the Lagoon as a result of breaching activities. These effects would occur at an important nesting and wintering location, but would be limited in area and frequency. We do not expect that the proposed action would prevent the monitoring and management activities needed to affect the population increase needed to recover the species.

Critical Habitat of the Western Snowy Plover

We expect that the proposed action would have adverse effects on critical habitat for the western snowy plover, but that those effects would be limited in area and temporary in nature. We do not expect that the long-term conservation value of Unit CA 20 would be substantially reduced by the proposed action.

Tidewater Goby

We expect that the proposed action would result in mortality of an unknown and potentially large number of tidewater gobies. We also expect periodic reductions in the availability of tidewater goby habitat when the Lagoon is breached. We do not expect these effects to be of a magnitude that would prevent the Pajaro River's potentially unique tidewater goby population from rebounding and sustaining itself. We also do not expect the proposed action to prevent the habitat restoration actions identified for the Pajaro River in the tidewater goby's recovery plan.

Critical Habitat of the Tidewater Goby

We expect the proposed action to occasionally reduce the stability of Lagoon conditions and thereby degrade PCE 1c of critical habitat for the tidewater goby. However, we expect this effect to be temporary and intermittent throughout the Permit term. There would also be some periodic losses of burrowing substrate and aquatic vegetation (PCEs 1a and 1b), but we expect these to be minor relative to the total amount of these habitat components available within the Action Area and range-wide. In summary, we expect adverse effects to tidewater goby critical habitat, but we expect them to be limited in geographic and temporal scope.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. We do not consider future Federal actions that are unrelated to the proposed action in this section because

they require separate consultation pursuant to section 7 of the Act. We are not aware of any non-Federal activities that are reasonably certain to occur in action area.

CONCLUSION

The regulatory definition of “to jeopardize the continued existence of the species” focuses on assessing the effects of the proposed action on the reproduction, numbers, and distribution, and their effect on the survival and recovery of the species being considered in the biological opinion. For that reason, we have used those aspects of the western snowy plover’s and tidewater goby’s statuses as the basis to assess the overall effect of the proposed action on the species.

Western Snowy Plover

Reproduction

The proposed action would occur outside the western snowy plover’s breeding season and we expect no direct effects on reproduction. There may be some temporary effects on limited areas of breeding habitat, but we do not expect these effects to appreciably reduce the likelihood of both the survival and recovery of the western snowy plover.

Numbers

There is potential for the proposed action to result in mortality of adult or juvenile western snowy plovers if they are killed by heavy equipment during breaching operations or flushed from cover and eaten by predators. However, we expect such mortality events to occur rarely to never during the 10-year permit term. We do not expect such a small reduction in numbers to appreciably reduce the likelihood of both the survival and recovery of the western snowy plover.

Distribution

We do not expect the proposed action to affect the distribution of the western snowy plover.

Recovery

We expect the effects of the proposed action on the western snowy plover to be generally small and temporary. At worst, the proposed action could cause mortality of a few individuals and periodic reduced suitability of some unquantified, but relatively small, area of habitat. Even if these worst-case effects occur, we do not expect that the proposed action would prevent the management and monitoring needed to affect the population increase needed for recovery. Therefore, we do not expect that the proposed action would appreciably reduce the likelihood of recovery of the western snowy plover.

After reviewing the current status of the western snowy plover, the environmental baseline for the action area, the effects of the proposed sandbar breaching at the mouth of the Pajaro River,

and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the western snowy plover.

Western Snowy Plover Critical habitat

Use of heavy equipment and outflow from the breached lagoon would disturb areas of sandy beach above and below the high-tide line with occasional surf-cast wrack supporting small invertebrates, and generally barren to sparsely vegetated terrain. However, we expect that such disturbance would be limited in area and temporary in nature.

After reviewing the current status of the critical habitat of the western snowy plover, the environmental baseline of critical habitat for the action area, the effects of the proposed sandbar breaching at the mouth of the Pajaro River on critical habitat, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to result in the destruction or adverse modification of critical habitat of the western snowy plover because:

1. The effects on the various primary constituent elements would be small and temporary;
and
2. The effects on the conservation value and function of critical habitat would be small.

Tidewater Goby

Reproduction

The amount of breeding habitat available to tidewater gobies may be reduced as water levels drop following breaching events. Declining water levels caused by mechanical breaching may also strand tidewater goby eggs in burrows, which would interfere with reproduction by killing the eggs. However, the proposed breaching channel is designed (location, angle, and dimensions) to evacuate the Lagoon incompletely, which would reduce these effects relative to a complete evacuation. Also, the season of work avoids the peak breeding times of the tidewater goby, which would reduce the potential for stranding within burrows, relative to a spring or summer breach. Therefore, even though the proposed action would likely reduce the availability of breeding habitat and kill some eggs, we do not expect these effects to be of a magnitude that would reduce appreciably the likelihood of both the survival and recovery of the tidewater goby.

Numbers

We expect that the proposed action will result in mortality of an unknown and potentially large number of tidewater gobies. However, because the tidewater goby habitat in the Pajaro drainage is large and complex (with tidewater gobies known to occur within Watsonville Slough and at least 2.9 miles upstream within the Pajaro River), we expect that sufficient habitat will be available for the species to persist in the system despite the periodic mortality events that are likely due to the proposed mechanical breaching. Tidewater goby populations naturally fluctuate widely within and between years, and we expect that the population within the Pajaro system would be able to rebound from losses caused by the proposed mechanical breaching events.

Therefore, even though the proposed action is expected to kill tidewater gobies, we do not expect this mortality to have long-term population-level effects that would reduce appreciably the likelihood of both the survival and recovery of the tidewater goby.

Distribution

The proposed action would cause periodic temporary reductions in the distribution of the tidewater goby within the Pajaro River drainage, because some areas of habitat would be dewatered due to mechanical breaching. However, we expect all such effects to be temporary and localized, such that the likelihood of both the survival and recovery of the tidewater goby would not be appreciably reduced.

Recovery

We expect the proposed action to result in mortality of tidewater gobies and periodic reductions in the amount and quality of habitat in the action area. However, we expect the population to persist within the Pajaro River drainage despite periodic mortality events caused by the proposed mechanical breaching and that effects to habitat would generally be limited and temporary. As discussed in the status of the species section, tidewater goby populations naturally fluctuate widely within and between years, and we expect that the population within the Pajaro system would be able to rebound from losses caused by the proposed action. We do not expect the proposed action to prevent the habitat restoration actions identified for the Pajaro River in the tidewater goby's recovery plan or to result in permanent reduction of the potentially unique population there. We do not expect these effects to appreciably reduce the likelihood of recovery of the tidewater goby.

After reviewing the current status of the tidewater goby, the environmental baseline for the action area, the effects of the proposed sandbar breaching at the mouth of the Pajaro River, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the tidewater goby.

Tidewater Goby Critical habitat

We expect the proposed action to occasionally reduce the stability of lagoon conditions and thereby degrade PCE 1c of critical habitat for the tidewater goby. However, we expect this effect to be temporary and intermittent throughout the Permit term. There will also likely be some occasional losses of burrowing substrate and aquatic vegetation (PCEs 1a and 1b), but we expect these to be minor relative to the total amount of these habitat components available within the Action Area and range-wide. In summary, we expect adverse effects to tidewater goby critical habitat, but we expect them to be limited in geographic and temporal scope.

After reviewing the current status of the critical habitat of the tidewater goby, the environmental baseline of critical habitat for the action area, the effects of the proposed sandbar breaching at the mouth of the Pajaro River on critical habitat, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to result in the destruction or adverse modification of critical habitat of the tidewater goby because:

1. The effects on the various primary constituent elements would be small and temporary; and
2. The effects on the conservation value and function of critical habitat would be minimized.

INCIDENTAL TAKE STATEMENT

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

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

We anticipate that some western snowy plovers could be taken as a result of the proposed action. We expect the incidental take to be in the forms of harassment, or mortality (kill), or both. Western snowy plovers may be killed if they are struck by vehicles or heavy equipment during breaching operations. Western snowy plovers may be harassed if they are disturbed by breaching activities to the extent that they abandon their normal sheltering behaviors and become more vulnerable to predation as a result. We anticipate some temporary adverse effects on western snowy plover habitat, but we do not expect these effects to be of a magnitude that is likely to result in harm.

We anticipate that some tidewater gobies could be taken as a result of the proposed action. We expect the incidental take to be in the forms of harm, mortality (kill), or both. Tidewater gobies would be killed if they are dug up in burrows during breaching operations, washed to sea as the Lagoon evacuates due to breaching operations, or are stranded as areas are de-watered due to

breaching operations. Harm may occur if important habitat features are made unavailable by the de-watering of areas due to breaching operations (e.g., if a cover area of aquatic vegetation is de-watered and tidewater gobies that would normally have sheltered there are eaten by predators).

We cannot quantify the precise number of western snowy plovers that may be taken as a result of the actions that the Corps has proposed because western snowy plovers move over time. The number of individuals present, their behaviors, and their location within the action area varies daily and seasonally. The protective measures proposed by the Corps are likely to prevent mortality or injury of most individuals. In addition, finding a dead or injured western snowy plover may be unlikely, especially in a case where it is predated.

We cannot quantify the precise number of tidewater gobies that may be taken as a result of the actions that the Corps has proposed because the number of tidewater gobies present in the action area varies. In addition, individuals may not be detected due to their cryptic nature, small size, and use of burrows and vegetative cover. The protective measures proposed by the Corps are likely to prevent mortality or injury of most individuals. In addition, accurately counting the number of dead or injured tidewater gobies is difficult because most of the individuals killed would likely be buried, eaten by predators or scavengers, or washed to sea.

Consequently, we are unable to reasonably anticipate the actual number of western snowy plovers or tidewater gobies that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to western snowy plovers would likely be low given the nature of the proposed activities, and we, therefore, anticipate that take of western snowy plovers would also be low. The Environmental Baseline and Effects Analysis sections of this biological opinion also indicate that adverse effects to tidewater gobies would likely be potentially high given the nature of the proposed activities, and we, therefore, anticipate that take of tidewater gobies would also be potentially high. We also recognize that for every western snowy plover or tidewater goby found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

Similarly, for estimating the number of tidewater gobies that would be taken by capture, we cannot predict how many may be encountered for reasons stated earlier. Because the number of tidewater gobies present would be highly variable and potentially very large, we have set a limit on the percentage of captured individuals that die rather than a limit on the total number captured.

We do not anticipate that capture and relocation of western snowy plovers would be necessary or beneficial.

Therefore, if more than 2 western snowy plovers of any life stage are found dead or wounded, the Corps must contact our office immediately to reinitiate formal consultation. Furthermore, if more than 300 tidewater gobies are found dead or more than 5 percent of the tidewater gobies captured and relocated die, the Corps must contact our office immediately to reinitiate formal

consultation. Project activities that are likely to cause additional take should cease during this review period because the exemption provided under section 7(o)(2) would lapse and any additional take would not be exempt from the section 9 prohibitions.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of the western snowy plover and tidewater goby:

- 1) Take of western snowy plovers must be minimized by using qualified individuals to direct breaching activities away from western snowy plovers and to monitor effects of breaching activities on the species.
- 2) Take of western snowy plovers must be minimized by limiting vehicle driving speeds to reduce the likelihood of birds being crushed by vehicles.
- 3) Take of tidewater gobies must be minimized by using qualified individuals and procedures to monitor, capture, and relocate tidewater gobies.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions implement reasonable and prudent measure 1:

- a) Only qualified biologist(s), approved by the Service under the auspices of this biological opinion, may conduct the following monitoring and minimization measures for the western snowy plover. The Corps must request our approval of any biologist they wish to employ for activities with the western snowy plover. The request must be in writing and received at least 30 days prior to the initiation of activities.
- b) A qualified biologist must survey the sandbar across the Pajaro River mouth for western snowy plovers within 48 hours of any proposed breaching event. The number, location, and activities of any western snowy plovers observed will be recorded. The number, location, and activities of any potential western snowy plover predators must also be reported. In the unlikely event that western snowy plover eggs or chicks are observed, the Service must be contacted immediately for guidance.
- c) A qualified biologist must be on site during breaching activities and will help determine the on-the-ground location of the breaching channel to minimize disturbance of western snowy plovers. Any western snowy plovers in the vicinity of the breaching operation will be observed and their behaviors recorded.

- d) The Corps must monitor western snowy plover breeding within the action area to confirm our assumption that longer-term effects to the species due to disturbance of nesting habitat are small. Point Blue Conservation Science currently monitors nesting activities within and surrounding the Action Area and we recommend that the Corps or County simply develop an agreement to support this ongoing effort.

The following term and condition implements reasonable and prudent measure 2:

- a) Vehicles and heavy equipment will not be driven off-road over 10 miles per hour.

The following terms and conditions implement reasonable and prudent measure 3:

- a) Only qualified biologists(s), approved by the Service under the auspices of this biological opinion, may conduct the following monitoring and minimization measures for the tidewater goby. The Corps must request our approval of any biologist they wish to employ for activities with the tidewater goby. The request must be in writing and received at least 30 days prior to the initiation of activities.
- b) A qualified biologist must be on site during and immediately following breaching operations and will survey areas that are de-watered for stranded tidewater gobies. Any live stranded gobies must be transferred to a shallow container(s) of clean water taken from the project site and released at the closest appropriate habitat location. The qualified biologist will have discretion to choose a relocation site that they believe minimizes the chances of relocated tidewater gobies being subject to additional stranding, predation, or being swept out to sea.
- c) The Corps must develop and implement a tidewater goby survey plan to document presence, distribution, and abundance of the species within the Action Area. This is necessary to confirm our assumption that the tidewater goby population will rebound from the loss of individuals that is likely due to the proposed action. The National Marine Fisheries Service (NMFS) has required a steelhead (*Oncorhynchus mykiss*) survey plan for the Action Area (NMFS 2015). The Corps must coordinate these two fish survey plans to avoid duplication of effort and resultant unnecessary disturbance of habitat. The tidewater goby survey plan must be submitted to the Service for approval within 60 days of issuance of the Corps' permit.

REPORTING REQUIREMENTS

Pursuant to 50 CFR 402.14(i)(3), the Corps must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement. A report must be submitted to the Service's Ventura Fish and Wildlife Office (2493 Portola Road, Suite B; Ventura, California 93003) within 60 days following every breaching season of work (i.e., the breaching season of work runs from October 15 to March 1 and an annual report is required by the end of the following April). This report will include: 1) the results of the surveys and monitoring prescribed in the terms and conditions; 2) a summary of how the terms and conditions of this biological opinion and the protective measures proposed by the Corps worked;

and 3) any suggestions of how these measures could be revised to improve conservation of western snowy plovers or tidewater gobies while facilitating compliance with the Act.

DISPOSITION OF DEAD OR INJURED SPECIMENS

As part of this incidental take statement and pursuant to 50 CFR 402.14(i)(1)(v), upon locating a dead or injured western snowy plover or tidewater goby initial notification within 3 working days of its finding must be made by telephone and in writing to the Ventura Fish and Wildlife Office (805-644-1766). The report must include the date, time, location of the carcass, a photograph, cause of death or injury, if known, and any other pertinent information.

The Corps must take care in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. The Corps must transport injured animals to a qualified veterinarian. Should any treated western snowy plover or tidewater goby survive, the Corps must contact the Service regarding the final disposition of the animal(s).

The Service should be contacted to determine the appropriate disposition location for any injured or dead specimens that are identified. Any dead tidewater gobies should be preserved in a solution of at least 80 percent ethanol for possible genetic analysis.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- 1) The Recovery Plan for the western snowy plover recommends intensive monitoring and management in perpetuity of western snowy plovers and their habitat to affect population increases. Such monitoring and management is ongoing for the Monterey Bay population by a partnership lead by Point Blue Conservation Science. However, funding is limited and monitoring and management in perpetuity is not secured. The Corps and County should coordinate with Point Blue Conservation Science, CDFW, the Service, and CDPR to support ongoing species monitoring and habitat management throughout the Monterey Bay area.
- 2) The Recovery Plan for the tidewater goby identifies habitat within the Pajaro River as in need of restoration due to erosion, channelization, and poor water quality. The Corps and County should coordinate with CDPR and other local landowners in the lower Pajaro River and Watsonville Slough drainages to address these restoration needs.

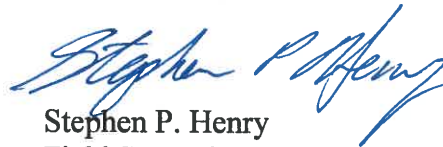
The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending reinitiation.

If you have any questions about this biological opinion, please contact Jacob Martin of my staff at (831) 768-6953, or by e-mail at Jacob_Martin@fws.gov.

Sincerely,



Stephen P. Henry
Field Supervisor

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California Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
2825 Cordelia Road, Suite 100
Fairfield, CA 94534
(707) 428-2002
www.wildlife.ca.gov

EDMUND G. BROWN, Jr., Governor
CHARLTON H. BONHAM, Director



October 18, 2018

Antonella Gentile
Santa Cruz County Department of Public Works
701 Ocean Street, Room 410
Santa Cruz, CA 95060

Dear Antonella Gentile:

Final Lake or Streambed Alteration Agreement, Notification No. 1600-2018-0081-R3, Pajaro River; Pajaro River Sandbar Breaching Program

Enclosed is the final Streambed Alteration Agreement (Agreement) for the Pajaro River Sandbar Breaching Program (Project). Before the California Department of Fish and Wildlife (CDFW) may issue an Agreement, it must comply with the California Environmental Quality Act (CEQA). In this case, CDFW acting as a responsible agency filed a Notice of Determination (NOD) within five working days of signing the Agreement. The NOD was based on information contained in the Negative Declaration prepared by the lead agency.

Under CEQA, the filing of an NOD triggers a 30-day statute of limitations period during which an interested party may challenge the filing agency's approval of the Project. You may begin the Project before the statute of limitations expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this letter, please contact Monica Oey, Environmental Scientist at (707) 428-2088 or by email at monica.oey@wildlife.ca.gov.

Sincerely,

Craig J. Weightman, Environmental Program Manager

cc: California Department of Fish and Wildlife
Lieutenant Schindler

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
BAY DELTA REGION
2825 CORDELIA ROAD, SUITE 100
FAIRFIELD, CA 94534(707) 428-2002



STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2018-0081-R3
PAJARO RIVER

COUNTY OF SANTA CRUZ DEPARTMENT OF PUBLIC WORKS
PAJARO RIVER SANDBAR BREACHING PROGRAM

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Wildlife (CDFW) and the County of Santa Cruz Department of Public Works (Permittee) or as represented by Antonella Gentile.

RECITALS

WHEREAS, pursuant to Fish and Game Code section 1602, Permittee notified CDFW on March 15, 2018 that Permittee intends to complete the project described herein.

WHEREAS, pursuant to Fish and Game Code section 1603, CDFW has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement.

PROJECT LOCATION

The project is located at the mouth of the Pajaro River, approximately 0.65 miles south of the mouth of its tributary, Watsonville Slough; the project area spans the Pajaro River lagoon and Watsonville Slough at Sunset-Palm State Beach in the County of Santa Cruz, State of California; Latitude 36.842222, Longitude -121.805556 or Section 36, Township 12S, Range 1E, U.S. Geological Survey (USGS) map Moss Landing, base and meridian; Assessor's Parcel Number (APN) 052-231-35 to Zmudowski State Beach at APN 412-032-015 and extends to Beach and Shell Roads.

PROJECT DESCRIPTION

The County of Santa Cruz Department of Public Works (Permittee) will conduct routine maintenance activities at the Pajaro River lagoon that are subject to Fish and Game

Code Section 1602. Routine maintenance is defined as periodically scheduled and implemented activities necessary to maintain flood control of the Pajaro River lagoon.

Maintenance activities that are considered 'routine' are listed in Exhibits A and B and are hereby made a part of this 1602 Routine Maintenance Agreement (RMA). The activity covered under this RMA includes the Pajaro River Sandbar Breaching (Project).

Routine maintenance activities do not include any work other than what is described in Exhibit A or any removal of or damage to living riparian vegetation.

The Project is limited to trench excavation in beach sands to create a low flow outlet path from the terminus of the Pajaro River lagoon to the Pacific Ocean. The dimensions of the excavated trench prior to breaching of the lagoon will be 10 feet wide, 3 feet deep and between 250 and 1,000 linear feet long. After the lagoon breaches, trench dimensions are expected to increase between 50 to 100-feetwide and decrease to between 1 to 2 feet deep. Trench length is not expected to change. Trench excavation activities shall not occur more than two times during each winter season for the term of this Routine Maintenance Agreement (RMA). If an unsuccessful breach occurs (e.g., closure of the Pajaro River lagoon after the County of Santa Cruz breaches the lagoon), the County of Santa Cruz may conduct more than two (2) breaches per winter season, only after receiving written approval from CDFW.

Large equipment, such as a hydraulic excavator, will be used to breach the sandbar within the project area when rising water from the Pajaro River and Watsonville Slough begin to flood adjacent agricultural and residential land and roads. Other equipment to be used during project activities includes one to two trucks for field personnel transport. Project activities for the purposes of reducing the water level in the lagoon may occur during the rainy season).

The sandbar may be breached at any time during the rainy season when the County of Santa Cruz staff gauge located at Watsonville Slough reads +4.5 Mean Sea Level (MSL) and river flows are predicted and when Beach and Shell Roads begin to flood. Once on the beach, equipment will be transported on rubber tired vehicles at the High Tide Line to a 50-foot x 50-foot staging area that is adjacent to the breaching site. Breaching will occur during daylight hours at high tide to allow the river flow to deepen and widen the new cut. The area excavated will depend upon the size of the sandbar at the start of project activities. Excavation will begin at the ocean side and continue back towards the lagoon with a sand plug approximately 15 to 20 feet long and 10 to 15 feet wide remaining at the upper end to prevent lagoon water from rushing out. The sand will then be scraped off the plug until the pressure of the lagoon water erodes the remainder of the plug.

The Project has been previously covered in Streambed Alteration Agreement notification number 1600-2013-0232-R3.

PROJECT IMPACTS

Existing fish or wildlife resources the project could substantially adversely affect include:

Common Name	Scientific Name	Status
Steelhead – central CA coast ESU	<i>Oncorhynchus mykiss irideus</i>	FT
Tidewater goby	<i>Eucyclogobius newberryi</i>	FE, SCC
Western pond turtle	<i>Emys marmorata</i>	SCC
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	FT, SCC

Notes:

FE = federally endangered under ESA; FT = federally threatened under ESA; SSC = state species of special concern

The adverse effects the project could have on the fish or wildlife resources identified above include:

- Displacement and/or take of steelhead trout;
- Displacement and/or take of tidewater goby;
- Disturbance of wildlife from project activity;
- Impediment to migration of aquatic species; modification of the river channel;
- Temporary deterioration of water quality and aquatic habitat.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

- 1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to CDFW personnel, or personnel from another state, federal, or local agency upon request.
- 1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.
- 1.3 Notification of Conflicting Provisions. Permittee shall notify CDFW if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, CDFW shall contact Permittee to resolve any conflict.

