California State Coastal Conservancy – Lead Agency

Eel River Estuary and Centerville Slough Enhancement Project

Draft Environmental Impact Report

SCH # 2014122040

Volume II of II

September 2016

Table of contents

Draft EIR - Located in Volume I

Appendices

Appendix A - Notice of Preparation
Appendix B - Letters in Response to NOP
Appendix C - Dune Assessment
Appendix D - CalEEMod Emissions Estimates
Appendix E - Biological Studies
Appendix F - Hydraulic Design Report

Appendices

Appendix A Notice of Preparation

California State Coastal Conservancy – Lead Agency

Revised Notice of Preparation of

Draft Environmental Impact Report for

Eel River Estuary and Centerville Slough Enhancement Project

SCH# 2014122040

November 2015

THIS PAGE INTENTIONALLY LEFT BLANK

Revised Notice of Preparation of Draft Environmental Impact Report
for the

Eel River Estuary and Centerville Slough Enhancement Project

SCH# 2014122040

California State Coastal Conservancy, Lead Agency
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

Attention: Michael Bowen
Project Manager
(510) 286-1015

Prepared by:

GHD Inc.
718 Third Street
Eureka, CA 95501

Contact: Misha Schwarz
Project Manager
(707) 443-8326

November 2015

Project Ref#: 1000298-8410882

THIS PAGE INTENTIONALLY LEFT BLANK

Table of contents

1. Introduction 1
   1.1 CEQA Requirements 1
   1.2 General Information 1
   1.3 Previous Notice of Preparation 1
   1.4 Purpose of this Revised Notice of Preparation 2
2. Project Location and Setting 2
3. Project Description 4
4. Probable Environmental Effects 10

Appendices

Appendix A - Figures

THIS PAGE INTENTIONALLY LEFT BLANK

1. Introduction

1.1 CEQA Requirements

This proposed Project is subject to the requirements of the California Environmental Quality Act (CEQA). The lead agency is the California State Coastal Conservancy (Coastal Conservancy), as it will be the first public decision-making body to act on the proposed project. The Coastal Conservancy is responsible for assuring the completion of the appropriate evaluation and processes required by CEQA. The Coastal Conservancy has the sole responsibility to make the appropriate findings and determinations with respect to the CEQA process and disposition of the Project. The purpose of this Revised Notice of Preparation (Revised NOP) is to solicit participation in determining the scope of the Environmental Impact Report (EIR) which would be prepared for the Eel River Estuary and Centerville Slough Enhancement Project (Project), (formerly referred to as the Eel River Estuary Preserve Ecosystem Enhancement Project) with regard to the Project description modifications described below. The EIR is intended to satisfy the requirements of CEQA (Public Resources Code, Div 13, Sec 21000-21177), and the State CEQA Guidelines (California Code of Regulations, Title 14, Chapter 3, Sec 15000-15387).

1.2 General Information

Protect Title: Eel River Estuary and Centerville Slough Enhancement Project

Lead Agency: California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612-2530
Attention: Michael Bowen, Project Manager

Availability of Project Documents/Files: Project documents/files are available for review at the Coastal Conservancy, located at 1330 Broadway, 13th Floor, Oakland, California. www.scc.ca.gov and **http://scc.ca.gov/webmaster/ftp/eel_river/.** Document files will also be made available upon request at GHD Inc. 718 Third Street, Eureka, CA 95501.

Written Comments: Written comments on the scope of the EIR can be sent to Michael Bowen, Project Manager, California State Coastal Conservancy, located at 1330 Broadway, 13th Floor, Oakland, California, 94612-2530. They can also be sent via fax to 510-286-0470, with "Eel River Estuary and Centerville Slough Enhancement Project, Comments on Revised NOP" in the title.

Comment Period: CEQA Guidelines Section 15082 (b) provides a 30-day response period for input about the scope and content of the EIR. The comment period for the Revised NOP begins on November 13, 2015, and ends on December 18, 2015. The deadline for submitting written comments is December 18, 2015 at 5:00 p.m.

Public Scoping Meeting: A public scoping meeting to accept comments on the environmental issues germane to the Project will be held on December 9, 2015 at 3:00 PM at the River Lodge Conference Center, 1800 Riverwalk Drive, in Fortuna, California.

1.3 Previous Notice of Preparation and Scoping

On December 17, 2014, the Coastal Conservancy issued the original NOP for the original version of the Project. The NOP was issued in accordance with the State CEQA Guidelines (14 California Code of Regulations [CCR] Section 15082) with the intent of informing agencies and interested

parties that an EIR would be prepared for the above-referenced Project. A public scoping meeting for the proposed project was held in Fortuna January 12, 2015 at 3:00 P.M. The Coastal Conservancy received extensive input on the proposed Project, but the comments received did not warrant reissuance of the NOP or rescoping. However, in August 2015 adjacent property owners requested that the Project scope extend beyond the Eel River Estuary Preserve (EREP) then-defined Project area to include adjacent properties.

In response to input received during the initial scoping, as well as more recent stakeholder interest and input, the Project has since been revised by the applicant. The Project area now includes approximately 600-acres to the south. This expanded footprint is extended at the request of adjacent property owners and similar Project components are proposed for implementation on these adjacent properties. To address the addition of these properties into the Project area, the Coastal Conservancy has prepared this Revised NOP to allow for additional public and agency comment on the preparation of an EIR for this revised proposed Project. Comments provided in response to this Revised NOP will be considered and addressed in the Draft EIR. Comments provided previously, in response to the original NOP, will continue to be considered in the Draft EIR. (Please note: if you provided a comment on the original NOP, you do not need to provide a duplicate comment of that comment. However, if you have a new comment on the revised NOP, please provide your comment in response to this Notice)

1.4 Purpose of this Revised Notice of Preparation

The purpose of an NOP is to provide sufficient information about the revised proposed Project and