- 1.4 Project Site Entry. Permittee agrees that CDFW personnel may enter the project site at any time to verify compliance with the Agreement.
- 1.5 Access to Property Not Owned by Permittee. This Agreement does not grant the Permittee authority to enter, use, or trespass on the property rights of individuals or organizations not a party of this RMA. If access to property not owned by the Permittee is necessary, the Permittee shall obtain written authorization from outside parties, in accordance with applicable laws.
- 1.6 Unauthorized Take. This RMA does not authorize the take of any state or federally listed species. State or federally listed species include threatened, endangered, and/or candidate species. Liability for any take or incidental take of state or federally listed species remains the responsibility of Permittee for the duration of the project. Permittee is required to comply with all applicable state and federal laws, including the CESA and ESA. If CDFW determines, or the Permittee finds, that the project will cause take of a state or federally listed species on the project site, Permittee shall cease all work activities and notify CDFW and/or U.S. Fish and Wildlife Service (USFWS), accordingly. Any unauthorized take of state or federally listed species may result in prosecution and nullification of the RMA.
- 1.7 Authorized Activities. Permittee may only conduct those activities described in Exhibit B to this Agreement under this RMA.
- 1.8 Exceptions to Authorized Activities. The Permittee shall submit separate written notification pursuant to Code Section 1602 (Form DFW 2023), along with the appropriate fee listed in the current CDFW Agreement fee schedule, attachments, and otherwise follow the normal notification process prior to the commencement of work activities in all cases where:
 - The proposed work does not meet the criteria established for routine maintenance in Exhibit B.
 - The nature of the proposed work is substantially modified from the work described in Exhibit B.
 - Work will occur at a location where CDFW advises Permittee that conditions affecting fish and wildlife resources on the site have substantially changed or such resources would be adversely affected by the proposed maintenance activity.
 - The proposed work would adversely impact a state species of special concern or state or federally listed rare, threatened, endangered, or candidate species or its habitat.

1.9 CDFW-Approved Qualified Biologist(s) and Monitor(s). Permittee shall submit to CDFW for written approval, the names and resumes of all qualified biologists and biological monitors involved in conducting surveys and/or monitoring work within a minimum of fourteen (14) days prior to initiating fish and wildlife surveys or construction within the project area.

- A qualified biologist is an individual who shall have a minimum of five years of academic training and professional experience in biological sciences and related resource management activities with a minimum of two years conducting surveys for each species that may be present within the project area.
- A biological monitor is an individual who shall have academic and professional experience in biological sciences and related resource management activities as it pertains to this project, experience with construction-level biological monitoring, be able to recognize species that may be present within the project area, and be familiar with the habits and behavior of those species.

Permittee shall not enter into non-disclosure agreements with biological staff or otherwise implement penalties or disincentives restricting direct communication with CDFW.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

Work Period Measures

- 2.1 Seasonal Work Period. Project construction activity shall take place after October 15 and before April 15. Project activity shall occur no more than two (2) times per winter season for the term of this RMA. If an unsuccessful breach occurs (e.g., closure of the Pajaro River lagoon after the County of Santa Cruz breaches the lagoon), the County of Santa Cruz may conduct more than two (2) breaches per winter season, only after receiving written approval from CDFW. Permittee shall make requests for an additional breach by sending an written request to monica.oey@wildlife.ca.gov. The request shall include (1) why breaching was unsuccessful; (2) reasoning why the Pajaro River lagoon needs to be breached again; (3) current photos of the Pajaro River lagoon; (4) current reading of the Santa Cruz staff gauge located at Watsonville Slough; and (5) date when the Pajaro River lagoon will be breached again. Permittee shall report any additional breaches in the Annual Report and submit appropriate fees (see Measure 3.2).
- 2.2 Predetermine Excavated Channel Location. Channel excavation shall be limited to the southern end of the Pajaro River lagoon and at a southern angle to the Pacific

Ocean. Breaching of the lagoon shall occur during daylight and soon after the peak level of high tide as the tide recedes. The channel angle to the Pacific Ocean can be modified with written approval from CDFW and appropriate federal agencies such as U.S. Fish and Wildlife Service and National Marine Fisheries Service.

Habitat Protections

- 2.3 Vegetation Disturbance. No disturbance or removal of vegetation, other than non-native, invasive plant species, such as, but not limited to, ice plant shall occur as a result of Project activities. Vegetation outside the construction corridor shall not be removed or damaged without prior consultation and approval of CDFW. Vegetation may be disturbed only as specified in this measure.
- 2.4 Large Woody Debris. Permittee shall not remove or reposition any large woody debris as part of this Project. If large woody debris causes blockage of the Pajaro River outlet channel, Permittee shall provide written request to CDFW to remove or reposition the large woody debris. Written approval from CDFW is required before large woody debris is removed or repositioned.

Biological Measures

- 2.5 On-site CDFW-Approved Qualified Biologist with Stop Work Authorization. Permittee shall have a CDFW-approved qualified biologist on-site daily during project activities that occur within the lagoon and sand/beach areas to minimize impacts to fish and wildlife habitat. The CDFW-approved qualified biologists shall be authorized to stop construction if necessary to protect fish and wildlife resources. If there is a threat of harm to any sensitive species, or other wildlife, the qualified biologist shall halt construction and notify Monica Oey at (707) 428-2088 or electronic communication sent to monica.oey@wildlife.ca.gov. Consultation with CDFW shall be required before re-commencing work.
- 2.6 Training Session for Personnel. Permittee shall ensure that a CDFW-approved qualified biologist conducts an education training for all persons employed on the project prior to project commencement. Instruction shall consist of:
- A presentation by the qualified biologist that includes a discussion of the biology and general behavior of any sensitive species which may be in the area, how they may be encountered within the work area, and procedures to follow when they are encountered.
 - The status of CESA-listed species including legal protection, penalties for violations and project-specific protective management measures provided in this Agreement shall be discussed.

- Upon completion of the training, employees shall sign an affidavit stating they attended the program and understand all protection measures. These forms shall be filed at the Permittee's office and be available to CDFW upon request.

In the case that workers join the project after project commencement, the qualified biologist shall provide the same education training prior to the workers commencing work on the project. Permittee shall provide interpretation for non-English speaking workers.

- 2.7 Special-Status Wildlife Surveys. Within 72 hours prior to each breaching event, a CDFW-approved qualified biologist shall survey the project area at the appropriate time of day for presence of western snowy plover and other special-status wildlife species that may be present and shall establish the appropriate equipment mobilization pathway to avoid any special-status species and their habitat. This Agreement does not authorize the take or disturbance of any species listed under the ESA or CESA. All wildlife species encountered during surveys shall be recorded. CDFW reserves the right to provide additional provisions to this Agreement designed to protect special-status species.
- 2.8 Mortality and Injury to Fish and Wildlife. CDFW shall be notified immediately of any instance of mortality or injury to any special status species.
- 2.9 Disinfect Equipment Prior to Entry Into Watercourses. To prevent spread of invasive aquatics and diseases, equipment to be used in watercourses including, but not limited to, boots, waders, hand tools and nets must be decontaminated with a minimum 5 percent chlorine solution for 2 minutes prior to entry into a watercourse. In addition if a piece of equipment has been exposed or is suspected to have been exposed to areas harboring New Zealand mud snails then that equipment must either be dried out for two weeks, frozen for 48 hours, or placed in 55 degrees Celsius water for 5 minutes.
- 2.10 Lagoon Water Quality and Fish Survey Plan. As part of Streambed Alteration Agreement #1600-2013-0232-R3 Measure 2.15, Permittee submitted a Lagoon Water Quality and Fish Survey Plan (Plan) for CDFW review; however, the Plan was not finalized following CDFW's comments. As part of this RMA, Permittee shall revise the Plan incorporating CDFW comments provided to the Permittee in August 2014, and, at a minimum, include methodology, timing and location of survey sites throughout the lagoon and lower Watsonville Slough (downstream of Shell Road). Permittee shall submit the revised Plan to CDFW by August 15, 2018, for written approval. Permittee shall not conduct projected related activities until the Plan is finalized. If Permittee would like a copy of CDFW comments on the draft Plan from August 2014, please contact Monica Oey by email at monica.oey@wildlife.ca.gov.

- 2.11 Lagoon Water Quality and Fish Surveys. Permittee shall implement the CDFW-approved finalized Lagoon Water Quality and Fish Survey Plan (Measure 2.10).
- 2.12 Lagoon Water Surface Elevation/Depth Restriction. If the areal extent and depth of the lagoon has approached levels detrimental to tidewater goby and/or steelhead trout, then the sandbar shall be rebuilt. These restrictions shall be based on data collected for the Lagoon Water Quality and Fish Survey Plan and amended into this Agreement by CDFW.
- 2.13 Post Breach Stranded Fish and Amphibian Relocation. For the period of three days post breaching, a CDFW-approved qualified fisheries biologist shall survey the project area for stranded native fish every day. Stranded native fish shall be moved to the nearest appropriate site where they will not be subject to stranding and in appropriate habitat. The CDFW-approved qualified fisheries biologist shall obtain all applicable permits for the relocation of native fish.
- 2.14 Fish and Amphibian Relocation. During fish and amphibian relocation, if the relocation of native fish and amphibians is unavoidable, the CDFW-approved qualified fisheries biologist shall take the following measures to avoid harm and mortality resulting in fish and amphibian relocation activities, as follows:
- 2.14.1 Relocated Fish and Amphibians Records. Relocated fish and amphibians shall be moved to the nearest appropriate site for their protection and survival. The CDFW-approved qualified biologist shall record all relocated fish and amphibians. The record shall include the date of capture and relocation, the method of capture, the location of the relocation site in relation to the project site, and the number and species of fish captured and relocated. The record shall be provided to CDFW within two weeks of the completion of the work season or project, whichever comes first. Please note, only a CDFW-approved qualified biologist who possesses the necessary agency permits or approvals may handle and relocate steelhead. Permittee is not authorized to handle coho without incidental take coverage.
- 2.14.2 Release Locations Criteria. Before capturing fish and amphibians, an appropriate release location(s) shall be determined. Permittee shall use the following criteria: (1) water temperature in the release locations shall be similar to water temperature at the capture location; (2) place species in locations containing protective cover (e.g., emergent vegetation or bank overhangs for captured fish); (3) be in proximity to the capture site however there shall be a low likelihood for the relocated species to re-enter the work site; (4) contain suitable habitat; (5) not be affected by project activities, and (6) to the best of the qualified biologists knowledge, relocation areas shall be free of exotic predatory species (e.g. bullfrogs).
- 2.14.3 Handling Species. Handling of fish and amphibians shall be limited.

However, when handling is necessary, the CDFW-approved qualified biologist shall always wet hands or nets prior to touching fish and amphibians.

2.14.4 Proper Holding Technique. The CDFW-approved qualified biologist shall temporarily hold fish and amphibians in cool, shaded, aerated water in a flow-through live car. The qualified fisheries biologist shall protect fish and amphibians from jostling and noise and shall not remove fish from this container until the time of release.

2.14.5 Water Temperatures and Water Changes. The CDFW-approved qualified fisheries biologist shall measure air and water temperatures periodically. A thermometer shall be placed in holding containers and, if necessary, periodically conduct partial water changes to maintain cool temperatures.

2.14.6 No Overcrowding. Overcrowding in containers shall be avoided by having at least two containers and segregating young-of-year fish and amphibians from larger age-classes to avoid predation. Larger amphibians, such as Pacific giant salamanders, shall be placed in the container with larger fish. If fish are abundant, the capturing of fish and amphibians shall cease periodically and shall be released to the predetermined locations.

2.14.7 Mortality Rate of Native Fish and Native Amphibians. If mortality during relocation exceeds five (5) percent, capturing efforts shall stop and Permittee shall immediately contact CDFW. Consultation with CDFW is required before re-commencing work.

2.14.8 Relocate Native Fish and Native Amphibians During Cool Temperatures. The qualified biologist shall conduct relocation activities in the morning when the temperatures are cooler.

Western Snowy Plover Protective Measures

2.15 Western Snowy Plover Protection. Temporary fencing marking construction vehicle pathways and work areas shall be erected if lagoon alteration is done between March 1 and April 15 or at an earlier date if western snowy plover nesting activity is detected during pre-breach surveys (see Measure 2.7). Permittee shall coordinate with CDFW, California State Park, or USFWS staff to determine a suitable lagoon alteration location to minimize effects to western snowy plovers. Permittee or the CDFW-approved qualified biologist shall halt project-related activities if activities cause an incubating adult western snowy plover to leave the nest or brood for more than 20 minutes. Permittee or the CDFW-approved qualified biologist shall temporarily halt activities if such disturbance to incubating adults occurs again within two hours of the first disturbance. Permittee shall not allow such

disturbances to occur more than four times within a 24-hour period. Permittee staff, including contracted workers, shall be informed that they are not authorized to handle or otherwise move western snowy plovers or their eggs and chicks encountered at the project site. Permittee shall ensure that adequate staff is present at the project site to monitor and control access to the breaching alteration site to prevent unauthorized personnel from entering areas where western snowy plovers may be located. Excavation sites shall be placed as far as possible from the closest edge of any breeding areas for western snowy plover on the sandbar. The minimum distance to breeding areas with active nests shall be 250 feet. If conditions require project activities to be conducted within 100 feet of breeding areas, Permittee shall first contact CDFW and the USFWS for approval.

- 2.16 Construction Vehicle Mobilization and Activities. Equipment mobilization onto beach areas and excavation activities shall be overseen by the CDFW-approved qualified biologist. The CDFW-approved qualified biologist shall ensure that equipment mobilization will not result in the destruction of snowy plover habitat.

Construction Measures

- 2.17 No Equipment in Channel. Permittee shall not operate equipment within a flowing or ponded stream at any time.
- 2.18 Staging and Storage Areas. Construction equipment, building materials, fuels, lubricants and solvents shall not be stockpiled or stored where they could be washed into state waters or where they will cover aquatic or riparian vegetation.
- 2.19 Equipment over Drip Pans. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the lagoon and beach areas shall be positioned over drip-pans.
- 2.20 Check Equipment for Leaks. Any equipment or vehicles driven and/or operated adjacent to the lagoon and beach areas shall be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife or beach habitat. Vehicles and equipment shall be moved away from the lagoon and beach areas prior to refueling and lubrication.
- 2.21 Hazardous Materials. Any hazardous or toxic materials that could be deleterious to aquatic life that could be washed into State waters or their tributaries shall be contained in water tight containers or removed from the project site.
- 2.22 Imported Materials. Permittee shall not import, take from or move any rock, gravel, and/or other materials within the streambed or banks except as otherwise addressed in this Agreement.

- 2.23 Debris and Waste Disposal. Permittee shall not dump any litter or construction debris within the project area. All such debris and waste shall be picked up daily and properly disposed of at an appropriate site. Upon completion -of operations and/or onset of wet weather, all construction material and/or debris shall be removed from the Project work site to an area not subject to inundation. All removed vegetation and debris shall be disposed of according to State and local laws and ordinances.
- 2.24 Spoils. Permittee shall not place spoil where it can either be washed into or enter sensitive habitat, such as western snowy plover nesting and overwinter roost areas, or place over vegetation except as specifically noticed to and accepted by CDFW in writing.

3. Reporting Measures

Permittee shall meet each reporting requirement described below.

- 3.1 Notification of Project Commencement/Completion to CDFW. Permittee shall notify CDFW in writing, at least five (5) calendar days prior to initiation and completion of the project. Notification shall be either faxed to CDFW at (707) 428-2036, Attn: Lake and Streambed Alteration Program – Monica Oey, or made by email to monica.oey@wildlife.ca.gov. Please refer to Notification Number 1600-2018-0081-R3 when communicating with CDFW.
- 3.2 Annual Report of Completed Projects. Permittee shall provide CDFW written notification of maintenance projects completed by December 31, of each year of this RMA. Annual reports shall include;
- A brief description of each project activity;
 - A list of all wildlife species encountered during fish and special status species surveys;
 - Results of lagoon water quality and fish surveys, per the Lagoon Water Quality and Fish Survey Plan (see Measure 2.10);
 - Results of fish and amphibian relocation activities and whether or not fish and/or amphibian mortalities occurred;
 - Results from special status wildlife surveys including the dates, start times and duration of survey, species encountered, number of western snowy plovers present in the area and number of nests; for fish relocation efforts include the capture methods, methods used for handling, stress minimization, equipment cleaning and disinfection, sizes of holding facilities, and descriptions of relocation sites; for water quality and fish surveys, include the raw data for water quality

samples, for each fish captured during fish surveys the survey site of capture, species and age class (if determinable) and for steelhead trout, the measured fork length and degree of smoltification determined by pigmentation patterns (parr vs. fully smolted) and whether infected by black spot disease;

- An aerial image identifying the location of any wildlife species encountered during fish and special status species surveys;
- Pre- and post-project activity photo. Each pre- and post-project activity photo set shall include a minimum of four (4) vantage points, in relationship to the waterway, to show changes at the project activity area. Pre- and post-project activity photos shall be taken at the same location and in the same direction (e.g., taking photos at a fixed GPS point and using mountain ranges or buildings to take the 'same' pre- and post-project activity photos). A reference key shall be submitted with the photos describing the location of the photo, the direction of the view, and whether the photo is a pre- or post-maintenance work;
- The appropriate fee determined from the CDFW Streambed Alteration Agreement Fee Schedule for work completed under the RMA based upon the number of projects completed in the reporting period; and
- Annual reports shall be submitted whether or not maintenance projects were conducted in that period. CDFW reserves the ability to terminate this agreement if late reports and fees are not submitted within 30 days of a written request from CDFW.

3.3 Notification to the California Natural Diversity Database. If any listed, rare, or special status species are detected during project surveys or on or around the project site during project activities, the Permittee shall submit CNDDDB Field Survey Forms to CDFW in the manner described at the CNDDDB website (<https://www.wildlife.ca.gov/Data/CNDDDB/Submitting-Data>) within five (5) working days of the sightings. Copies of such submittals shall also be submitted to the CDFW Bay Delta regional office at 2825 Cordelia Road, Suite 100, Fairfield, CA

CONTACT INFORMATION

Any communication that Permittee or CDFW submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or CDFW specifies by written notice to the other.

To Permittee:

Antonella Gentile
County of Santa Cruz Department of Public Works

701 Ocean Street, Room 410
Santa Cruz, CA 95060
Phone – (831) 454-2632
Email – dpw186@santacruzcounty.us

To CDFW:

Department of Fish and Wildlife
Bay Delta Region
2825 Cordelia Road, Suite 100 Fairfield, CA 94534
Attn: Lake and Streambed Alteration Program – Monica Oey
Notification #1600-2018-0081-R3
Phone – (707) 428-2088
Email – monica.oey@wildlife.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute CDFW's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

CDFW may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before CDFW suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before CDFW suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused CDFW to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes CDFW from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects CDFW's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it. For example, if the project causes take of a species listed as threatened or endangered under the Endangered Species Act (ESA), such take will be unlawful under the ESA absent a permit or other form of authorization from the U.S. Fish and Wildlife Service or National Marine Fisheries Service.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the Fish and Game Code including, but not limited to, Fish and Game Code sections 2050 *et seq.* (threatened and endangered species), section 3503 (bird nests and eggs), section 3503.5 (birds of prey), section 5650 (water pollution), section 5652 (refuse disposal into water), section 5901 (fish passage), section 5937 (sufficient water for fish), and section 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

CDFW may amend the Agreement at any time during its term if CDFW determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by CDFW and Permittee. To request an amendment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective,

unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter CDFW approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with Fish and Game Code section 1605, subdivision (b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to CDFW a completed CDFW "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). CDFW shall process the extension request in accordance with Fish and Game Code section 1605, subdivisions (b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code § 1605, subd. (f)).

EFFECTIVE DATE

The Agreement becomes effective on the date of CDFW's signature, which shall be: 1) after Permittee's signature; 2) after CDFW complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable Fish and Game Code section 711.4 filing fee listed at <https://www.wildlife.ca.gov/Conservation/CEQA/Fees>.

TERM

This Agreement shall expire on December 31, 2022, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as Fish and Game Code section 1605, subdivision (a)(2) requires.

EXHIBITS

The documents listed below are included as exhibits to the Agreement and incorporated herein by reference.

- A. Notification of Lake or Streambed Alteration #1600-2018-0081-R3.
- B. Covered Activities.
- C. Definition of Terms.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

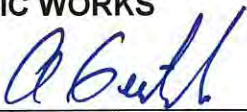
AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify CDFW in accordance with Fish and Game Code section 1602.

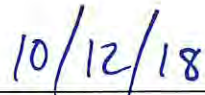
CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR COUNTY OF SANTA CRUZ DEPARTMENT OF PUBLIC WORKS




Antonella Gentile
Permittee

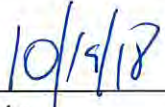


Date

FOR DEPARTMENT OF FISH AND WILDLIFE



Craig J. Weightman
Environmental Program Manager



Date

Prepared by: Monica Oey, Environmental Scientist

Date Sent: May 29, 2018

Date Revised: June 28, 2018; July 9, 2018; July 17, 2018; August 7, 2018

EXHIBIT A
Notification of Lake or Streambed Alteration #1600-2018-0081-R3

EXHIBIT B
Covered Activities

1. Pajaro River Sandbar Breaching.
 - a. Excavation of a trench in beach sand at the closed terminus of the Pajaro River. Trench excavation will be approximately 10 feet wide by 3 feet deep.
 - b. Final trench dimensions, after breaching, will be approximately be 50 to 100 feet wide, 1 to 2 feet deep, and 250 to 1000 feet long.
 - c. Pajaro River sandbar breaching shall only occur when flooding of roadways and/or structures is imminent, and shall not occur more than two (2) time during each winter season for the term of this RMA. If an unsuccessful breach occurs (e.g., closure of the Pajaro River lagoon after the County of Santa Cruz breaches the lagoon), the County of Santa Cruz may conduct more than two (2) breaches per winter season, only after receiving written approval from CDFW.

2. Exempt Activities. Trash and debris removal not including silt or sandbar removal (e.g., baby diapers, shopping cars, metal, wood, and plastic) are not subject to the provisions of the RMA between the California Department of Fish and Wildlife and Permittee. These activities are also not subject to the provisions of Section 1600 of the Fish and Game Code if performed within the parameters stated.

EXHIBIT C Definition of Terms

As used herein and for the purposes of the RMA

Biological Monitor. A person designated by the Permittee who has undergone training in avoidance and minimization measures specific to special-status species potentially present at a given location. The biological monitor is responsible for ensuring that such measures are properly performed to protect against take. The biological monitor must have attended the most recent annual training conducted by the Permittee's qualified biologist and must demonstrate basic familiarity with species biology, avoidance measures, and the terms of the Agreement, if asked. If the biological monitor is to perform pre-work habitat assessments, s/he must be familiar with applicable habitat assessment methodology for listed species.

- A qualified biologist is an individual who shall have a minimum of five years of academic training and professional experience in biological sciences and related resource management activities with a minimum of two years conducting surveys for each species that may be present within the project area.

Designated Biologist. A designated biologist is a person with a combination of academic training and professional experience in the appropriate biological sciences. The biologist must be skilled in the identification of special-status species that have potential to occur at a given project location, and s/he must be knowledgeable about accepted avoidance and minimization approaches used to mitigate impacts to the species. The Agreement does not include the handling or translocation of special-status species.

Heavy Equipment. Equipment used that exceeds 16,000 pounds.

Large Woody Material: Stumps, rootwads, and logs having an average diameter greater than six inches and a length greater than 10 feet.

Project. All routine maintenance activities performed by the Permittee throughout the Permittee's jurisdiction during a given year. Annual project fees are due for each project type that occurs on the channel. A Project does not include minor debris removal such as removing a shopping cart or a bag of garbage. Project, for purposes of an annual notification and per project fee calculation, means routine maintenance activities performed by the Permittee in a distinct Project location (channel) per year. Each "activity" within the channel shall be construed as one Project for fee purposes. "Project" does not mean project as defined in section 21065 of the Public Resources Code or section 15378 of title 14 of the California Code of Regulations.

Project Location. An area where a specific routine maintenance activity is being conducted.

Special-Status Species. Any species identified as a candidate or sensitive species in

local or regional plans, policies or regulations, or by CDFW or the U.S. Fish and Wildlife Service. Plants on Lists 1A, 1B, or 2, published by the California Native Plant Society, are also considered special-status species for the purposes of this Agreement.

Take. As defined in Section 86 of the California Fish and Game Code, and for federally listed species, as defined in Section 9 of the U.S. Endangered Species Act.



RMA

FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No.
3-15-18	\$3,474.25	\$		1600-2018-0081-R3
Assigned to: Monica Oey		Lt. Schindler		

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

1. APPLICANT PROPOSING PROJECT Designated Representative: Antonella Gentile, contact info below

Name	Santa Cruz County Flood Control			
Business/Agency	Santa Cruz County Department of Public Works			
Mailing Address	701 Ocean Street Room 410			
City, State, Zip	Santa Cruz, CA 95060			
Telephone	(831) 454-2160	Fax		
Email				

Fish & Wildlife
 MAR 15 2018
 Napa

2. CONTACT PERSON (Complete only if different from applicant)

Name	Antonella Gentile, Resource Planner			
Street Address	701 Ocean Street Room 410			
City, State, Zip	Santa Cruz, CA 95060			
Telephone	(831) 454-2632	Fax		
Email	dpw186@santacruzcounty.us			

3. PROPERTY OWNER (Complete only if different from applicant)

Name	State of California			
Street Address	303 Big Trees Park Road			
City, State, Zip	Felton, CA 95018			
Telephone		Fax		
Email				

4. PROJECT NAME AND AGREEMENT TERM

A. Project Name		Pajaro River Sandbar Breaching Program		
B. Agreement Term Requested		<input checked="" type="checkbox"/> Regular (5 years or less) <input type="checkbox"/> Long-term (greater than 5 years)		
C. Project Term		D. Seasonal Work Period		
Beginning (year)	Ending (year)	Start Date (month/day)	End Date (month/day)	E. Number of Work Days
2018	2022	January 1	December 31	~ 5



5. AGREEMENT TYPE

Check the applicable box. If box B, C, D, E, or F is checked, complete the specified attachment.

A.	<input type="checkbox"/> Standard (Most construction projects, excluding the categories listed below)	
B.	<input type="checkbox"/> Gravel/Sand/Rock Extraction (Attachment A)	Mine I.D. Number: _____
C.	<input type="checkbox"/> Timber Harvesting (Attachment B)	THP Number: _____
D.	<input type="checkbox"/> Water Diversion/Extraction/Impoundment (Attachment C)	SWRCB Number: _____
E.	<input checked="" type="checkbox"/> Routine Maintenance (Attachment D)	
F.	<input type="checkbox"/> Remediation of Marijuana Cultivation Sites (Attachment E)	
G.	<input type="checkbox"/> Department Grant Programs	Agreement Number: _____
H.	<input type="checkbox"/> Master	
I.	<input type="checkbox"/> Master Timber Operations	

6. FEES

See the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. *Note: The Department may not process this notification until the correct fee has been received.*

	A. Project	B. Project Cost	C. Project Fee
1	Pajaro River Breaching Program - 5 years	N/A	N/A
2			
3			
4			
5			
6			
7			
8			
9			
10			
		D. Base Fee (if applicable)	\$3,474.25
		E. TOTAL FEE*	\$3,474.25

* Check, money order, and Visa or MasterCard payments are accepted. When payment is made by credit card, CDFW shall assess a separate credit card processing fee of 1.6% to the Total Fee. Credit card payment must be submitted with a completed Credit Card Payment Authorization Form (DFW 1443b (Rev. 8/15)) available online at: <https://www.wildlife.ca.gov/Conservation/LSA/Forms> or at a Department regional office.



7. PRIOR NOTIFICATION AND ORDERS

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?

Yes (Provide the information below) No

Applicant	Notification Number	Date
Santa Cruz Cnty Flood Control	1600-2013-0232-R3	August 13, 2013

B. Is this notification being submitted in response to a court or administrative order or notice, or a notice of violation (NOV) issued by the Department?

No Yes (Enclose a copy of the order, notice, or NOV. If the applicant was directed to notify the Department verbally rather than in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.)

Continued on additional page(s)

8. PROJECT LOCATION

A. Address or description of project location.
 (Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway)

The project is located on the beach, at the mouth of the Pajaro River, approximately 0.65 miles south of the confluence with its tributary, Watsonville Slough. The project area includes portions of APN 052-231-35 in Santa Cruz County (Sunset State Beach) and APN 412-032-015 in Monterey County (Zmudowski State Beach). See Attachment 1.

Continued on additional page(s)

B. River, stream, or lake affected by the project. Pajaro River

C. What water body is the river, stream, or lake tributary to? Monterey Bay / Pacific Ocean

D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts? Yes No Unknown

E. County Santa Cruz and Monterey Counties

F. USGS 7.5 Minute Quad Map Name	G. Township	H. Range	I. Section	J. ¼ Section
Moss Landing	12S	1E	36	

Continued on additional page(s)

K. Meridian (check one) Humboldt Mt. Diablo San Bernardino

L. Assessor's Parcel Number(s)

052-231-35 (Santa Cruz County) and 412-032-015 (Monterey County)

Continued on additional page(s)

Exhibit 6



M. Coordinates (If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)			
Latitude/Longitude	Latitude: 36° 50' 32" North		Longitude: 121° 48' 20" West
	<input checked="" type="checkbox"/> Degrees/Minutes/Seconds	<input type="checkbox"/> Decimal Degrees	<input type="checkbox"/> Decimal Minutes
UTM	Easting:	Northing:	<input type="checkbox"/> Zone 10 <input type="checkbox"/> Zone 11
Datum used for Latitude/Longitude or UTM		<input type="checkbox"/> NAD 27	<input checked="" type="checkbox"/> NAD 83 or WGS 84

9. PROJECT CATEGORY

WORK TYPE	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR-MAINTAIN-OPERATE EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bank stabilization – rip-rap/retaining wall/gabion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat dock/pier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat ramp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bridge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Channel clearing/vegetation management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Culvert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Debris basin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Filling of wetland, river, stream, or lake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Geotechnical survey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Habitat enhancement – revegetation/mitigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low water crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Road/trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sediment removal: pond, stream, or marina	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
flood control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storm drain outfall structure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Temporary stream crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utility crossing: horizontal directional drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
jack/bore	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
open trench	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water diversion without facility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water diversion with facility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify): Breach sandbar	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



10. PROJECT DESCRIPTION

A. Describe the project in detail. Include photographs of the project location and immediate surrounding area.

- Written description of all project activities with detailed step-by-step description of project implementation.
- Include any structures (e.g., rip-rap, culverts) that will be placed or modified in or near the stream, river, or lake, and any channel clearing.
- Specify volume, and dimensions of all materials and features (e.g., rip rap fields) that will be used or installed.
- If water will be diverted or drafted, specify the purpose or use.
- Enclose diagrams, drawings, plans, and maps that provide all of the following: site specific construction details; dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, stockpile areas, areas of temporary disturbance, and where the equipment/machinery will access the project area.

Proposal to include maintenance of the Pajaro river mouth by excavating a trench in beach sand at the closed terminus of the Pajaro River, to allow river flows to outlet into the Pacific Ocean and prevent local flooding. Trench dimensions will be 10 feet wide, 3 feet deep, and 250-1000 feet long. Breaching activities are to take place when flooding of roadways and/or structures is imminent or occurring. See Attachment 2.

Continued on additional page(s)

B. Specify the equipment and machinery that will be used to complete the project.

One hydraulic excavator; 1-2 vehicles for transport of field personnel

Continued on additional page(s)

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).

Yes No (Skip to box 11)

D. Will the proposed project require work in the wetted portion of the channel?

Yes (Enclose a plan to divert water around work site)
 No



11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (square feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

Breaching the river mouth will reconnect the river flow of the Pajaro River lagoon to the Pacific Ocean. Excavation of the trench on the beach is expected to result in a final trench configuration with the following dimensions: 50-100 feet wide and 250-1,000 feet long.

Continued on additional page(s)

B. Will the project affect any vegetation?

Yes (Complete the tables below) No (Include aerial photo with date supporting this determination)

See Attachment 3

Vegetation Type	Temporary Impact	Permanent Impact
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)

Continued on additional page(s)

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

Yes (List each species and/or describe the habitat below) No Unknown

Beach sands: snowy plover. Lagoon waters: tidewater goby, steelhead.

Continued on additional page(s)

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

08 May 1993 Pajaro River Lagoon Management Plan, Mitchell Swanson & Associates, sections 2.6 and 2.7. See Attachment 4.

Continued on additional page(s)

E. Has a biological study been completed for the project site?

Yes (Enclose the biological study) No

See Attachment 4

Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.

Exhibit 8



F. Has a hydrological study been completed for the project or project site?

Yes (Enclose the hydrological study) No

See Attachment 4

Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.

G. Have fish or wildlife resources or waters of the state been mapped or delineated on the project site?

Yes (Enclose the mapped results) No

Note: Check "yes" if fish and wildlife resources or waters of the state on the project site have been mapped or delineated. "Wildlife" means and includes all wild animals, birds, plants, fish, amphibians, reptiles and related ecological communities, including the habitat upon which the wildlife depends." (Fish & G. Code, § 89.5.) If "yes" is checked, submit the mapping or delineation. If the mapping or delineation is in digital format (e.g., GIS shape files or KMZ), you must submit the information in this format for the Department to deem your notification complete. If "no" is checked, or the resolution of the mapping or delineation is insufficient, the Department may request mapping or delineation (in digital or non-digital format), or higher resolution mapping or delineation for the Department to deem the notification complete.

12. MEASURES TO PROTECT FISH, WILDLIFE, AND PLANT RESOURCES

A. Describe the techniques that will be used to prevent sediment from entering watercourses during and after construction.

Not applicable.

Continued on additional page(s)

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

Biological monitor required to be present before, during, and after breaching activities to ensure that no individuals are present in the work area or left behind in isolated pools after the river outlet has opened and lagoon waters have receded.

Biologist to provide a training session for work personnel prior to the start of breaching activities.

Breaching activities to occur during daylight hours.

Equipment will be checked for leaks prior to entering the site.

Equipment will not enter the channel.

Continued on additional page(s)

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

None proposed.

Continued on additional page(s)



13. PERMITS

List any local, State, and federal permits required for the project and check the corresponding box(es). Enclose a copy of each permit that has been issued.

A.	RWQCB 401 Cert #34416WQ19	See Attachment 5	<input type="checkbox"/> Applied	<input checked="" type="checkbox"/> Issued
B.	USACE 404 Provisional Permit File # 2007-00848S	See Attachment 6	<input checked="" type="checkbox"/> Applied	<input type="checkbox"/> Issued
C.	CA Coastal Commission Coastal Development Permit		<input checked="" type="checkbox"/> Applied	<input type="checkbox"/> Issued
D.	Unknown whether <input type="checkbox"/> local, <input type="checkbox"/> State, or <input type="checkbox"/> federal permit is needed for the project. (Check each box that applies)			

Continued on additional page(s)

14. ENVIRONMENTAL REVIEW

A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA) and/or National Environmental Protection Act (NEPA)?

Yes (Check the box for each CEQA or NEPA document that has been prepared and enclose a copy of each.) See Attachment 7
 No (Check the box for each CEQA or NEPA document listed below that will be or is being prepared.)

<input type="checkbox"/> Notice of Exemption	<input checked="" type="checkbox"/> Mitigated Negative Declaration	<input type="checkbox"/> NEPA document (type): _____
<input checked="" type="checkbox"/> Initial Study	<input type="checkbox"/> Environmental Impact Report	
<input type="checkbox"/> Negative Declaration	<input checked="" type="checkbox"/> Notice of Determination (Enclose)	
<input type="checkbox"/> THP/ NTMP	<input type="checkbox"/> Mitigation, Monitoring, Reporting Plan	

B. State Clearinghouse Number (if applicable)

C. Has a CEQA lead agency been determined? Yes (Complete boxes D, E, and F) No (Skip to box 14.G)

D. CEQA Lead Agency: County of Santa Cruz Planning Department

E. Contact Person: Juliette Robinson F. Telephone Number: (831) 454-3156

G. If the project described in this notification is not the "whole project" or action pursuant to CEQA, briefly describe the entire project (Cal. Code Regs., tit. 14, § 15378).

The project described in the notification is the entire project.

Continued on additional page(s)

H. Has a CEQA filing fee been paid pursuant to Fish and Game Code section 711.4?

Yes (Enclose proof of payment) No (Briefly explain below the reason a CEQA filing fee has not been paid)

See Attachment 8

Note: If a CEQA filing fee is required, the Lake or Streambed Alteration Agreement may not be finalized until paid.



Applicant Name: Santa Cruz County Flood Control

Project Name: Pajaro River Sandbar Breaching Program

ATTACHMENT D

Routine Maintenance

Complete this attachment only when notifying for routine maintenance activities that will be recurring over the term of the agreement, such as maintaining a number of existing private or public facilities, including but not limited to canals, channels, culverts, and ditches. Submit this form with the completed notification form (DFW 2023).

I. REGULARLY RE-OCCURRING MAINTENANCE ACTIVITIES *(Check all that apply)*

- Sediment removal (concrete-lined lake or stream or earthen lake or stream):
- In and around bridges, culverts, storm drain outlets, and/or water diversion structure
 - Stream channel bed
 - Stream channel bank(s)
 - Pond or lake
 - Marina basin
 - Detention basin
 - Boat launch channel
 - Other: Sand bar / river mouth berm

Method (heavy equipment, suction dredge, etc.) – specify: dig trench with hydraulic excavator

Estimated total cumulative sediment volume removed annually: between 150 and 2000 cubic yards

Estimated total cumulative area impacted by sediment removal annually: up to 10,000 square feet

Estimated recurrence frequency for sediment removal: annually

- Vegetation management:
- Limbing and/or trimming of branches and tree limbs
 - Removal under high power lines
 - Removing fallen trees
 - Removing dead (not dormant) trees and shrubs
 - Stump left intact
 - Stump removal – specify: _____



- Removing vegetation (e.g., bulrush and cattails) from stream channel bed with:
 - Non-motorized hand tools
 - Mechanical vegetation cutters, shredders, string trimmers (a.k.a. weed-whacker, weed-whip), chainsaws
 - Mowing
 - Heavy equipment (soil disturbance)
 - Herbicide – specify chemicals and attach application plan: _____
 - Other: _____

- Removing vegetation from bank with:
 - Non-motorized hand tools
 - Mechanical vegetation cutters, shredders, string trimmers (a.k.a. weed-whacker, weed-whip), chainsaws
 - Mowing
 - Heavy equipment (soil disturbance)
 - Herbicide – specify chemicals and attach application plan: _____
 - Other: _____

- Removing only non-native vegetation with:
 - Non-motorized hand tools
 - Mechanical vegetation cutters, shredders, string trimmers (a.k.a. weed-whacker, weed-whip), chainsaws
 - Mowing
 - Heavy equipment (soil disturbance)
 - Herbicide – specify chemicals and attach application plan: _____
 - Other: _____

Vegetation and brush pile burning – specify burn location: _____

Other vegetation management: _____

Estimated total linear feet of vegetation removed annually: _____

Estimated total cumulative area impacted by vegetation management annually: _____

Estimated recurrence frequency for vegetation management: _____

Intentionally Left Blank



Existing facilities:

Erosion within existing facilities and easements

New erosion repair

Repair at existing erosion control sites

Other: _____

Road maintenance (e.g. repair or re-grade) of existing rights of way

Minor bridge work – work from bank or work in-channel (describe on a separate page if the work requires dewatering):

Reinforcing pilings

Reinforcing aprons

Painting (access and falsework)

Paint removal – specify method: _____

Other: _____

Specify materials and equipment: _____

Minor culvert repair:

Repairing wingwalls within existing footprint

Repairing scour protection within existing footprint – provide detail:

Other: _____

Maintenance of stormwater outfalls and drop-inlet culverts

Erosion repair

Flow dissipaters

Servicing of water quality monitoring stations, stream gages, etc.

Boat launch repair

Graffiti removal and abatement from bridges, culverts, and other instream structures

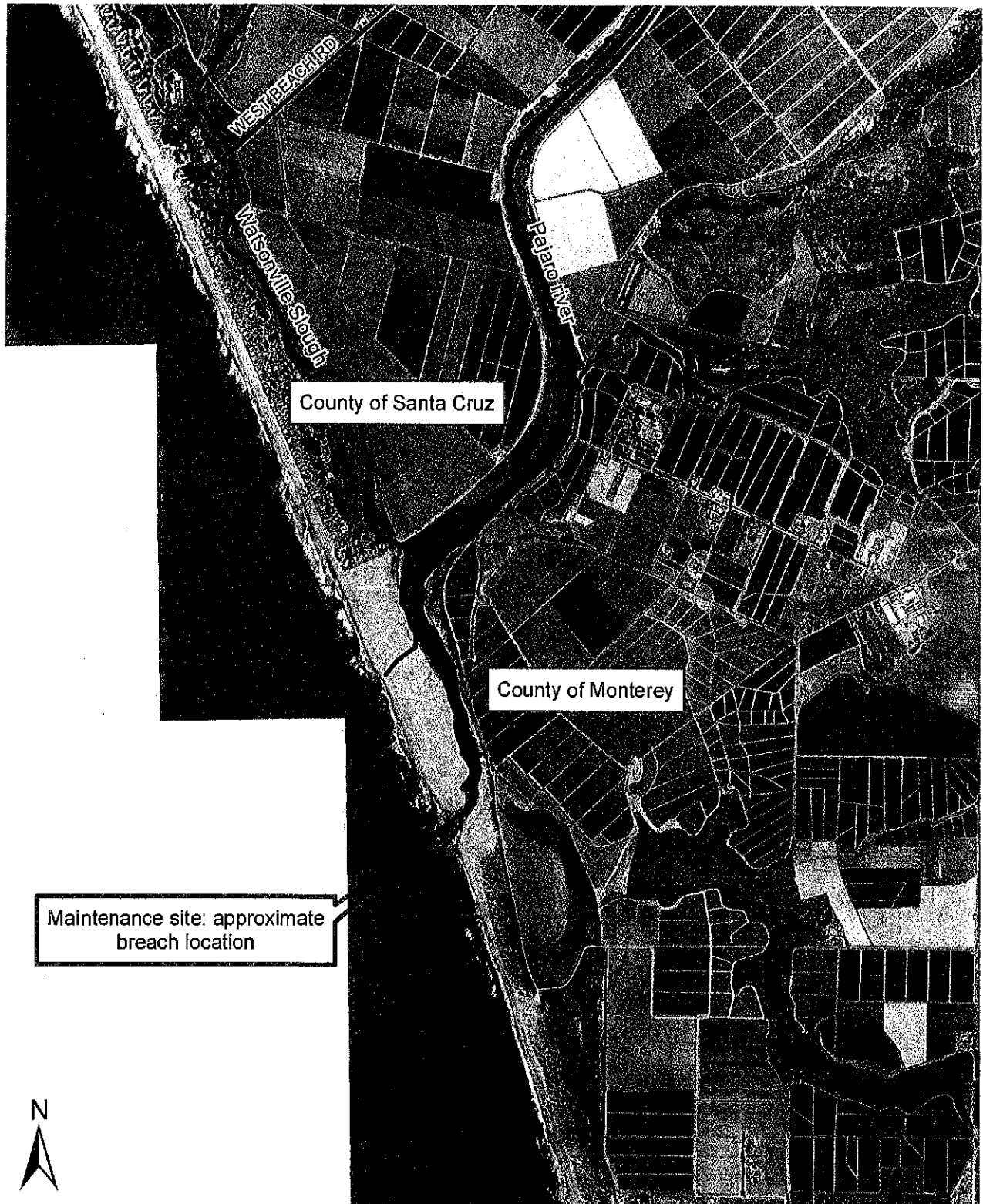
Removal of trash and debris from:

Within channels

Head gates, screens, racks, pilings and piers

Other: _____

Attachment D-II. Map of Maintenance Site



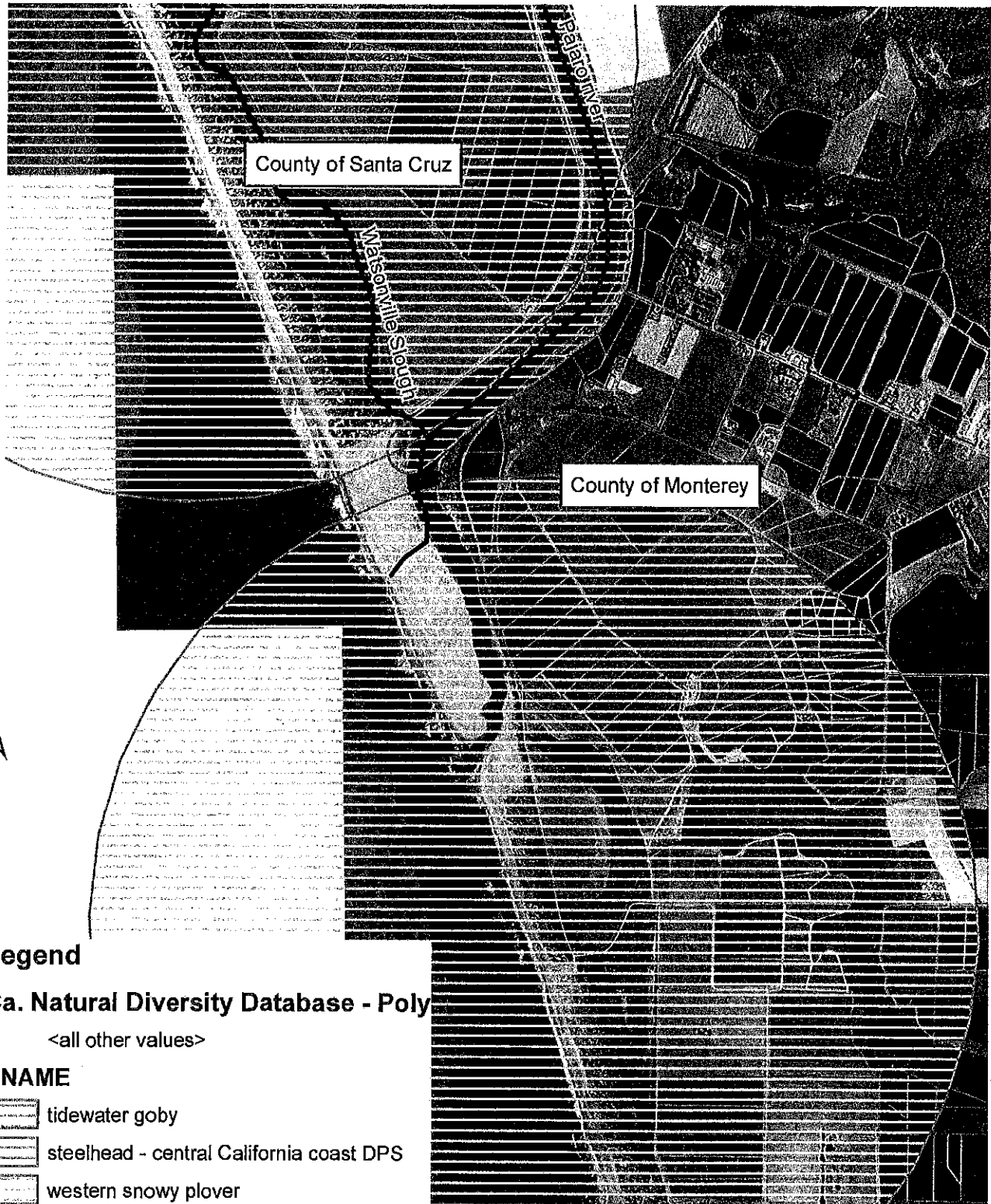
Maintenance site: approximate breach location



0 0.25 0.5 1 Miles

Map created by Santa Cruz County
Department of Public Works, February 2018

Attachment D-III. Special Status Species






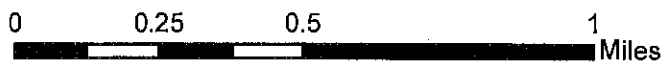
Legend

Ca. Natural Diversity Database - Poly

<all other values>

CNAME

-  tidewater goby
-  steelhead - central California coast DPS
-  western snowy plover



Map created by Santa Cruz County
Department of Public Works, February 2018

Notice of Determination

To:
Office of Planning and Research
For U.S. Mail:
P.O. Box 3044
Sacramento, CA 95812-3044

Street Address:
1400 Tenth Street
Sacramento, CA 95814

From:
Department of Fish and Wildlife
Bay Delta Region
2825 Cordelia Road, Suite 100
Fairfield, CA 95434
Contact: Monica Oey
Phone: (831) 428-2088



Lead Agency
County of Santa Cruz
701 Ocean Street
Santa Cruz, CA 95060
Contact: Ken Hart
Phone: (831) 454-3127

SUBJECT: *Filing of Notice of Determination pursuant to Public Resources Code section 21108*

State Clearinghouse Number: 2002122066

Project Title: Pajaro River Sandbar Breaching Program Project (Streambed Alteration Agreement No. 1600-2018-0081-R3)

Project Location: The project is located at the mouth of the Pajaro River; the project area spans the Pajaro River lagoon and Watsonville Slough at Sunset-Palm State Beach in the County of Santa Cruz, State of California; Latitude 36.842222, Longitude -121.805556 or Section 36, Township 12S, Range 1E, U.S. Geological Survey (USGS) map Moss Landing; Assessor's Parcel Numbers 052-231-35 and 412-032-015

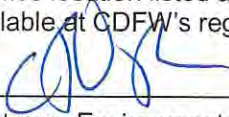
Project Description: The California Department of Fish and Wildlife (CDFW) has executed Streambed Alteration Agreement number 1600-2018-0081-R3, pursuant to section 1602 of the Fish and Game Code to the project Applicant, the County of Santa Cruz Department of public Works.

The County of Santa Cruz Department of Public Works will breach the Pajaro River lagoon to prevent localized flooding. Breaching activities will not occur more than two times during each winter season for the term of the Streambed Alteration Agreement. Additional breaches may occur, if CDFW provides written approval.

This is to advise that CDFW, acting as a Responsible Agency, approved the above described project on October 18, 2018 and has made the following determinations regarding the project pursuant to California Code of Regulations section 15096, subdivision (i):

1. The project will not have a significant effect on the environment. This determination is limited to effects within CDFW's permitting jurisdiction as a Responsible Agency.
2. CDFW considered the mitigated negative declaration / negative declaration prepared by the Lead Agency for this project pursuant to California Code of Regulations section 15096, subdivision (f).
3. Mitigation measures were / were not made a condition of CDFW's approval of the project.
4. A mitigation reporting or monitoring plan was / was not adopted by CDFW for this project.
5. A statement of overriding considerations was not adopted by CDFW for this project.
6. Findings were not made by CDFW pursuant to California Code of Regulations section 15091.

The mitigated negative declaration / negative declaration prepared for the project is available to the general public at the office location listed above for the Lead Agency. CDFW's record of project approval as Responsible Agency is available at CDFW's regional office.

Signature  Date: October 18, 2018
Craig J. Weightman, Environmental Program Manager

Date Received for filing at OPR: _____

Pajaro River Breaching Alternatives Analysis Work Program

County of Santa Cruz, California



Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

March 16, 2007

Exhibit 9
3-19-0344
Page 1 of 58

Pajaro River Breaching Alternatives Analysis Work Program

County of Santa Cruz, California



Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

March 16, 2007

Exhibit 9
3-19-0344
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EXECUTIVE SUMMARY

The County of Santa Cruz has been mechanically breaching the seasonal Pajaro River sandbar for flood control purposes since the 1950s. In 1992, the County entered into an interim breaching agreement with the U.S. Army Corps of Engineers, California Department of Fish & Game, the California Coastal Commission, and the California State Parks and Recreation Department. Although the interim agreement has expired, the County of Santa Cruz continues to coordinate breaching activities with these agencies. As a special condition to its 2006 breaching permit application (#3-03-015), the California Coastal Commission requested an Alternative Analysis. The request specified that the permittee (the County) submit an alternatives analysis work program that identifies the full range of alternatives to breaching. The purpose of this report is to provide the work program and an analysis of identified breaching alternatives.

The work program identifies the current flood risk priorities that motivate the breaching program. These are the flooding of the Beach and Shell Road intersection, which blocks access to the Pajaro Dunes community, and flooding of the Pajaro Dunes Community sanitary system which, when inundated, leads to a raw sewage spill into the Watsonville Slough and Pajaro Dunes community. There are other risks associated with flooding in the area, including damage to agricultural fields, private structures, and the Pajaro Dunes electricity system.

The alternatives studied include:

1. The installation of additional flap gates along Beach and Shell Roads;
2. Elevating Shell and Beach Roads sufficiently to eliminate flooding of these roads;
3. Flood-proofing of the Shell Road Pump Station;
4. Flood-proofing of sewer lines and the sewer pump station;
5. Elevating electrical boxes;
6. Elevating Rio Boca Road and sewer manholes;
7. Installation of a weir or a flume along the Lagoon edge;
8. Replacement of Beach Road drainage ditch flap gate;
9. Construction of a flood wall along Rio Boca Road;
10. Installation of a Tide Gate at the Watsonville Slough mouth;
11. Flood proofing the Cypress House community building;
12. Continue current breaching program with no additional projects; and
13. Discontinue breaching with no additional projects (i.e. 'do nothing').

The work program provides methodology for analyzing and rating each alternative for costs, environmental benefits and impacts, effect on breaching program, and general



constructability. Based on these factors, Schaaf & Wheeler recommends any single or combination of the following alternatives:

- Alternative 2: Elevate the Shell & Beach Road Intersection, with the potential to be combined with Alternative 4, Flood Proofing of the Sanitary Sewers and Pump Stations;
- Alternative 10: Construction of a Tide Gate at Watsonville Slough Mouth;
- Alternative 12: Continuation of the Current Breaching Program.

Each of these alternatives is a feasible means of protecting the highest priority flood risk elements identified in the work program while minimizing impacts to wildlife health and habitat. Given this conclusion, Schaaf & Wheeler recommends that for the time being the existing breaching program be continued.

BACKGROUND

The Pajaro River watershed encompasses more than 1,300 square miles and the lower reach of the Pajaro forms the boundary between Santa Cruz and Monterey Counties in California, as shown in Figure 1. In some years, due to a decrease in flows from the Pajaro River and natural coastal processes, a sandbar forms at its mouth, where the Pajaro River discharges to the Pacific Ocean. The formation of this sandbar closes the mouth of the River, preventing outflow to the Ocean. As Pajaro River flows are trapped behind the sandbar, water levels rise in the Pajaro Lagoon (Lagoon) and its associated adjacent sloughs and marshes.

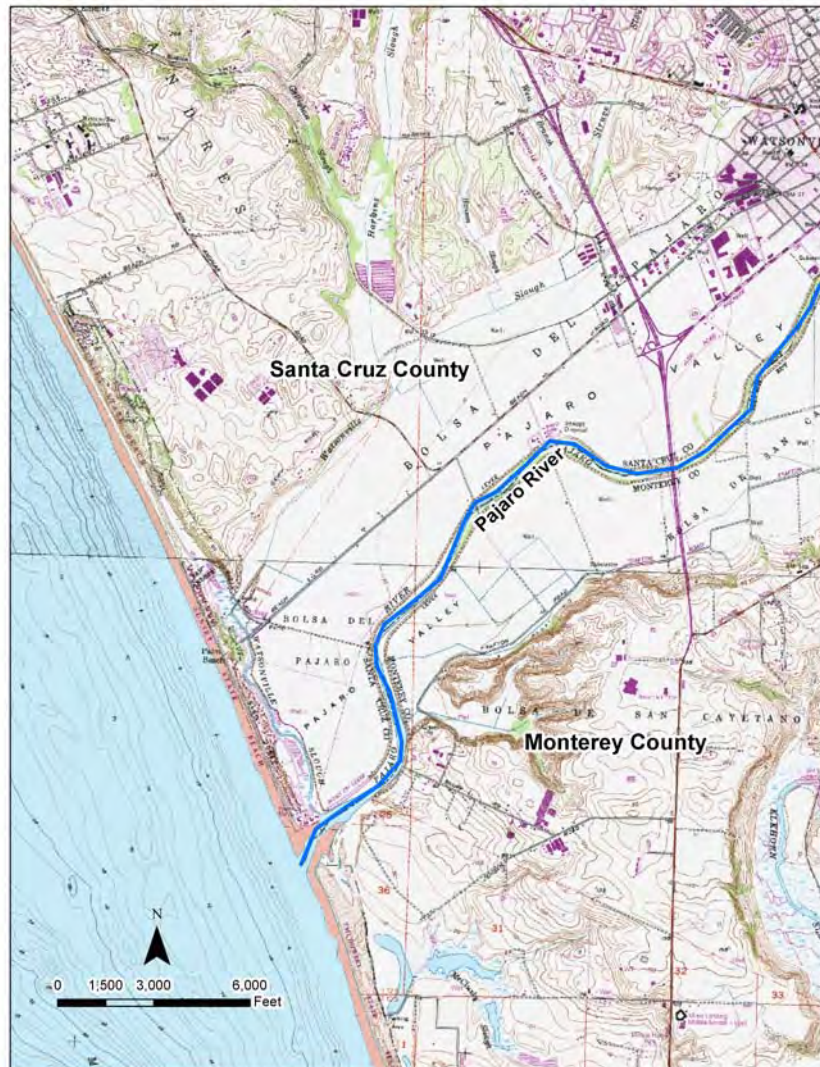


Figure 1: Location Map for Lower Pajaro River

Generally this sandbar forms in the late summer or fall. Breaching of the sandbar often occurs naturally during the early winter due to the force of increased flows in the Pajaro combined with high-energy waves accompanying winter storms.¹ During some years however, especially during particularly dry winters, the Pajaro River flows and Pacific Ocean wave action is not sufficient to naturally breach the sandbar. High water levels in the Lagoon can cause localized flooding in the agricultural and residential areas that surround the Lagoon and adjacent sloughs. Water backing up into Watsonville Slough (Slough) from the Lagoon can cause flooding of Santa Cruz County (County) roads and

¹ USACE 404/10 Permit Application, Page1-1



the Pajaro Dunes Residential Community (Pajaro Dunes). Specifically, local flooding threatens Monterey County farmlands, emergency access to and from Pajaro Dunes, the sewage collection and delivery network for Pajaro Dunes, as well as electrical infrastructure and property within the community.

To prevent this localized flooding, the County initiated a mechanical breaching program in the 1950s². In 1992, the County entered into an interim breaching agreement with the U.S. Army Corps of Engineers (USACE), California Department of Fish and Game (CDFG), California Coastal Commission (CCC) and the California State Parks and Recreation Department. This interim agreement has since expired, however the County continues to coordinate breaching activities and permitting with these agencies. An element of the breaching agreement was the development of the 1993 Pajaro Lagoon Management Plan which outlines specific breaching protocol to avoid adverse water quality conditions and protect fisheries in the Pajaro Lagoon.

As part of its ongoing coordination and permitting process for the breaching program, the County submitted a permit application (#3-03-015) to the California Coastal Commission on January 27, 2006. On June 23, 2006 the California Coastal Commission granted the County its permit to continue breaching the Pajaro River mouth as necessary for flood control purposes as described by the permit application. However this permit is subject to specific special conditions, including the submittal of an Alternative Analysis Work Program which identifies the full range of alternatives to breaching, including but not limited to a specific list of six (6) alternatives identified by the Coastal Commission³.

The purpose of this report is to present not only those alternatives identified by the Coastal Commission, but also alternatives identified by Schaaf & Wheeler through consultation with Santa Cruz County staff. A work program for alternative analysis was developed and utilized for each alternative. Schaaf & Wheeler estimated total project costs, and rated the impacts and benefits of each alternative scenario, utilizing the work program methodology described below. Each alternative was categorized based on the impact it may be expected to have on the breaching program, and the prioritized flooding risks identified by the County.

² USACE 404/10 Permit Application, Page 1-1

³ Coastal Development Permit Page 4 of 5, Requirement #7



ALTERNATIVE ANALYSIS WORK PROGRAM

The Work Program includes two parts: first, identifying the flooding risks and protection priorities of the affected communities and, second, developing a methodology that can be used to analyze and rate each alternative.

Community Flood Risk & Protection Priorities

As mentioned previously, backwater due to the mouth not breaching naturally has the potential to cause local flooding in the Pajaro River Lagoon, as well as along Watsonville Slough. Although Monterey County agricultural fields are subject to flooding due to this backwater effect, this report does not include those flooding risks, nor any alternatives that have the sole impact of reducing flooding risks to Monterey County lands. The existing Santa Cruz County permits do not allow consideration of these lands in its breaching program, and any alternatives that impact only Monterey County would be more appropriately included in a future Monterey County Breaching Program, should Monterey County prepare one.

The County of Santa Cruz owns and operates a water level gage in the Watsonville Slough just downstream of Beach Road. Although various reports refer to the levels of this gage as relative to a datum (i.e. Mean Sea Level or NGVD), Schaaf & Wheeler field surveys have found that this gage is not directly tied into a known vertical datum. For the purposes of this report, water levels in the Watsonville Slough are referred to as County Gauge datum (CG). Flooding risks are described in detail in various County documents and permit applications. It should be noted that these documents generally provide a range of gage heights corresponding to flood risks. A detailed topographic survey is needed to determine exact water levels corresponding to various flooding risks. At lower water elevations (5.5' CG) the Interim Criteria Plan (1992) states that there is a threat to "the sanitary manhole located adjacent to Lift Station #1 on the Pajaro Dunes Community"⁴. Neither the County nor Pajaro Dunes Home Owners Association (HOA) staff was able to identify the manhole to which this statement is referring. Over the last fifteen years, a few manholes have been raised by the City of Watsonville, so it is possible that this threat has already been mitigated.

Current permits allow for the mechanical breaching of the Pajaro River when water levels reach 4.5' (CG) during the rainy season (November – April). During the dry season (May – October) the height for allowed breaching is increased to 5.5' (CG). Crews begin to mobilize when water levels reach one foot below the breaching height. These breaching heights were established in the 1992 Interim Breaching Agreement. Figure 2

⁴ 1992 Interim Plan, p. 1



shows the location of the County Gage, as well as other notable features that are served by the breaching program.

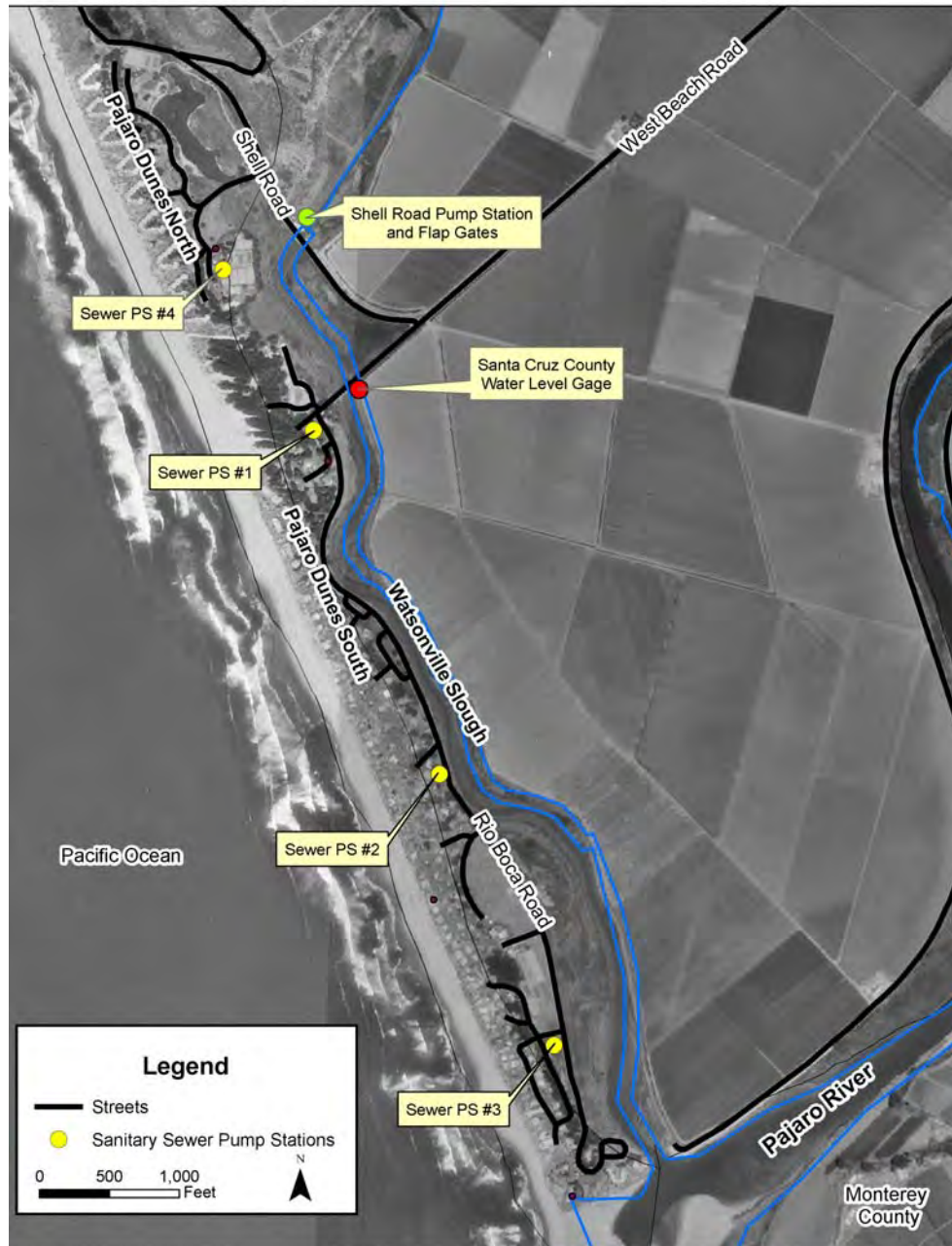


Figure 2: Area Map of Watsonville Slough and Relevant Flood Risk Landmarks



Schaaf & Wheeler has met with County Staff as well as the Pajaro Dunes HOA manager (Carol Turley). Both entities agree that the highest priority flood risks which are served by the breaching program include: limited emergency access due to street flooding, the flooding and backflow of the sanitary sewage system, including pump stations, and the flooding of privately owned community buildings. Specifically, the flooding of the Beach and Shell Roads intersection not only prevents access to the entire Pajaro Dunes Community, but it also creates a high risk of accidents at this location. Based on conversations with Pajaro Dunes HOA Management, it was determined that this intersection generally floods from the east, via Slough waters overtopping the banks in the short reach between Beach and Shell Roads.

The flooding of this intersection begins at 5.5' (CG). Shell Road, at the Shell Road Pump Station, also begins to flood at this elevation, further hampering emergency access to the Northern Pajaro Dunes Community. When Shell Road begins to flood, the Shell Road pump station is in danger of becoming inundated with floodwaters, and at least one sanitary manhole within Pajaro Dunes may also be threatened⁵. At this elevation the Pajaro Dunes Cypress House community building is also inundated with flood waters. Again based on conversations with HOA management, this flooding originates from the Slough overtopping its banks between Beach and Shell Roads, in this case then flowing north westerly towards the community buildings and sewer system.

The majority of the flood risk to the sewage system begins when water levels reach between 6.0-6.5' (CG), although due to the existing breaching program, water levels in the Slough rarely reach this height. Despite this, under the current program City of Watsonville crews generally sand bag both pump stations #1 and #3 during severe storm events and high water levels in Watsonville Slough due to concerns with the flooding risk (and resulting spillage) of the untreated sanitary system⁶. For the purposes of this report, it was assumed that the sanitary system becomes threatened at a water level of 6.5' (CG). Based on this assumption, a gage breaching height of 5.5' (CG) is recommended to provide one foot of freeboard for protection of the sanitary sewer system.

Under the current program Pajaro Dunes experiences fairly regular flooding of the Cypress House, a community building located near Pump Station # 1 in the Pajaro Dunes North area. Both the Pajaro Dunes HOA and the County consider this nuisance flooding, however, since it does not threaten human health and safety. During the winter months, at a water level of 4.5' (CG), local flooding of marsh habitat and until recently, the Pajaro

⁵ 1992 Interim Plan, p. 2

⁶ Meeting with HOA Director, January 11, 2007



Dunes South fields occurs.⁷ This height, however, allows for one foot of “freeboard” before the more serious flooding of roads and sanitary manholes described above. The freeboard is important to maintain, since the possibility of a severe local storm during the wet winter months is high. A severe storm centered above the Watsonville Slough watershed could lead to a swift rise in water surface elevations within the Slough resulting in flooding of the roads and sanitary system before crews are able to mobilize and mechanically breach the mouth to reduce water levels in the Pajaro River Lagoon and Watsonville Slough to safer levels.

During the summer months, when the likelihood of a significant flood is low, the breaching height water level is set to the highest possible value of 5.5’ (CG) that corresponds to the advent of higher risk flooding. As mentioned previously, at this height there is already flooding of the Slough marshlands, the Cypress House community building, and until recently, Pajaro Dunes South community fields and buildings.

Methodology

Acquisition of Data

The County of Santa Cruz provided Schaaf & Wheeler with copies of relevant reports and permit applications, as well as available digital data such as road and stream alignments. Although the County does maintain topographic data, in the area of the Watsonville Slough contours are only available in 10-foot intervals, which is not particularly helpful for this analysis. Additionally, the County provided Schaaf & Wheeler with digital aerial photos and with hard copy sanitary sewer system data.

In addition to the provided data, Schaaf & Wheeler engineers conducted several site visits and met with the County and the Pajaro Dunes HOA manager. The purpose of these site visits was to conduct vertical surveys, catalogue the existing Slough system, and gain a greater understanding of the overall site layout and constraints.

Preliminary List of Alternatives

In the CCC Permit special conditions alternatives analysis requirement, the County was directed to identify and analyze alternatives that either remove the need for breaching all together, or increase the water levels at which breaching occurs. As mentioned previously, the flooding of Beach and Shell Road generally occurs due to Slough waters overtopping their banks in the reach between Beach and Shell Roads, and flowing easterly toward this intersection.

⁷ USACE 404/10 Permit Application, p. 1-4



The following alternatives were defined by the CCC Permit special conditions requirement (#7 in permit documents):

1. The installation of ... additional flap gates along Beach and Shell Roads;
2. Elevating Shell and Beach Roads sufficiently to eliminate flooding of these roads;
3. Flood-proofing of the Shell Road Pump Station;
4. Flood-proofing of sewer lines and the sewer pump station;
5. Elevating electrical boxes and sewer manholes;
6. Installation of a weir or a flume along the Lagoon edge; and
7. Other flood protection measures as described in Exhibits 4 and 8.

Exhibits 4 and 8, referred to in the 7th bullet above, are the alternatives identified in the Swanson & Associates 1993 Parajo Lagoon Plan Report (exhibit 4) and the Summary of Measures Taken by the County to Implement Recommendations of the Pajaro River Management Plan (“Summary of Measures”, exhibit 8). As the title suggests, most of these measures have already taken place, with the exception of measure “a-iii”, which calls for replacing the culvert and flap gate at the terminal end of Beach Road Ditch. Thus, the additional alternatives required by the CCC via #7 above include:

8. Install a water level control pump and tie into the City of Watsonville’s Outfall; and
9. Improve the Drainage System around the Lagoon and Continue the Present Interim Breaching Program including:
 - a. Shell Road Pump Improvements;
 - b. Monterey County Gravity Outfalls; and
 - c. Replacement of Beach Road ditch flap gate.

In addition to these required alternatives, Schaaf & Wheeler, through consultation with County staff, identified the following additional alternatives:

10. Construction of a flood wall along Rio Boca Road;
11. Installation of a Tide Gate at the Watsonville Slough mouth;
12. Flood proofing the Cypress House community building;
13. Raise Rio Boca Road;
14. Continue current breaching program with no additional projects; and
15. Discontinue breaching with no additional projects (i.e. ‘do nothing’).

Final Alternative Selection

Schaaf & Wheeler first conducted a preliminary review of these alternatives, and based on that review, was able to discard, combine, or split several of the initial alternatives. Alternative 5 above was split into two separate alternatives. However, given the layout of the sanitary storm drain down the center of Rio Boca Road, raising the manholes along



this storm drain would require raising the road itself – therefore, this alternative was combined with Schaaf & Wheeler’s Alternative 13. Alternative 8, identified in the Swanson and Associates Lagoon Plan was rejected in the USACE Section 404/10 Permit Application⁸ due to water quality concerns and what was considered prohibitive construction costs. Although Schaaf & Wheeler did not exclude any alternative based on cost estimates, the benefit of this project is unclear. Without any additional elements this pump would have to effectively pump the whole of the Pajaro River and Lagoon in order to reduce flooding risks. In addition, due to the sometimes highly degraded water quality in the Slough from agricultural runoff, it is highly unlikely that such a project would receive the required permits. For these reasons, Alternative 8 was removed as an independent alternative and only considered as a subproject to other alternatives when appropriate.

Finally, Alternatives 9a and 9b were excluded from this analysis. Alternative 9a has already taken place, as documented in the Summary of Measures exhibit⁹. Alternative 9b was omitted because as mentioned previously, alternatives which solely address flooding within Monterey County were excluded from this analysis, although Santa Cruz County Public Works staff remains available to work with Monterey County in efforts to improve their flood conditions. Making these changes resulted in the final selection of alternatives:

1. The installation of ... additional flap covers along Beach and Shell Roads;
2. Elevating Shell and Beach Roads sufficiently to eliminate flooding of these roads;
3. Flood-proofing of the Shell Road Pump Station;
4. Flood-proofing of sewer lines and the sewer pump station;
5. Elevating / Flood-proofing electrical boxes;
6. Elevating Rio Boca Road and sewer manholes;
7. Installation of a weir or a flume along the Lagoon edge;
8. Replacement of Beach Road drainage ditch flap gate;
9. Construction of a flood wall along Rio Boca Road;
10. Installation of a Tide Gate at the Watsonville Slough mouth;
11. Flood proofing the Cypress House community building;
12. Continue current breaching program with no additional projects; and
13. Discontinue breaching with no additional projects (i.e. ‘do nothing’).

Figure 3 shows the general location of each of these alternatives.

⁸ USACE 404/10 Permit Application, Page 2-1

⁹ County Breaching Permit Application, exhibit 8

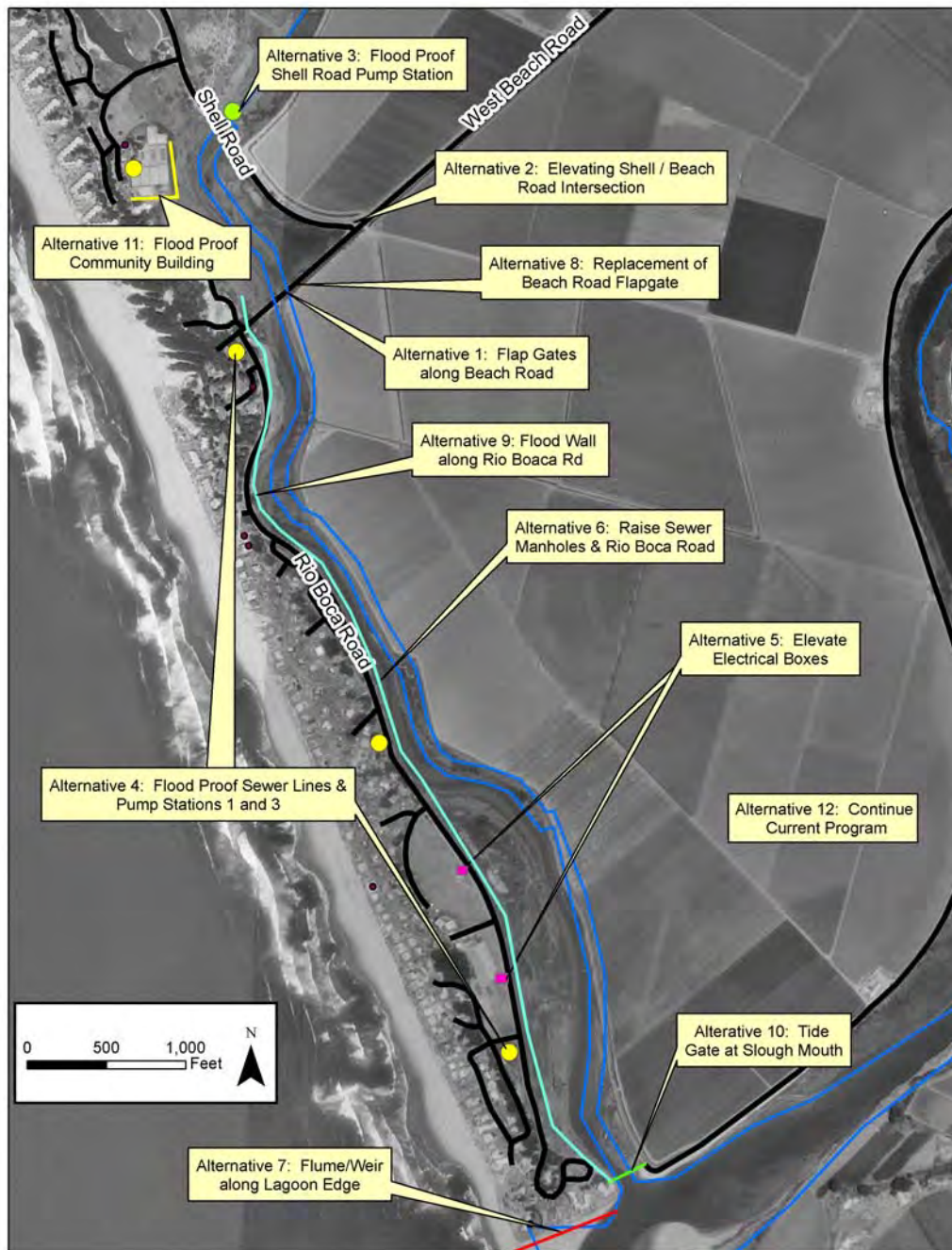


Figure 3: Selected Alternatives Included for Analysis

Cost Estimates of Alternatives

Preliminary construction costs for each alternative were estimated. These estimates include a 40% contingency for design, permitting, and unknowns; however the estimates do not include costs for ongoing operations and maintenance for the proposed projects.

Exhibit 9
3-19-0344

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Due to the preliminary nature of the alternative designs, assumptions were made throughout the cost estimating process. Quantities were estimated based on the available topographic data and information collected from site visits. Preliminary costs were referenced from 2007 Current Construction Costs¹⁰, which were then modified depending on constructability and project size. Items were also estimated from previous Schaaf & Wheeler design projects with similar size and scale. All alternative cost estimates discussed herein should be considered very preliminary. Additional analysis will be required to calculate more detailed and accurate cost estimates for any individual alternative, as well as to estimate the design and permitting related costs, which may be substantial for some proposed alternatives.

At this time, the County has not secured funding for any of the above identified alternatives except Alternative 12, the ‘existing program’ alternative and Alternative 13, which requires no funding. The funding for the breaching program is currently included in the County’s annual budgeting process. If an environmental benefit is expected, there are a variety of grants that the County may be able to qualify for to fund a given alternative. Some amount of cost-sharing with the Pajaro Dunes HOA may be possible, although the extent of the potential sharing is unknown, and possibly insignificant when compared to project costs. Finally, Alternative 10 is an element at least partially already included in the USACE Pajaro River Flood Control Project. As such, all or some of this project may be paid for by the USACE, however this funding source would be highly dependant on the timing of this project compared to the overall Pajaro River Flood Control project timing.

Alternatives Rating & Analysis

Schaaf & Wheeler first defined each alternative in greater detail. Many of these alternatives would require additional elements to have the intended effect without impacting flooding conditions in other locations, so those elements were explored and added to the project description. Project costs were estimated, and each alternative was rated on a scale of 1 to 5 on a variety of potential project impacts and benefits. The basis for comparison for the rating was the ‘do nothing’ alternative. Rated project impacts include:

- Environmental: The footprint of the project, and its impact on plant and animal life was rated;
- Aesthetic;
- Constructability: a rating based on the likelihood of securing permitting and easements, as well as overall project feasibility.

¹⁰ Saylor Publications, 2007



The rated project benefits include:

- Reduction in flooding: The projects impact on flooding of the Shell & Beach Road intersection, the sanitary sewer system, and the Cypress House community building were each rated.
- Environmental Enhancement
- Water Quality Enhancement

A rating of “1” indicates either significant benefit or minimal impact when compared to the ‘do nothing’ alternative. Conversely, a rating of “5” indicates either no benefit or significant impact. By using this approach, Schaaf & Wheeler was able to sum the total rating for each alternative to produce an equally weighed total rating score for each alternative. Using this system, the lowest total rating value is the “best” score. However it is important to note that this score is not weighted, so the scoring alone does not necessarily yield the most preferred alternative. These scores are meant to be used in conjunction with the cost estimates and the community flood risk and protection priorities described above to provide a balanced approach in preferred alternative selection.

In addition to the rating, each alternative was analyzed for the impact it would have on the recommended breaching height in winter months. For this analysis it was assumed that one foot of freeboard between recommended breaching water levels and severe flooding (i.e. flooding that threatens health or safety) would be maintained. If the alternative effectively removed the need for breaching then a recommended breaching height was not applicable.

The reasoning behind each rating is described in more detail for each alternative below. Within the general constructability discussion, regulatory permits considered include:

- CDFG 1602 Lake and Streambed Alteration Agreement
- USACE 404 Permit
- Regional Water Quality Control Board (RWQCB) 401 Water Quality Certification
- Coastal Commission Coastal Development Permit
- Biological Opinions from NOAA Fisheries and the United States Fish and Wildlife Services (USFWS)
- Grading and Construction Permits from the County of Santa Cruz

When applicable, permissions, easements, leases, and/or fee/title purchases of land from the following agencies or individuals were considered:

- Extension State Lands Commission lease
- County Roads



- Utilities
- Water Resources or Districts
- Flood Control
- Pajaro Dunes HOA
- Agricultural landowners

As described in more detail in the Alternatives Analysis section below, many projects may be considered categorically exempt from CEQA analysis as follows:

- Class 1 Operation, Repair or Maintenance of Existing Structures,
- Class 2 Replacement or Reconstruction of Existing Structures, or
- Class 3 Construction or Conversion of Small New Facilities.

Although some of the alternatives analyzed are not expected to require CEQA analysis, implementation of a combination of multiple breaching alternatives described in this document would likely constitute a “project” under CEQA and require one or more of the following:

- Initial Study/Mitigated Negative Declaration;
- Environmental Impact Report; and/or
- Mitigation and Monitoring Program.

It should be noted that each alternative was analyzed and rated independently. When applicable, the potential for alternative combinations was discussed in the ‘benefits’ section of the Alternatives Analysis, and in the Summary and Recommendations section of the report.

ALTERNATIVES ANALYSIS

Using the above described Work Program Methodology, each alternative was analyzed for its potential costs, impacts, benefits, and general constructability.

Alternative 1: The Installation of One-way Flap Gates on Beach Road Culverts

Project Description

The Pajaro Dunes homeowners association installed one-way flap gates on three 12-inch drainage culverts that run under Rio Boca Road. These flap gates were installed to eliminate, or at least reduce, the amount of Slough water back-flowing westward through these drainage culverts into the playing fields when water surface elevations in the Slough reach about 4.0’ (CG). The CCC Permit directs the County to evaluate “how well these reduced or eliminated flooding of the Pajaro Dunes community building” and “whether additional flap gate covers along Beach and Shell Roads would provide an



effective flood control alternative to breaching.” The flap gates on the culverts under Rio Boca Road have not been in place long enough to allow for a meaningful judgment on their performance, although thus far they appear to be serving their intended purpose of diminishing Slough waters in the fields. Since the Rio Boca Road and Shell Road culverts now have functioning flap gates, Schaaf & Wheeler has interpreted this required alternative to refer to the potential effectiveness of installing flap gates on the Beach Road culverts.

Per this alternative four 36-inch flap gates would be installed on the downstream (discharge) end of the four existing culverts where West Beach Road crosses Watsonville Slough. While installation of flap gates at Beach Road would reduce upstream flooding between Beach and Shell Roads, a slight increase in localized water levels may occur south of Beach Road along the roadside drainage ditch parallel to Beach Road (see Figure 4). Additionally, as is the case at the Shell Road flap gates and pump station, this alternative would require a pump station to pump local runoff in Watsonville Slough downstream of Beach Road when the flap gates were closed due to high backwater conditions. The purpose of this pump station is represented schematically in Alternative 3, Figure 6 below (see page 23).

Figure 4 shows a detailed view of this alternative.



Figure 4: Alternative 1 -- Installation of Additional Flap Covers Along Beach Road

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$889,000. The project elements and their associated costs are provided in Table 1.



Table 1: Cost Estimate for Alternative 1

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Flap gates at Beach Road	4	EA	\$2,500	\$10,000
Pump station	1	EA	\$600,000	\$600,000
2' concrete headwall	100	CY	\$250	\$25,000
SUBTOTAL				\$635,000
40% CONTINGENCY				\$254,000
TOTAL COST				\$889,000

This cost estimate assumes a new pump station capacity of 30 cubic feet per second. As this alternative involves Watsonville Slough, a known Waters of the U.S., Waters of the State, CDFG jurisdictional habitat, and area under the regulation of the multiple agencies listed previously, the level of effort and expense to comply with CEQA, environmental permitting, and monitoring for a suite of alternatives described herein may be substantial. On an order of magnitude, the CEQA and permitting effort may represent one to two years of time and as much a \$150,000, not including development of design documents and construction plans. Therefore, the 40% contingency may be an underestimate for this, and any other alternative which directly involves Watsonville Slough.

Benefits

As a result of this alternative, including the elements described above, the portion of Watsonville Slough north of Beach Road would be protected from backwater impacts. Since it is this portion of the Slough overflow that causes the flooding of the Beach and Shell Road intersection, this project would essentially eliminate the flood risk to that intersection due to backwater as well as the flood risk to the northern half of Pajaro Dunes. This project offers no protection to the sanitary system in Pajaro Dunes South, and as such, breaching would still be required when water levels in the Slough reach 5.5' (CG) in order to prevent flooding of the Pajaro Dunes sanitary sewer system. This alternative does not create any environmental or water quality benefits.

Impacts

Direct environmental impact to USACE and CDFG jurisdictional habitats in Watsonville Slough would be limited to temporary construction-related impacts south of Beach Road. There would be an alteration in the hydrologic regime in the short reach between Beach and Shell Roads. The periodicity of flooding potentially supporting jurisdictional wetlands, as well as the salinity content of the water, would be altered in timing potentially causing a gradual conversion of habitat from transitional brackish marsh to

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freshwater marsh. Moreover, the existing perennial wetland fringe established at the current maximum Slough water surface elevation of 5.4' (CG) may in time convert to seasonal wetland or riparian habitat due to the reduction of flooding in the reach.

In addition to gradual vegetation conversion, the use of this short reach by swimming aquatic organisms, e.g., fish and amphibians from the Lagoon would be stopped by the permanent barrier to passage represented by the flap gates. Finally, there will be an incremental slowing in the timing of freshwater inputs from upstream portions of Watsonville Slough to waters below the flap gates which, when occurring in a year of late seawater inputs into the Lagoon, could reduce the rate of conversion of Lagoon water from saline to relatively non-saline in the summer months. The effects of the flap gates on localized mixing and/or salt stratification (layering) in the water column below the flap gates is difficult to predict. However, large increases in summer Lagoon salinities slowly degrade the value of the Lagoon habitat for rearing juvenile steelhead, tidewater goby, and several benthic organisms. Such considerations are highly nuanced and the flap gates would probably not be considered a significant water quality impact.

General Constructability

This alternative, including the flap gates and the secondary drainage amenities are not particularly difficult to construct and construction-related impacts would be temporary. The regulatory permits required to implement this alternative would be the same as those in place for breaching described previously, e.g., CDFG, USACE, RWQCB, Coastal Commission, and County.

Construction of the pump station would likely require acquisition of permissions, easements, leases, and/or fee/title purchases of lands from the agencies or individuals also described previously in the work program methodology.

Excepting construction of the pump station, the components of this alternative are relatively small and may be considered categorically exempt from CEQA analysis as defined in the methodology section above. Depending on the placement of the pump station, however, the project may require full CEQA documentation.

Alternative 2: Elevating the Shell and Beach Roads Intersection

Project Description

As described previously, the intersection of Shell & Beach Roads floods when Slough water levels reach 5.5' (CG). This floodwater reaches the intersection by flowing easterly from Watsonville Slough between Beach and Shell Roads. When this intersection is flooded, it prevents access to and from both North and South Pajaro Dunes Community Center.



The flooding of this intersection has been identified by the County as the primary motivation for breaching of the Pajaro River. Alternative 2 proposes to elevate this intersection approximately two feet for about 850 feet along Beach Road and 300 feet along Shell Road. Where Beach Road crosses the Watsonville Slough, retaining walls are proposed so that no fill in the Slough is necessary. Included in this project is a new culvert to improve the drainage along the northern side of Shell Road just west of this intersection where water ponds currently due to poor drainage. Figure 5 shows a schematic of this alternative.

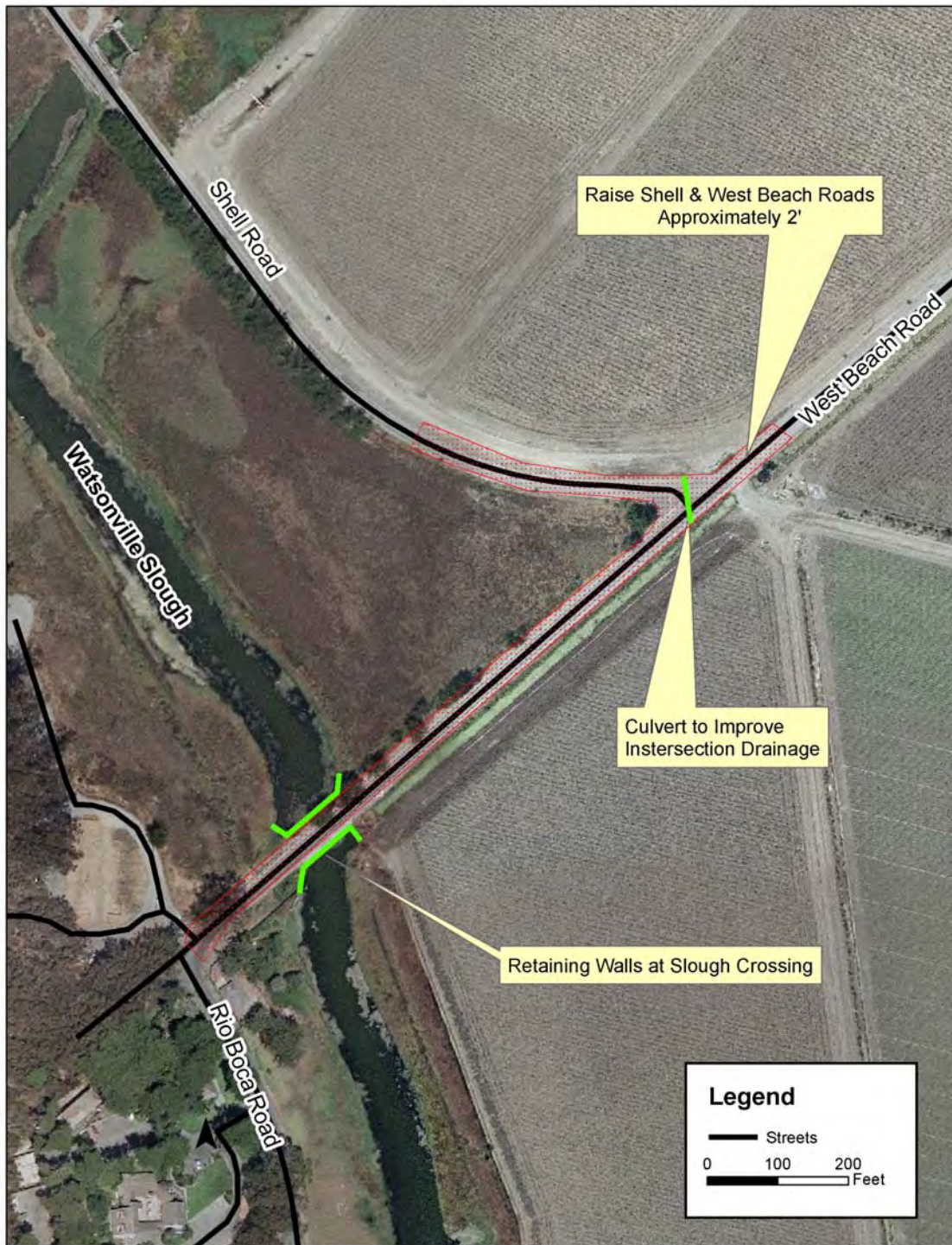


Figure 5: Alternative 2 -- Elevate Shell and Beach Roads



Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be about \$331,450. The project elements and their associated costs are provided in Table 2.

Table 2: Cost Estimate for Alternative 2

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Remove AC pavement	41,000	SF	\$1	\$41,000
4" aggregate base	41,000	SF	\$1	\$41,000
2" asphalt	41,000	SF	\$3	\$123,000
Fill	3,000	CY	\$7	\$21,000
Retaining wall	25	CY	\$250	\$6,250
Drainage culvert	60	LF	\$75	\$4,500
SUBTOTAL				\$236,750
40% CONTINGENCY				\$94,700
TOTAL COST				\$331,450

All assumptions used in this cost analysis were summarized in the methodology section above.

Benefits

This alternative would remove the risk of flooding at the Beach and Shell Road intersection due to backwater of the Watsonville Slough. This project does not protect the Pajaro Dunes sanitary sewer system, therefore the new breaching height after this project would be 5.5' (CG) in winter months in order to assure no inundation of the sanitary system. In addition, this alternative removes the ponding which currently occurs north of Shell Road adjacent to this intersection due to poor drainage conditions.

This alternative does not create any environmental or water quality benefits.

Impacts

Raising the roadbed surface elevation by approximately two feet would likely include a minimum corresponding widening of the road prism along either shoulder. In order to maintain a stable 2:1 side slope, the road would be widened roughly four feet on either side. If a standard road shoulder were included to minimize public safety risks, then road widening would be more dramatic.

Road widening would have relatively minor environmental impacts, but would require realignment of roadside drainage on the south side of Beach Road. The realignment of drainage ditches and the creation of additional mitigation wetland habitat along



Watsonville Slough would impact agricultural lands. This alternative specifically calls for retaining walls at the Slough crossing to avoid the impacts of road widening (and the associated fill) over the Slough.

While there would be very minor habitat losses, this alternative would probably have no significant negative impacts on site hydrology or individual animal species.

General Constructability

This alternative, including road raising and corresponding widening would have temporary construction related impacts. If the raising of the Roads was able to be accomplished without any fill in the Slough (via retaining walls as proposed above), then this alternative would likely be categorically exempt from CEQA analysis.

Construction would likely require acquisition of permissions, easements, leases, and/or fee/title purchases of lands from County Roads, Flood Control, and agricultural landowners, among others. This alternative would be supported by the County, the Pajaro Dunes HOA, and some residents of Shell Road as it addresses flood control for emergency ingress and egress. Adjacent farmers might oppose encroachment into agricultural lands.

Alternative 3: Flood Proofing of the Shell Road Pump Station

Project Description

Currently flap gates at Shell Road prevent Slough water from traveling upstream of Shell Road. As such, when water in the Slough increases due to backwater from the Pajaro Lagoon, the local runoff into the Slough upstream of the flap gates does not have enough pressure to open the flap gates, and must be pumped through Shell Road. A schematic of this scenario is shown in Figure 6.

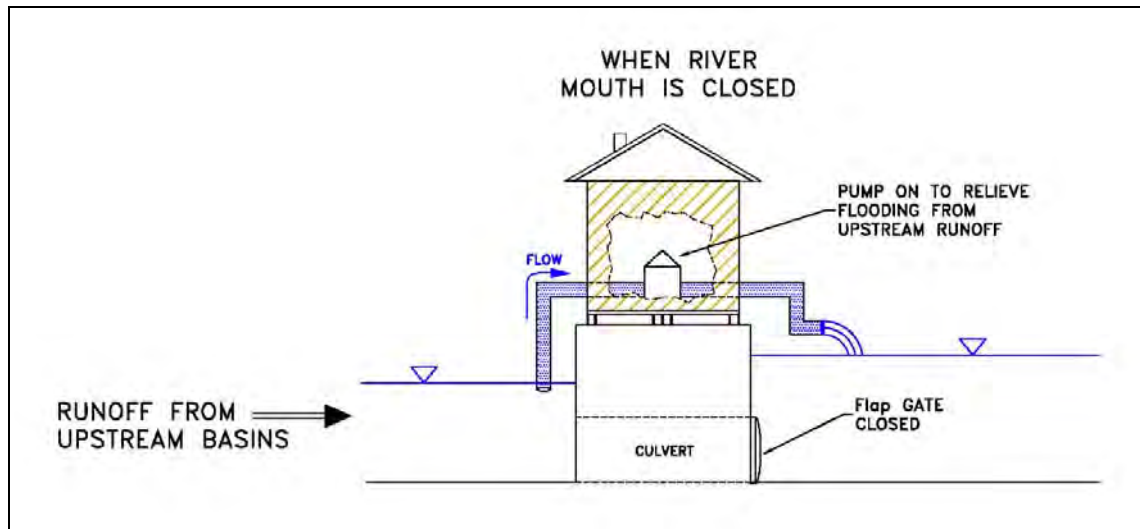


Figure 6: Schematic Describing the Purpose of the Shell Road Pump Station

Historically, at 5.0' (CG) the pumps at Shell Road pump station become ineffective. Recent pump improvements made by the County may have improved the Shell Road pump station efficiency at higher downstream water elevations; however sufficient backwater and storm conditions to test these improvements have not yet occurred.

When water reaches 5.5' CG, Shell Road begins to flood at the Watsonville Slough crossing¹¹. This flooding threatens to inundate the Shell Road pump station, which could potentially cause failure of the pump station. If the pump station were to fail, Shell Road and its flap gates would act like a dam – increasing flooding, potentially drastically, upstream along Watsonville Slough. Although water surfaces would eventually reach sufficient height to drive runoff flood waters either through the flap gates or over Shell Road, the extent of flooding when that occurs is unknown and may be significant.

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$840,000. The break down of the project elements and their associated costs is provided in Table 3.

¹¹ Swanson Management Plan, p. 16



Table 3: Cost Estimates for Alternative 3

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Replace existing with Flood Proof Pump Station	1	EA	\$600,000	\$600,000
SUBTOTAL				\$600,000
40% CONTINGENCY				\$240,000
TOTAL COST				\$840,000

Due to the age and condition of the Shell Road Pump Station, this cost estimate assumes that it will not be possible to flood proof the existing pump station, and that a new pump station would need to be constructed.

Benefits

Flood proofing of the Shell Road pump station offers increased flood protection redundancy to Watsonville Slough upstream of Shell Road. The project offers no increased flood protection when the pump station is not in danger of inundation by waters on Shell Road. This project would have no impact on the existing breaching program, and offers no environmental or water quality benefits.

Impacts

Flood proofing the Shell Road pump station would have very little to no environmental impact as improvements would not require a substantially greater footprint nor would the hydrology of the channel be substantially altered. Water quality of the Slough would neither be enhanced nor degraded under this alternative. Habitat for aquatic, avian, and mammalian species would not be improved or degraded.

General Constructability

Farmers and landowners upstream of the Shell Road pump station would be likely to support this alternative because in the event of a storm combined with high water levels in the Slough, the operation of this pump station is critical to minimizing flooding upstream of Shell Road. Additionally, the Santa Cruz Resource Conservation District would be likely to support this alternative as rehabilitation of the Shell Road Pump Station is a stated objective of both the *Watsonville Sloughs Watershed Resource Conservation Plan* (RCD, 2003) and the *Watsonville Slough Agricultural Drainage & Wetland Restoration Project* (RCD, 2006).



The Pajaro Dunes HOA and landowners downstream of the Shell Road pump station would be unlikely to be particularly supportive of this project since it does not offer any additional protection downstream of Shell Road; however there is also no obvious reason why they would oppose this project.

Alternative 4: Flood Proofing of Sewer Lines and At-Risk Sewer Pump Stations

Project Description

As described previously, when waters in Watsonville Slough reach approximately 6.5’ (CG), the Watsonville City Sanitation Pump (Pump #1) and a second sanitary pump station (Pump #3) are threatened by floodwaters. Pump electrical systems have become compromised in the past requiring City crews to come on site to manually pump out sewage from the area’s sewer lines in order to restore pump operation. Currently City crews generally place sand bags around these two pump stations during storm events to protect them from inundation.

This project proposes to flood proof the sewer lines by installing flood proof manholes along eleven sanitary manholes on Rio Boca Road. In addition, the alternative includes the flood proofing of the two above identified pump stations, which includes raising electrical systems and securing the bottom foot of each pump station structure.

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$63,000. The break down of the project elements and their associated costs is provided in Table 4.

Table 4: Cost Estimates for Alternative 4

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Raise electrical foundation	2	EA	\$500	\$1,000
Replace sub grade electrical vaults with watertight manhole	2	EA	\$4,000	\$8,000
Flood proof bottom 2 ft. of building	250	SF	\$40	\$10,000
Flood proof manhole covers	4	EA	\$4,000	\$16,000
Flood proof removable barrier	2	EA	\$5,000	\$10,000
SUBTOTAL				\$45,000
40% CONTINGENCY				\$18,000
TOTAL COST				\$63,000

Since Pump Station buildings are brick & mortar, it was assumed that flood proofing of the existing buildings can be accomplished by applying waterproof adhesive membrane



material. Removable barriers would be required to prevent flooding through the vertical door entry ways. The costs do not include replacement or reconstruction of the building.

Benefits

This project provides protection for the Pajaro Dunes sanitary system, and eliminates the need for City of Watsonville crews to be on hand to protect pump stations via sand bags, and manually pump the system when necessary. Flood proofing the sewer lines and electrical systems in the Watsonville City Sanitation Pump Stations 1 and 3 will halt or minimize illicit discharges of raw sewage into portions of the Pajaro Dunes community which ultimately drain into the Watsonville Slough. As such this alternative would provide a large direct benefit to surface water quality and secondary benefits to human health and wildlife habitat quality.

Because this project does not impact the flood risk of the Shell and Beach Road intersection, alone it has no impact on the current breaching program. Since the current breaching program also protects that sanitary sewer system, it therefore offers only a redundancy to the sanitary system protection, and perhaps additional protection during a very extreme flooding event. If completed in conjunction with a project that eliminates the flood risk to that intersection, however, this project may significantly impact the water levels for breaching.

Impacts

Flood proofing the high risk sanitary pump stations and installing flood proof manholes would have very little to no environmental impact as improvements would not require a substantially greater footprint. Water quality of the Slough would not be degraded under this alternative, and the aesthetics of the existing manholes and pump stations would be only minimally impacted. Habitat for aquatic, avian, and mammalian species would not be improved or degraded.

General Constructability

Flood proofing and other maintenance enhancements to the existing sanitary pump stations could be implemented with a minimum of permissions, permits, or environmental documents because it would probably be categorically exempt from CEQA. If combined with other breaching alternatives described herein, however, the total project would likely constitute a “project” under CEQA.

A high priority of the Pajaro Dunes HOA is to avoid health and safety impairments to the community resulting from sewage leaks during flooding. Hence, this alternative would be well supported by the community.



Alternative 5: Flood Proofing Electrical Boxes

Project Description

When water surface elevations reaching the Slough reach 6.0-6.5' (CG), below ground PG&E junction boxes in the area can become inundated, causing power outages and/or surges. Pajaro Dunes has experienced at least one fire due to these surges that destroyed a residential property. In addition, pump station electrical systems, located beside the pump station structures, may also become inundated. Schaaf & Wheeler field investigations found six (6) PG&E metal lids representing below-grade electrical systems, and at-grade electrical stations adjacent to each pump station structure. This alternative proposes flood proofing these electrical boxes via flood proof covers, and elevating the pump station electrical components located outside of the pump station structures. Sealing of the interior of the electrical boxes may also be required. Figure 7 shows the location of these electrical boxes.



Figure 7: Alternative 5 -- Rio Boca Road Electrical Boxes to be Flood Proofed



Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$58,100. The project elements and their associated costs are provided in Table 5.

Table 5: Cost Estimates for Alternative 5

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Raise electrical foundation	3	EA	\$500	\$1,500
Replace sub-grade electrical vaults with watertight manhole	4	EA	\$10,000	\$40,000
SUBTOTAL				\$41,500
40% CONTINGENCY				\$16,600
TOTAL COST				\$58,100

All assumptions used in this cost analysis were summarized in the methodology section.

Benefits

This project offers protection to the Pajaro Dunes electricity system in the event of flooding. Because this project does not impact the flood risk of the Shell and Beach Road intersection, alone it has no impact on the current breaching program.

Impacts

Flood proofing the below grade electrical boxes would have no environmental impact as improvements would not require a substantially greater footprint. Water quality of the Slough would not be degraded under this alternative, and the aesthetics of the existing electrical box covers would not be impacted. Habitat for aquatic, avian, and mammalian species would not be improved or degraded.

General Constructability

Flood proofing of the electrical boxes could be implemented with a minimum of permissions, permits, or environmental documents because it would probably be categorically exempt from CEQA, however permission from and coordination with PG&E would be required. Due to past fires due to surges of the electricity during flood events it is likely that Pajaro Dunes would be highly supportive of this alternative.

Alternative 6: Elevating Rio Boca Road and Sewer Manholes

Project Description

As described previously, when waters in Watsonville Slough reach 6.5' (CG), the sanitary sewer system is threatened by floodwaters. This alternative proposes protecting

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the sanitary system by raising the sewer manholes approximately 2 feet, which would require the raising of Rio Boca Road by the same amount. Within this alternative are two options: to raise the road along its current alignment, or to realign the road westward to offset some of the environmental impacts of raising the road, described in more detail below.

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$1,036,000. The project elements and their associated costs are provided in Table 6.

Table 6: Cost Estimates for Alternative 6

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Remove AC pavement	130,000	SF	\$1	\$130,000
4" aggregate base	130,000	SF	\$1	\$130,000
2" AC	130,000	SF	\$3	\$390,000
Fill	10,000	CY	\$6	\$60,000
Raise sewer manholes 2 ft.	15	EA	\$2,000	\$30,000
SUBTOTAL				\$740,000
40% CONTINGENCY				\$296,000
TOTAL COST				\$1,036,000

All assumptions used in this cost analysis were summarized in the methodology section.

Benefits

Raising the elevation of Rio Boca Road and its attendant sewer manholes will halt or minimize illicit discharges of raw sewage and provide a direct and secondary benefit to humans, wildlife, and water quality. By raising Rio Boca Road the sanitary pump stations in Pajaro Dunes South will be protected from flood inundation in addition to the sewer lines. Because this project does not impact the flood risk of the Shell and Beach Road intersection, alone it has no impact on the current breaching program. Since the current breaching program also protects that sanitary sewer system, it therefore offers only a redundancy to the sanitary system protection, and perhaps additional protection during a very extreme flooding event. If completed in conjunction with a project that eliminates the flood risk to that intersection, however, this project may eliminate the need for breaching.



Impacts

The greatest potential impact of raising Rio Boca Road by two feet would be the associated increase in roadway width adjacent to high quality wetland habitat between the eastern road edge and Watsonville Slough. If, however, the roadway was widened to the west away from existing wetlands and its eastern edge become the pedestrian pathway at its existing elevation then the project would have only temporary construction-related impacts. If a vegetation screen between the roadway and the path were included in the design, then the re-alignment would benefit wildlife by reducing the effects of night lighting.

If the roadway were to be widened in place without realignment to the west, then there would be a continuous linear fill of jurisdictional wetlands along the entire eastern shoulder of the roadway. While there would be substantial vegetative habitat losses under this alternative, there would probably be no significant negative impacts to individual animal species. It would be challenging to identify sufficient area for compensatory wetland mitigation.

Linear fill along the Slough-side of Rio Boca Road could also slightly reduce the cross sectional area of the Watsonville Slough flood zone, thereby effecting an incremental raise in flood elevation that would overbank into the agricultural field on the east side of the Slough at flood stage.

General Constructability

Raising and corresponding widening of Rio Boca Road in its current alignment would have both permanent and temporary impacts and require complex CEQA analysis and the full suite of regulatory permits described in the Work Program Methodology. The resource agencies would not support the widening of Rio Boca Road in place unless the alternative of realignment was shown to be infeasible.

This alternative would likely be ideologically supported by the Pajaro Dunes community as it addresses flood control, health, and safety concerns, however this support may lessen considerably due to the potential required cost sharing that often accompanies County involvement on private road construction.

Alternative 7: Installation of a Weir or Flume Along the Lagoon Edge

Project Description

A permanent overflow flume or weir along the beach could, if appropriately designed and maintained, allow for a release to the ocean when water in the Lagoon reached a designated height, and remove the need for mechanical breaching. This alternative



proposes the installation of a flume approximately 1000 feet long located about 150 feet south of Pajaro Dunes. Significant construction efforts and ongoing maintenance would be required to insure weir operated correctly. For this preliminary analysis, Schaaf & Wheeler assumed a flume 5' x 5' with 1' thick concrete on the sides and 3' thick concrete on the bottom. Deep footings or piers would be required, especially on the up and downstream limits of the flume, to ensure it was not washed away by Ocean or River processes. Figure 7 shows the proposed flume location.



Figure 8: Alternative 7 -- Install a Permanent Overflow Flume Along Lagoon Edge



Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$490,000. The project elements and their associated costs are provided in Table 7.

Table 7: Cost Estimates for Alternative 7

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Cast-in-place flume/weir	1,000	CY	\$250	\$250,000
Inlet/outlet structure	N/A	LS	\$100,000	\$100,000
SUBTOTAL				\$350,000
40% CONTINGENCY				\$140,000
TOTAL COST				\$490,000

Due to the study level of analysis, several assumptions were made as far as the design and size of the flume; therefore, this cost is very preliminary.

Benefits

The primary benefit of a permanent flume is that if designed and maintained appropriately, it could entirely remove the need for breaching, protecting both emergency access at the Shell and Beach Road intersection, and the inundation of the sanitary sewer system. However, the need for regular maintenance predicted for this alternative would require at least, if not more presence of people and equipment on the beach as the current breaching program.

Impacts

Installation of a permanent flume from the Lagoon across the sandbar that forms at the mouth of the Pajaro River and to the Pacific Ocean would constitute a significant environmental impact and require in depth CEQA analysis and regulatory permit acquisition. Impacts would be anticipated to site hydrology, morphology, biotic resources, public access, and aesthetics.

A flume would provide a permanent two-way breach point for discharge of winter flood flows and an inlet for high-energy waves in winter or summer. A permanent flume would alter the persistence, depth, and salinity of the Lagoon habitat. There would be a normalization of hydraulic regime and a general reduction in hydraulic variability. In short, the hydrologic and geomorphic variability of the dynamic Pajaro River mouth and Lagoon would be substantially narrowed. While this would alter both biotic and abiotic



factors, it is difficult to predict which aquatic species sensitive to such variation would benefit and which would be negatively impacted.

The flume would have to be designed to facilitate steelhead in-migration in the rainy season and smolt out-migration April to June. Flume elevations set low enough for spring out-migration may also increase seawater intrusion into the Lagoon and raise the Lagoon's summer salinity to a level above the rearing threshold for juvenile steelhead and tidewater goby. A permanent flume, unless fitted with slide weirs of varying elevations, would create a Lagoon with an overall lower water level. So the amount of habitat available for steelhead and tidewater goby would be decreased resulting in decreased food supply, increased predation, and increased competition for space and available food.

No significant impacts related to water elevation and habitat alteration would be anticipated for avian (brown pelican and snowy plover) and mammalian species.

A permanent flume across the sandbar would have a large aesthetic impact and may impede pedestrian access to the beach south of the flume. The flume could encourage localized sand accumulation from longshore currents at the seaward outlet of the flume and sediment aggradation at the inlet to the flume from the Pajaro River. Hence, a level of flume maintenance approximating at least the current level of effort involved in mechanical breaching would be involved in keeping the flume open at the right times. The presence of maintenance crews anytime between March and September would impact the snowy plover nesting season.

General Constructability

The flood control benefits of a permanent flume are substantial to the Pajaro Dunes community, local farmers, and the County. However, the flume would not necessarily decrease the County's current intermittent impacts related to mechanical breaching due to the maintenance needs of the flume. Schaaf & Wheeler predicts practically insurmountable challenges in designing, permitting and constructing a flume to serve as a permanent overflow release from the Pajaro Lagoon to the Pacific Ocean.

This alternative would not be supported by Pajaro Dunes community due to the visual impact, risks of pedestrians crossing the flume, and the concern that a flume may shift the River mouth northwards towards the Pajaro Dunes community.



Alternative 8: Replacement of Beach Road Drainage Ditch Flap Gate

Project Description

This alternative was included in the analysis because it was specifically requested for inclusion in the CCC special conditions, as described in more detail previously. The existing flap gate near Beach Road protects a drainage ditch running along the southern side of Beach Road from backwater impacts from Watsonville Slough. This ditch is owned and maintained by the County; however the existing flap gate is currently in a state of disrepair. This alternative proposes replacing this flap gate and repairing its bulkhead. It should be noted that the County is in the process of developing remediation for this flap gate.

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$18,900. The project elements and their associated costs are provided in Table 8.

Table 8: Cost Estimates for Alternative 8

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
48" CMP	40	LF	\$150	\$6,000
New Headwall	1	LS	\$5,000	\$5,000
Flap gate	1	EA	\$2,500	\$2,500
SUBTOTAL				\$13,500
40% CONTINGENCY				\$5,400
TOTAL COST				\$18,900

All assumptions used in this cost analysis were summarized in the methodology section above.

Benefits

Based on conversations with Pajaro Dunes and County Staff, floodwaters reach the Shell & Beach Road intersection from the east, not from this agricultural ditch. As such, this alternative would result in no reduction of flooding of either the Shell & Beach Road intersection or of the sanitary sewer system, although it would offer better flood projection to land owners adjacent to this Ditch. This project would not result in any change to the current breaching program. The aesthetics of the existing flap gate may be slightly improved.



Impacts

Replacement of the existing Beach Road ditch flap gate would have no environmental impact as improvements would not require a substantially greater footprint. Water quality of the Slough would not be degraded under this alternative. Habitat for aquatic, avian, and mammalian species would not be improved or degraded.

General Constructability

Replacement of this flap gate and rehabilitation of the bulk head could be implemented with a minimum of permissions, permits, or environmental documents because it would probably be categorically exempt from CEQA, however permission from and coordination with the adjacent land owner would be necessary. It is expected that Pajaro Dunes would neither prefer nor object to this alternative, as it has no impact to their flood risk. Landowners adjacent to this Ditch will likely be highly supportive of this alternative, and may be open to sharing some of the cost of this project.

Alternative 9: Construction of a Flood Wall Along Rio Boca Road

Project Description

As an alternative to raising Rio Boca Road and its sanitary manholes, a floodwall could be constructed along the eastern side of Rio Boca Road. This alternative proposes to construct a wall approximately 2 feet tall along the length of Rio Boca Road (approximately one mile). In order to be effective, the northern end of this flood wall must be designed to tie into high ground. Available topography does not have sufficient detail or accuracy to allow Schaaf & Wheeler to determine if there is suitable natural high ground to tie into. It may be necessary to extend this floodwall significantly to tie into an elevation such that the flood wall serves its intended purpose of protecting Pajaro Dunes South from flood inundation. The following cost estimates are for only one mile of flood wall; however the benefits and impacts discussion and rating assume that the flood wall would be designed to serve this purpose. Figure 8 shows a schematic of the flood wall cross section.

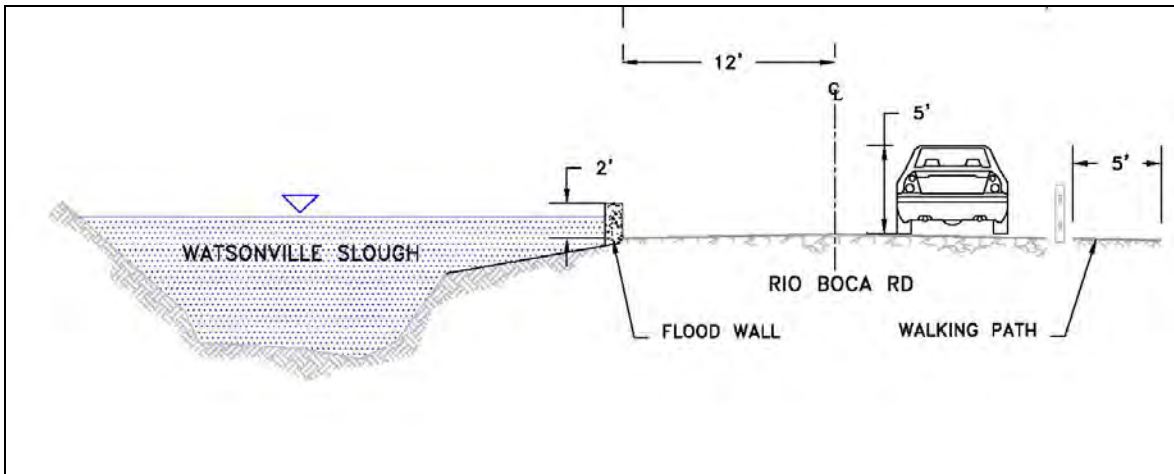


Figure 9: Alternative 9 -- Flood Wall Along Rio Boca Road

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$2,100,000. The project elements and their associated costs are provided in Table 9.

Table 9: Cost Estimates for Alternative 9

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Flood wall along Rio Boca Road	6,000	LF	\$250	\$1,500,000
SUBTOTAL				\$1,500,000
40% CONTINGENCY				\$600,000
TOTAL COST				\$2,100,000

All assumptions used in this cost analysis were summarized in the methodology section.

Benefits

Construction of a continuous flood wall along the eastern edge of Rio Boca Road will stop potential flood damages in the entire Pajaro Dunes South community and remove the potential for illicit discharges of raw sewage. This would provide a direct benefit to humans, wildlife, and water quality. Similar to the raising of Rio Boca Road alternative, this project would offer protection for the sanitary pump stations in Pajaro Dunes South in addition to the sewer lines in Pajaro Dunes South. This project does not impact the flood risk of the Shell and Beach Road intersection, so it has no impact on the current breaching program. Since the current breaching program also protects the sanitary sewer system, it therefore offers only a redundancy to the sanitary system protection, and perhaps additional protection during a very extreme flooding event. If completed in

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conjunction with a project that eliminates the flood risk to that intersection, however, this project may reduce the need for breaching.

Impacts

Construction of a floodwall along the present alignment of Rio Boca Road will cause both permanent and temporary impacts to adjacent jurisdictional wetlands in Watsonville Slough. This alternative would probably require a full EIR and all of the aforementioned regulatory permits.

Some of the permanent environmental impacts would include:

- Vegetative habitat losses resulting from continuous linear fill of jurisdictional wetlands along the entire eastern shoulder of the roadway;
- Installation of a permanent barrier to the movement of small mammals and amphibians between the Slough and the community;
- Potential increase in flooding along the eastern adjacent farmlands; and
- Aesthetic impact.

It would be challenging to identify sufficient area for compensatory wetland mitigation.

Similar to the raising of Rio Boca Road, in order to avoid a full EIR, the roadway could be realigned westward away from existing wetlands and the floodwall constructed in the current roadbed. As a result, this project would have mostly temporary construction-related impacts. The interior edge of the flood wall could be planted to provide a vegetation screen between the roadway and the Slough thereby reducing the aesthetic impact and the effects of night lighting.

General Constructability

The County may support this alternative, but much of the cost would likely fall on the Pajaro Dunes HOA. Some community members may not want the visual impact of a flood wall. Moreover, this alternative would not reduce flooding in Pajaro Dunes North. The regulatory agencies might not support construction of the flood wall along the current alignment of Rio Boca Road unless the alternative of road realignment to the west was shown to be infeasible.

Alternative 10: Installation of a Tide Gate at the Watsonville Slough Mouth

Project Description

The USACE has proposed building a self regulating tide gate facility at the mouth of the Watsonville Slough as part of their larger Pajaro River Levee Project. This tide gate would limit the amount of backwater from the Pajaro River allowed into the Slough. **Exhibit 9**



preliminary USACE proposal calls for a self regulating tide gate that remains open much of the year, closing only when flows into the Slough reach a design elevation at the tide gate¹². Although not called for in the USACE document, an element of this alternative must include storing or discharging runoff flows in the Watsonville Slough when the tide gate is closed. This need has been described in more detail in Alternative 1, the installation of flap gates at Beach Road. In summary, any project that prevents backflow into Watsonville Slough may also prevent discharge from the Slough – which could increase flooding along the Slough upstream of the project site. For this alternative, Schaaf & Wheeler assumed that local Slough drainage during tide gate closure is achieved via a pump station at the tide gate, however other options may exist. Figure 8 shows the proposed location of this structure.

¹² USACE Preliminary Design



Figure 10: Alternative 10 -- Tide Gate at Watsonville Slough Mouth

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$1,106,000. The project elements and their associated costs are provided in Table 10.



Table 10: Cost Estimates for Alternative 10

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Tide gate	1	EA	\$90,000	\$90,000
Site work	N/A	LS	\$100,000	\$100,000
Pump station	1	EA	\$600,000	\$600,000
SUBTOTAL				\$790,000
40% CONTINGENCY				\$316,000
TOTAL COST				\$1,106,000

Tide gate cost estimate was assessed using information obtained from a preliminary report written by the Army Corps of Engineers (Feb. 2003). The report looked at elevating the eastern levees along the Watsonville Slough and the construction of a tide gate at the mouth. A 72” x 72” Waterman-Nekton self-regulating tide gate was priced at \$75,000-\$85,000. This estimate was used in the cost estimate for this alternative.

Benefits

This alternative would protect the Shell and Beach Road intersection, as well as the Pajaro Dunes sanitary system from flood inundation. Removing the potential for illicit discharges of raw sewage would provide both direct and secondary benefits to humans, wildlife, and water quality. The alternative would essentially remove the need for mechanical breaching.

Impacts

Construction of a permanent tide gate facility across the mouth of Watsonville Slough would likely require an EIR, additional studies, and the full suite of aforementioned regulatory permits. There would be permanent and temporary impacts both direct and indirect; however, establishing the significance of these impacts requires a better understanding of the Pajaro Lagoon system. If the tide gate was closed only briefly and only closed during some years (similar to the current breaching program regularity) many of the potential impacts would be minor. The longer and more regularly the tide gate is closed the more severe the potential impacts become. Some of these impacts include:

- Direct fill in USACE and CDFG jurisdictional habitats in Watsonville Slough;
- Hydrologic/hydraulic impacts along the Slough, such as the periodicity of flooding and salinity regime;
- Gradual conversion of habitat from transitional brackish marsh to freshwater marsh;



- Temporary entrapment of aquatic species (fish and amphibians) upstream of the weir

A tide gate at the Slough mouth would have a generally negative aesthetic impact. The placement of the fill in the Slough associated with construction of the tide gate facility would have an immediate, direct, but one time impact. The other three potential impacts, however, are indirect and cumulative over the long-term. The tide gate does not act like the unidirectional flap gates in Alternative 1. The tide gate instead floats, which in itself mitigates the potential hydrologic impacts that could lead to habitat conversion. The potential entrapment of aquatic species would be temporary until such time as the floating tide gate drops to restore passage.

General Constructability

This alternative may be aesthetically displeasing to the Pajaro Dunes HOA. Landowners along the south bank of the Pajaro Lagoon (Monterey County) may see the tide gate as a structure that increases flooding on their land. The USACE can be expected to be supportive of this project. It should be noted that regardless of County and Pajaro Dunes support (or lack thereof) of this project, if the Pajaro River Levee Project is eventually constructed, some kind of barrier is likely at this location.

Alternative 11: Flood Protection for the Cypress House Community Building

Project Description

The Cypress House community meeting hall experiences regular flooding of approximately 3” - 4” inside of the building. This is the most common flooding occurrence in Pajaro Dunes. The Cypress House is the only building in the Pajaro Dunes community that experiences regular flooding since the installation of the flap gates along the Rio Boca Road culverts that protect a second Community building that was previously inundated regularly. This alternative proposes the construction of a 2 foot tall approximately 250 foot long berm to protect the Cypress House community meeting hall. Figure 9 shows the approximate location of the proposed berm.



Figure 11: Alternative 11 -- Berm to Protect the Cypress House Community Building

Cost Estimate

Schaaf & Wheeler estimates the cost of this alternative to be \$35,700. The project elements and their associated costs are provided in Table 11.



Table 11: Cost Estimates for Alternative 11

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Berm	250	CY	\$10	\$2,500
2 ft. floodproof wall	200	SF	\$30	\$6,000
Site improvement	N/A	LS	\$17,000	\$17,000
SUBTOTAL				\$25,500
40% CONTINGENCY				\$10,200
TOTAL COST				\$35,700

All assumptions used in this cost analysis were summarized in the methodology section above.

Benefits

The construction of this berm will protect the Cypress House community building from flood inundation. This alternative results in no reduction of flooding of either the Shell & Beach Road intersection or of the sanitary sewer system. As such, this project would not result in any change to the current breaching program.

Impacts

Construction of a flood control berm within the existing landscape near the Cypress House community center would have little to no environmental impact. Such a project, taken as a stand alone project, would not initiate CEQA or require permits from the regulatory resource agencies. Although it could have a negative aesthetic impact, this could be mitigated easily by landscaping on the berm surface.

General Constructability

Construction of a berm to protect the Cypress House community building could be completed with a minimum of permissions, permits, or environmental documents because it would probably be categorically exempt from CEQA, however permission from and coordination with Pajaro Dunes would be necessary. While this alternative would likely be supported by the Pajaro Dunes HOA and County, it is of much lower priority compared to the other at-risk elements in the overall site and vicinity.

Alternative 12: Continue Current Program of Mechanical Breaching

Project Description

The history and current context of the existing breaching program was described in detail in the Background section of this report. The County has been conducting mechanical

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breaching when since 1988. Since that time, a total of fourteen mechanical breaching have taken place, most recently on December 5, 2003¹³. There is in-place framework to minimize the environmental impact of mechanical breaching and to pay the costs of mechanical breaching. Biological monitoring to determine the impact of breaching was begun in 2002.

Cost Estimate

The Santa Cruz County Public Works Department estimates the total costs for the breaching program between 1988 and 2006 to be \$885,000¹⁴. Biological monitoring started in 2002 and is currently budgeted for \$20,000 annually; although only \$8,700 was spent in 2005. Because breaching-related expenses are already included in the Public Works budget, Alternative 12 creates no new project or construction costs.

Benefits

The current breaching program has a good track record of providing flood protection to the Shell and Beach Road intersection, as well as to the sanitary sewer system, except during the most extreme of storm events. This alternative does not provide protection to the Cypress House community building. National Marine Fisheries Service (NMFS) biological opinion concludes that the timing of breaching and re-closure of the mouth after breaching as described in the permit conditions constitutes a beneficial effect for steelhead, water quality, and overall habitat¹⁵.

Impacts

The existing breaching program causes short term aesthetic impacts during the actual breaching operation. The program is expected to have no impacts on wildlife or wildlife habitat¹⁶, and, because it simulates a natural process, has no net negative water quality impact.

General Constructability

Maintenance of intermittent mechanical breaching required the County to re-apply periodically to the Coastal Commission for breaching permits, to comply with all the requirements therein, and to conduct manual monitoring of water levels in the Slough to determine when breaching is necessary.

¹³ Who Benefits Approximate Expenditures

¹⁴ Who Benefits Appendix

¹⁵ County Breaching Permit Application, p. 16

¹⁶ USACE 404/10 Permit Application, p. 4-7



The current mechanical breaching has wide support from multiple stakeholders. Continuation of current mechanical breaching does not preclude the implementation of any other measures described in these alternatives.

Alternative 13: Do Nothing -- Discontinue Current Project, Add No Alternative

Project Description

For purposes of comparison, Schaaf & Wheeler included the ‘do nothing’ alternative in this analysis. In this scenario, this alternative proposes discontinuing the existing breaching program, without constructing any of the above described alternatives.

Cost Estimate

By definition, this Alternative has no associated project or construction costs. That said, significant liability exposure of the County is possible under this alternative. If Alternative 13 were selected, these liability issues, and the potential costs incurred due to expected flood damage related litigation should be explored.

Benefits

This alternative would remove the need for the County to undergo the complex permitting process for the breaching program. Although undocumented, it is possible the existing breaching program has some unknown environmental impacts – this alternative would remove those impacts.

Impacts

As mentioned previously, NMFS has concluded that the current program serves as a benefit to steelhead, water quality, and overall habitat, so it follows that discontinuing the program could negatively impact those elements. Regular inundation of the Shell and Beach Road intersection could be expected, as well as the inundation of the sanitary sewer system, posing a significant threat to Slough water quality, wildlife health and habitat, and human health and safety.

General Constructability

The alternative requires no construction; however the liability assumed by the County by discontinuing the breaching program may be substantial.



ALTERNATIVES RATINGS

Using the Work Program Methodology each of the alternatives was rated, and conclusions drawn from the rating table combined with an overall knowledge of the flooding risks and priorities of the community to make specific alternative recommendations.

Table 12 is the complete rating table, with alternatives in the same order they were described above. The following conclusions can be drawn from Table 12:

- Any project which does not protect the Shell and Beach Road intersection results in no change to the existing breaching program.
- Any project which protects the sanitary system received high ratings (i.e. low numbers) for Environmental Enhancement and Water Quality benefit, due to the risks inherent in a raw sewage spill.
- The alternative with the overall best rating (i.e. lowest number) is Alternative 4 (Flood Proofing Sewer Lines & Pump Stations), however this alternative would have no impact on the breaching program.



Table 12: Rating of All Alternatives

	1. Flap Gates at Beach Road	2. Elevating Shell & Beach Roads	3. Flood Proofing Shell Road Pump Station	4. Flood proofing of sewer lines and sewer pump stations	5. Flood Proofing Electrical Boxes	6. Elevating Rio Boca Road & Sewer Manholes	7. Installation of a weir or flume along the lagoon edge	8. Replacement of Beach Road Drainage Ditch Flap gate	9. Flood wall along Rio Boca Road	10. Tide Gate at Slough Mouth	11. Flood Proofing Community Building	12. Continue Current Breaching Program	13. Do Nothing (i.e. stop breaching w/ no projects)
Cost (millions of dollars)	\$0.88	\$0.33	\$2.1	\$0.03	\$0.06	\$1.03	\$0.49	\$0.02	\$2.1	\$1.1	\$0.03	n/a	\$0.00
Gage Height at Breaching (existing is 4.5' CG)	5.5'	5.5'	4.5'	4.5'	4.5'	4.5'	n/a	4.5'	4.5'	n/a	4.5'	4.5'	n/a
Impact													
Environmental Impact													
Footprint	3	2	1	1	1	5	5	1	4	3	1	1	1
Plant	5	1	1	1	1	5	3	1	4	2	1	1	5
Animal	4	1	1	1	1	1	4	1	5	3	1	1	5
Aesthetic	2	2	1	1	1	3	3	1	5	3	2	2	1
General Constructability	4	3	3	1	1	5	5	1	5	4	1	1	1
Benefit													
Reduction in Flooding													
Sewer System	4	5	5	1	5	1	1	5	1	1	5	5	5
Community Building	1	5	5	5	5	5	1	5	5	1	1	1	5
Shell & Beach Road	1	1	5	5	5	5	1	5	5	1	5	5	5
Environmental Enhancement	5	5	5	1	5	1	3	5	5	1	5	5	5
Water Quality	5	5	5	1	5	1	5	5	3	1	5	5	5
Total Rating Score:	34	30	32	18	30	32	31	30	42	20	27	27	38

Rating System Scale: "1" signifies no impact or significant benefit; "5" represents significant impact or no benefit.



ALTERNATIVES ANALYSIS SUMMARY

The objective of the alternative analysis condition in the CCC Permit is to “...avoid artificial breaching until Lagoon levels reach an elevation of at least +5.4 MSL ...during the rainy season, instead of at +4.5 MSL, currently proposed, as well as a combination of alternatives that may reduce the need to breach until at least +5.9 MSL or eliminate the need to breach at all.”¹⁷ As noted previously, these water levels are not mean sea level, but are specific to the County gage. Based on this objective and the results of this analysis, Schaaf & Wheeler has separated those alternatives which do and do not have an immediate effect on increasing the recommended breaching gage height. Table 13 and 14 show this distinction.

Table 13: Alternatives with No Impact on Breaching Gage Height

	3. Flood Proofing Shell Road Pump Station	4. Flood proofing of sewer lines and sewer pump stations	5. Flood Proofing Electrical Boxes	6. Elevating Rio Boca Road & Sewer Manholes	8. Replacement of Beach Road Drainage Ditch Flap Gate	9. Flood wall along Rio Boca Road	11. Flood Proofing Community Building	12. Continue Current Breaching Program
Cost (millions of dollars)	\$2.1	\$0.03	\$0.06	\$1.03	\$0.02	\$2.1	\$0.03	n/a
Gage Height at Breaching (existing is 4.5' CG)	4.5'	4.5'	4.5'	4.5'	4.5'	4.5'	4.5'	4.5'
Impact								
Environmental Impact								
Footprint	1	1	1	5	1	4	1	1
Plant	1	1	1	5	1	4	1	1
Animal	1	1	1	1	1	5	1	1
Aesthetic	1	1	1	3	1	5	2	2
General Constructability	3	1	1	5	1	5	1	1
Benefit								
Reduction in Flooding								
Sewer System	5	1	5	1	5	1	5	5
Community Building	5	5	5	5	5	5	1	1
Shell & Beach Road	5	5	5	5	5	5	5	5
Environmental Enhancement	5	1	5	1	5	5	5	5
Water Quality	5	1	5	1	5	3	5	5
Total Rating Score:	32	18	30	32	30	42	27	27

¹⁷ Coastal Development Permit, p. 6



As stated previously, the County's highest priority for flood protection is the inundation of the Beach and Shell Road intersection. As such, Alternatives 4 (Flood proofing of sewer lines and pump stations), 6 (Elevating Rio Boca Road), and 9 (Flood wall along Rio Boca Rd) do not, in and of themselves, impact the breaching program. These alternatives, however (numbers 4, 6, and 9) could be considered in combination with some of the alternatives identified in Table 14 which protect the intersection. Of these three alternatives, #4 (Flood proofing sewer lines and pump stations) is both the best rated (i.e. lowest score) and least expensive. By definition, Alternative 12 (Continue current program) has no impact on the current program. As an independent alternative it does, however, offer flood protection to both the sanitary system and the Shell and Beach Road intersection.

Alternatives 3 (Flood proofing Shell Road pump station), 5 (Flood proofing electrical boxes), 8 (Replacement of ditch flap gate) and 11 (Flood protection for the Cypress House) offer no protection to either the Shell and Beach Road intersection or the sanitary system. As such, these alternatives have no impact on the breaching program as stand alone projects, or in combination with any other alternatives. Therefore these alternatives are not recommended to fulfill the CCC Permit Objectives. Some of these projects would be appropriate for the Pajaro Dunes HOA or private land owners to undertake to alleviate problems associated with local flooding.



Table 14: Alternatives That Impact Current Breaching Program Gage Height

	1. Flap Gates at Beach Road	2. Elevating Shell & Beach Roads	7. Installation of a weir or flume along the Lagoon edge	10. Tide Gate at Slough Mouth	13. Do Nothing (i.e. stop breaching w/ no projects)
Cost (millions of dollars)	\$0.88	\$0.33	\$0.49	\$1.1	\$0.00
Gage Height at Breaching (existing is 4.5' CG)	5.5'	5.5'	n/a	n/a	n/a
Impact					
Environmental Impact					
Footprint	3	2	5	3	1
Plant	5	1	3	2	5
Animal	4	1	4	3	5
Aesthetic	2	2	3	3	1
General Constructability	4	3	5	4	1
Benefit					
Reduction in Flooding					
Sewer System	4	5	1	1	5
Community Building	1	5	1	1	5
Shell & Beach Road	1	1	1	1	5
Environmental Enhancement	5	5	3	1	5
Water Quality	5	5	5	1	5
Total Rating Score:	34	30	31	20	38

Alternatives 1 (Flap Gates at Beach Road) and 2 (Elevating Shell and Beach Roads intersection) provide flood protection to the Shell and Beach Road intersection, allowing for access to both Pajaro Dunes North and South during flood events. This protection allows the breaching gage height to be raised, but breaching to protect the sanitary system from inundation (i.e. at 5.5' CG) would still be required. How this breaching gage height change would affect the regularity of breaching is unknown. It is possible that under existing conditions, every time that the gage reaches breaching height (4.5' CG) it would, if not mechanically breached, continue to 5.5' CG relatively quickly. Because the breaching currently occurs at 4.5' CG it is impossible to predict the occurrence of an



elevation of 5.5' CG without a much more detailed hydrologic and hydraulic understanding of the system. That said, the impact of either of these Alternatives (1 and 2) would be to raise the required breaching gage height, a stated objective of the CCC Permit Special Conditions.

Alternative 7 (Installation of a permanent flume) would, if designed appropriately, entirely eliminate the need for breaching. However, Schaaf & Wheeler concludes that this alternative is the least feasible project alternative. Although the construction costs are not estimated to be particularly high, the analysis, permitting, design, impacts, and on going need for maintenance renders this alternative unfeasible. Alternative 13 (Do Nothing) would also remove the need for breaching, by definition, however the resulting flooding and the associated threats to human health and safety, in addition to environmental impacts, is so significant to render this alternative also unfeasible. Finally, Alternative 10 (Tide gate at Slough mouth) would remove the need for breaching, while alleviating flooding and minimizing environmental impact.

RECOMMENDATIONS

Based on this Alternatives Analysis, Schaaf & Wheeler has identified three alternatives which minimize both construction and long term environmental impacts, while providing the necessary protection to the Shell and Beach Roads intersection and the sanitary sewer system.

1. Continue the Current Breaching Program.

Although the objective of the CCC Special Permit requirement is to identify alternatives which raise the gage height for breaching, or eliminate the need for breaching all together, the advantages of the existing program can not be ignored. The existing breaching program has been found to enhance some environmental aspects of the Lagoon¹⁸, and a program is in place to both minimize and monitor the impacts of the breaching. The costs associated with the current breaching program are relatively low and already accounted for in the County's Public Works budget.

2. Tide Gate at Watsonville Slough Mouth.

This alternative, originally proposed by the USACE as an element of their Pajaro River Levee Project, would effectively eliminate the need for mechanical breaching. A floating tide gate that closes only when water levels in the Lagoon reach pre determined high risk levels would have only a moderate environmental impact. This impact is difficult to predict, but it is expected to be gradual, and may fluctuate in any given year (depending

¹⁸ County Permit Application, Pages 16-18



on if, and how long, the gate was closed). Permitting for this project is predicted to be substantial, but not insurmountable. The support of the USACE would be helpful in both the permitting process, and potentially in cost sharing opportunities. This alternative is also preferred because some kind of backwater limiting structure at this location is practically a required element of the Pajaro Levee Project - the alternative being huge amounts of levees wrapping around the entire Slough.

3. Elevate Shell & Beach Roads.

Elevating the Shell and Beach Road intersection is relatively inexpensive, and would allow the gage height for breaching to be raised to 5.5' CG. Schaaf & Wheeler does not foresee any major permitting issues with this alternative; however land owners adjacent to Beach Road may protest this project due to the required infringement onto their agricultural lands. The costs associated with the construction itself are relatively small, however if land must be purchased from adjacent owners the costs may increase substantially. As stated previously, whether this alternative will result in a decrease in the occurrence of breaching is unknown. This project could serve as a phased approach to eliminating the breaching program, the second phase of which would be to remove the risk of flood water inundating the sanitary system via **flood proofing of the sanitary sewers and pump stations**. It should be noted that even with both of these projects, mechanical breaching may be required during extreme backwater events. The gage height would be determined based on the elevated road height, or other unknown risks that are currently served by the existing breaching height.



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**PROPOSITION 1 GRANT APPLICATION
COVER PAGE**

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Contact Person	Dr. Mark Strudley	Email	mark.strudley@santacruzcounty.us
Phone	831-454-2807		
Address	701 Ocean Street, Rm. 410		
City	Santa Cruz	Zip	95060

PROJECT INFO

Project Name	Coastal Ecosystem Resiliency Project for the Lower Watsonville Slough		
Summary	<small>The proposed Project is a Feasibility Analysis and Initial Project Design (35%) for a Coastal Ecosystem Resiliency Project in the Pajaro River Lagoon/Lower Watsonville Slough. The purpose of the Project is to design a mostly naturebased infrastructure project that re-establishes and enhances wetland and tidal marsh habitat while providing flood risk reduction, climate change adaptation, and recreational opportunities to economically-disadvantaged local community residents. Project activities would investigate and identify the plan that reasonably maximizes ecosystem restoration benefits, is technically feasible, and preserves environmental and cultural values at Watsonville Slough. Project benefits include habitat restoration and creation, flood risk reduction, water quality improvement, groundwater sustainability, and recreational access for disadvantaged communities.</small>		
Total Project Cost	\$ 1,700,000	Amount Requested	\$ 850,000
Start Date	Summer 2019	End Date	Dec. 31, 2021
Project Type (check all that apply)	<input checked="" type="checkbox"/> Planning <input type="checkbox"/> Acquisition <input type="checkbox"/> Implementation/Construction <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Agricultural Preservation <input checked="" type="checkbox"/> Climate Change <input checked="" type="checkbox"/> Habitat Conservation/Enhancement <input type="checkbox"/> Urban Greening <input type="checkbox"/> Urban Waterfront		
Acres	TBD	Trail Miles	TBD
		APNs (Acquisition Only)	

LOCATION INFO

County	Santa Cruz	Specific Location	Watsonville Slough
Latitude	36.8682	Longitude	-121.8173
What point is represented by the lat/longs (eg., parking lot, center of site, etc):	Terminus of W. Beach Road at Watsonville Slough		

ELECTED OFFICIALS

Districts	Number(s)	Name(s)
State Senate	17	Bill Monning
State Assembly	29, 30	Mark Stone, Robert Rivas
Congressional	20, 18	Jimmy Panetta, Anna Eshoo

**PROPOSITION 1 GRANT APPLICATION
PROJECT DESCRIPTION**

Project Name	Coastal Ecosystem Resiliency Project for the Lower Watsonville Slough
Contact Person (Name and Title)	Dr. Mark Strudley, Flood Control Division Manager
Tax ID #	946000534

Complete each of the elements of the project description below with clear, but detailed answers. Limit your response to this section to no more than four pages if possible.

1. **Need for the project.** Describe the specific problems, issues, or unserved needs the project will address.

The lower reach of the Pajaro River forms the boundary between Santa Cruz and Monterey Counties in California. In most years, due to a decrease in flows from the Pajaro River and natural coastal processes, a sandbar forms at its mouth, where the Pajaro River discharges to the Pacific Ocean. The formation of the sandbar closes the mouth of the river, preventing outflow to the ocean, and forms a lagoon. When the sandbar is in place, water levels can rise in the lagoon and its associated sloughs and marshes.

High water levels in the Lagoon can cause localized flooding in the agricultural and residential areas that surround the Lagoon and adjacent sloughs. Flooding can threaten farmlands, County roads, emergency access to the Pajaro Dunes community, sewage collection and delivery for Pajaro Dunes, electrical infrastructure and property, as well as the City of Watsonville wastewater treatment facility.

Since the 1930s, most of the original Watsonville Slough channel and tidal marsh system had been reclaimed for agriculture. Hydrologic function of the lower Watsonville Slough system was constrained by adjacent land use and engineered facilities built over the next several decades. To prevent localized flooding, the County initiated a mechanical breaching program in the 1950s in which earth-moving equipment is used to artificially drain the Pajaro River lagoon through trenching a tie-channel between the open ocean and the lagoon. As part of an ongoing coordination and permitting process for mechanical breaching, Santa Cruz County developed an Alternative Analysis (Schaff and Wheeler, 2007) to develop a list of ranked solutions that could be implemented to reduce flood risk. The alternatives analysis was limited in critical ways:

- Solutions did not consider effects of sea-level rise;
- Nature-based solutions were not included in the suite of alternatives;
- Most alternatives did not offer system-wide, multi-benefit solutions;
- Many alternatives would be detrimental to habitat;
- Protection of farmland, habitat restoration, and enhancement of recreation and accessibility were not included as objectives of the analysis.

2. **Goals and objectives.** The goals and objectives should clearly define the expected outcomes and benefits of the project.

The proposed Project is a Coastal Ecosystem Resiliency Project in the Lower Watsonville Slough. The purpose of the Project is to conduct feasibility analysis and initial design for a mostly nature-based infrastructure project that re-establishes and enhances wetland and tidal marsh habitat while providing flood risk reduction, climate change adaptation, and recreational opportunities to economically-disadvantaged local residents. Project activities would investigate and identify a technically feasible plan that maximizes ecosystem benefits and that responds to stakeholder concerns. Expected project benefits include:

- Improved water quality in the surf zone and nearshore environments adjacent to the Pajaro River Lagoon.
- Enhanced wetland and tidal marsh habitat, as measured by additional designed acreage of expanded/enhanced tidal wetland and marsh habitat, and measured species richness and abundance.
- Reduced or eliminated mechanical breaching of the Pajaro River Lagoon, as measured by the number of times mechanical breaching would be required post-Project implementation to protect life and safety through provision of emergency ingress/egress.
- Reduction in greenhouse gas emissions through the reduction or elimination of equipment mobilization and operation required to mechanically breach the Pajaro River Lagoon.
- Improved public access to the coast for Watsonville and Pajaro Valley residents and visitors by alleviating seasonal flooding of beach access points and through evaluation of additional access improvement projects such as improved connectivity with coastal trails.
- Enhanced carbon sequestration through tidal marsh/wetland complex expansion and restoration.
- Reduced flood risk for county farmlands, infrastructure (roads, sewer distribution system), Pajaro Dunes Community, and wastewater and water supply facilities.
- Reduced groundwater pumping by providing an expanded tidal prism seaward of a freshwater diversion that is used to recharge the coastal aquifer.

3. Project Description. Describe all of the major project components (i.e., what will actually be done to address the need and achieve the goals and objectives).

The proposed Project will examine the feasibility of restoring and expanding the existing wetland/tidal marsh complex of the Lower Watsonville Slough, and improving local infrastructure including the West Beach Road crossing over Watsonville Slough, the Shell Road Pump Station, and drainage ditches, culverts, and gates that meet the slough system.

The feasibility study would be conducted by the United States Army Corps of Engineers (USACE) Continuing Authority Program (CAP) under authority of Section 1135 of the Water Resources Development Act (WRDA) of 1986 (Public Law (PL) 99-662). Initial Project activities would include development of an USACE Federal Interest Determination report and Feasibility Cost Share Agreement.

Following initial administrative matters above, feasibility level analysis would include Plan Formulation, Alternatives Analysis, and integrated reporting that examines local hydrology and hydraulics of the slough system, geotechnical engineering analysis, environmental planning and field surveys, site mapping and geospatial analysis, real estate appraisals, project implementation cost estimation, public engagement and outreach, and environmental impact analysis (both NEPA and CEQA). Plan formulation and selection of a preferred alternative will culminate with 35% civil designs including quantities, plans, and vegetation/re-vegetation plans. Finally, a Monitoring and Adaptive Management Plan will be developed as part of the preliminary design phase.

The goal is to fully prepare the Project for implementation and to secure other cost-share funding sources for construction phasing.

4. Future Phases. For planning projects or other projects where future phases are critical to project success, explain the strategy for funding and implementing the future construction phase(s).

Future project phases include Preconstruction Engineering Design, Construction, and long-term Operations and Maintenance, Monitoring, and Adaptive Management. The Design and Construction phases will be funded through phased implementation of a Section 1135 Continuing Authorities Program authorized through the U.S. Army Corps of Engineers. Local cost-share funding includes competitive application under the Pajaro River Watershed IRWMP planning process and other State funding initiatives as opportunities become available. Long-term Operations and Maintenance, as well as Monitoring and Adaptive Management, will be cost-shared between the U.S. Army Corps of Engineers and the Pajaro Storm Drain Maintenance District.

5. Site Description. Describe the project site or area, including site characteristics that are tied to your project objectives (i.e.: for acquisition of habitat, describe current vegetation assemblages, condition of habitats, known wildlife migration corridors, etc.). When relevant, include ownership and management information.

The proposed Project location is in Santa Cruz County and includes the Pajaro River Lagoon, the lower Watsonville Slough, and adjacent wetland and agricultural lands (see attached location maps). The Pajaro River is a 1300 square mile watershed that begins in Santa Clara and San Benito Counties and forms the boundary between Santa Cruz and Monterey Counties in the lower part of the watershed before reaching a complex mosaic of wetland, marsh, and slough habitat at the coast of Monterey Bay. Access to the coast, which includes the Pajaro Dunes community, Palm Beach State Park, local agricultural land, and Pajaro Lagoon is via West Beach Road from State Route 1 which traverses the western margin of the City of Watsonville. Residents from economically-disadvantaged City of Watsonville and Town of Pajaro typically access the coast via W Beach Road.

The Pajaro River Lagoon is an important natural resource containing biologically productive habitats for many plants, aquatic and terrestrial wildlife species, including breeding habitat for endangered migratory waterfowl, habitats for marine and freshwater fish, and potential rearing habitat for anadromous steelhead trout. The lagoon, tributary sloughs, and marshes are remnant of an historically larger estuary system. It is also part of the remaining 10 percent of the original coastal lagoons and estuaries in California that have been altered or otherwise destroyed. The Watsonville Slough is an 800-acre wetland complex that supports over 250 resident and migratory bird species and 23 different native plants and animals that are State and federally listed as threatened, endangered, or species of special concern.

The lower Pajaro Valley is a valuable agricultural area accounting for an important part of the local and regional economy. Specialty crops (strawberries and artichoke) and truck crops (lettuce, celery, broccoli, brussel sprouts) are commonly grown on the valley floor and adjacent foothills. Agricultural uses occur along the sloughs and marshes of the Pajaro River and Watsonville Slough.

6. **Specific Tasks.** Identify the specific tasks that will be undertaken and the work that will be accomplished for each task.

#	Task Name	Description
1	Project Administration	
1a	USACE Federal Interest Document and Feasibility Cost Share Agreement	<p>Goals: Develop description of federal interest in cost sharing.</p> <p>Outcomes: Plan project strategy, scope, budgeting, and phasing.</p> <p>Milestones: Initial field visit and non-federal sponsor meeting (January 2019); submittal of draft and final FID reports (May 2019); signing of FCSA (August 2019).</p> <p>Deliverables: FID (Federal Interest Document) and FCSA (Federal Cost Share Agreement).</p>
1b	Project Administration	<p>Goals: Maintain master project schedule and budget, coordination between USACE and non-federal project staff, sequencing and coordination of meetings and activities, budget tracking, maintain compliance with Federal Cost Share Agreement.</p> <p>Outcomes: Successful coordination and sequencing of project activities, timely completion of project tasks, attain milestones and develop products within schedule and budget.</p> <p>Milestones: Project completion on-schedule and on-budget, consistent with Section 1135 CAP Authority Projects and OPC grant guidelines.</p> <p>Deliverables: Grant invoices and progress reports, meeting agendas, final grant report.</p>
2	Plan Formulation, Alternatives Analysis, and Integrated Report	<p>Goals: Develop technical analyses, surveys, and cost estimates that would investigate and identify the plan that reasonably maximizes ecosystem restoration benefits, is technically feasible, and preserves environmental and cultural values at Watsonville Slough.</p> <p>Outcomes: Identify preferred project plan and develop Integrated Detailed Project Report and Environmental Assessment (DPR/EA).</p> <p>Milestones: Design Charette Milestone, Alternative Formulation Milestone, Tentatively Selected Plan Milestone, Agency Decision Milestone, Draft Integrated Report, Publicly distributed draft integrated report; Delivery of final integrated report.</p> <p>Deliverables: Charette Report Synopsis, Risk Register, DMP, and Decision Log. Technical memos, Integrated Detailed Project Report and Environmental Assessment (DPR/EA)</p>
2a	Hydrology and Hydraulics modeling	Review existing information related to hydrology, hydraulics, geomorphology, habitat design, and sedimentation to participate in verification of measures and alternatives and in the development of preliminary evaluation criteria and metrics for screening measures and evaluating alternatives.
2b	Geotechnical Engineering Analysis	Review existing geotechnical information, identify data needs, collect additional data as required for the development of preliminary evaluation criteria and metrics for screening measures and evaluating alternatives.
2c	Environmental Planning and Field Surveys	(1) review scientific literature and technical data to identify sources of data and potential gaps; (2) identify analytical approaches for use and interpretation of data to include consideration of planning models; (3)

		participate in verification of problems, opportunities, objectives, goals and constraints; (4) participate in verification of measures and alternatives (5) provide guidance and lead the development of preliminary evaluation criteria and metrics for screening measures and evaluating alternatives, (6) characterize existing baseline conditions and future without project conditions within the project area and; (7), and begin initial coordination (outreach) with the resource agencies with regulatory jurisdiction over the agencies.
2d	Mapping, geospatial analysis	Prepare maps and integrate geospatial data for the purposes of organizing data and screening alternatives; preparation for designs.
2e	Real estate appraisals	Prepare preliminary real estate cost estimates for preliminary screening/comparison. Prepare preliminary real estate acquisitions map to identify potential impacted parcels.
2f	Cost Estimating	Provide a cost estimate for the array of alternatives. The cost estimate will include engineering and design, construction management, and mitigation.
2g	Public Engagement and Education	Project design will utilize past work that has relied on these technical partners and current and past planning efforts that have integrated extensive public participation, such as the Pajaro River Flood Risk Reduction Project (ongoing) and the City of Watsonville's Urban Greening Plan (2012). The proposed Project will leverage these past planning efforts by identifying ways to either advance the implementation of prior coastal access plans or enhance public access in a way that is complimentary to these planning efforts and is reflective of the strong local interest in expanded coastal access.
2h	Environmental Impact Analysis and NEPA document	The Corps environmental staff will manage the environmental documentation as required by NEPA and informal consultations, as required. The NEPA information will be integrated into the Final Report, including drafting a compliance section, identifying any resource issues, necessary permits, and consultation status, integrating draft affected environment and baseline into the report, and drafting analyses for Prime and Unique Farmland, Wild and Scenic River, Migratory Bird analysis, etc. as applicable.
2i	Integrated Detailed Project Report and Environmental Assessment	Outcomes: Identify preferred project plan and develop Integrated Detailed Project Report and Environmental Assessment (DPR/EA). Milestones: Draft Integrated Report, Publicly distributed draft integrated report; Delivery of final integrated report. Deliverables: Technical memos, Integrated Detailed Project Report and Environmental Assessment (DPR/EA).
3	CEQA Environmental Impact Analysis and Reporting	Goals: Disclose to the public the significant environmental effects of the proposed alternatives through preparation of an Initial Study (IS), Mitigated Negative Declaration (MND), or Environmental Impact Report (EIR). The County anticipates the required CEQA document will be a MND. Outcomes: Assessment of environmental impact of proposed alternatives, and production of environmental document. Public engagement on environmental impact and benefits of proposed project.

		<p>Milestones: Public comment period on draft environmental document, filing of Notice of Determination.</p> <p>Deliverables: IS, MND or EIR for proposed project.</p>
4	Civil Design (35% level)	<p>Goals: Develop initial civil design (35%) plans, vegetation and re-vegetation plans, and refined cost estimates for preferred project alternative.</p> <p>Milestones: Review draft of plans, specifications, and cost estimate; final 35% plans, specifications and cost estimate.</p> <p>Deliverables: Initial plans and specs (35%), Vegetation and Re-Vegetation Plans and Specs.</p>
4a	Quantities and Design Plans	
4b	Cost Estimating	
4c	Vegetation and Re-vegetation Plans	
5	Monitoring and Adaptive Management Plan	<p>Goals: Development of an adaptive management plan for the proposed Project that describes management interventions and monitoring to provide ongoing Project performance understanding and decision points to guide Project success and sustainability.</p> <p>Outcomes: Identification of critical monitoring needs and strategies to achieve long-term Project success in the face of changing boundary conditions and forcings related to climate change and anthropogenic influences.</p> <p>Milestones: Review draft of Monitoring and Adaptive Management Plan; final Monitoring and Adaptive Management Plan</p> <p>Deliverables: Monitoring and Adaptive Management Plan.</p>

Add or delete rows as necessary.

7. **Work Products.** List the specific work products or other deliverables that the project will result in.

Task 1. Project Administration

- Task 1a. USACE Federal Interest Document and Feasibility Cost Share Agreement
Deliverables: FID (Federal Interest Determination) and FCSA (Federal Cost Share Agreement)
- Task 1b. Project Administration
Deliverables: Grant invoices and progress reports, meeting agendas, final grant report

Task 2. Plan Formulation, Alternatives Analysis, and Integrated Report

- *Deliverables:* Charette Report Synopsis, Risk Register, DMP, and Decision Log. Technical memos, Integrated Detailed Project Report and Environmental Assessment (DPR/EA)

Task 3. CEQA Environmental Impact Analysis and Reporting

- *Deliverables:* IS, MND or EIR for proposed project.

Task 4. Civil Design (35% level)

- Task 4a. Quantities and Design Plans
- Task 4b. Cost Estimating
- Task 4c. Vegetation and Re-vegetation Plans
Deliverables: Initial plans and specs (35%), Vegetation and Re-Vegetation Plans and Specs.

Task 5. Monitoring and Adaptive Management Plan

- *Deliverables:* Monitoring and Adaptive Management Plan

8. **Measuring Success.** For projects involving restoration, construction or land acquisition, describe the plan for monitoring, evaluating and reporting project effectiveness, and implementing adaptive management strategies if necessary. Who will be responsible for funding and implementing ongoing management and monitoring? Planning projects should discuss monitoring/evaluation of how many projects get implemented in the future or the plan to monitor future projects.

The proposed Project is a planning level effort that will be considered successful with the completion of 35% plans and specifications for re-established and enhanced wetland and tidal marsh habitat that will provide flood risk reduction, climate change adaptation, and recreational opportunities to economically-disadvantaged local residents. However, as described in Task 5 of the work plan, the Project includes the development of a Monitoring and Adaptive Management Plan that will describe the plan for monitoring, evaluating and reporting Project effectiveness, and implementing adaptive management strategies as necessary for the implemented Project.

The Project is being implemented in partnership with the Army Corps of Engineers (ACE) and consistent with Federal guidelines for feasibility study requirements. Section 2039 of Water Resources Development Act (WRDA) 2007 states that when conducting a feasibility study for a project or component of a project for ecosystem restoration, the recommended project must include a plan for monitoring the success of the ecosystem restoration. The implementation guidance for Section 2039 of WRDA 2007, in the form of a CECW-PB Memo dated 31 August 2009, also requires the development of an adaptive management plan for all ecosystem restoration projects. In accordance with Section 2039 WRDA 2007, monitoring would be cost-shared at 75/25 up to 10 years unless ecological success is achieved sooner. Any monitoring beyond 10 years would be the responsibility of the non-federal sponsor (Pajaro Storm Drain Maintenance District).

9. **Project Maps and Graphics.** Provide the following project graphics with your application. Project maps and design plans should be combined into one pdf file with a maximum size of 10 MB. Project photos should be provided in jpg format.
- Regional Map – Clearly identify the project’s location in relation to prominent area features and significant natural and recreational resources, including regional trails and protected lands.
 - Site-scale map – Show the location of project elements in relation to natural and man-made features on-site or nearby. Any key features discussed in project description should be shown.
 - Design Plan – Construction projects should include one or more design drawings or graphics indicating the intended site improvements.
 - Site Photos – One or more clear photos of the project site

Project maps and graphics are submitted with the grant application.

10. **Permits:** If this is an implementation project, please list permits your project will require and their status.

Name of permit (s) <i>Add more rows if needed</i>	Status (Ex. acquired, pending, included in scope of proposed project)	Date of permit (or expected date)



DEPARTMENT OF PARKS AND RECREATION

Santa Cruz District
303 Big Trees Park Road
Felton, CA 95018

Lisa Ann L. Mangat, Director

April 23, 2019

RECEIVED

Antonella Gentile
Department of Public Works
County of Santa Cruz
701 Ocean Street, Room 410
Santa Cruz, CA 95060

MAY - 1 2019

CALIFORNIA
COASTAL COMMISSION
CENTRAL COAST AREA

Dear Ms. Gentile:

California State Parks recognizes the need of the Santa Cruz County Department of Public Works to breach the mouth of the Pajaro River to manage the water level in the Pajaro Lagoon. The Santa Cruz District of California State Parks consents to this on-going breaching activity, but reserves the right to withdraw consent by notification of the Department of Public Works and the California Coastal Commission. State Parks also reserves the right to place conditions on the breaching activities to protect State Park resources.

As you are aware, the mouth of the Pajaro River forms an important site for both wintering and breeding western snowy plover. All work related to breaching must be conducted in a manner to avoid or minimize potential impacts on the western snowy plover. We recommend that the plan for breaching include the following measures:

- The Santa Cruz District of California State Parks will be notified at least 48 hours prior to mobilization of breaching activities.
- A biologist approved by the US Fish and Wildlife Service with the authority to halt work will be present at all times when equipment is on the beach.
- Access to the river mouth will be through the Palm Beach day use area. An approved biologist will walk the equipment to an area below the High Tide Line. All vehicles and equipment will follow a route below the High Tide Line down the beach to the work site.
- The Department of Public Works will provide summaries of monitoring reports to State Parks after work is completed.

If you would like additional information, please contact me at (831) 335-6395.

Sincerely,

Joanne Kerbavaz
Senior Environmental Scientist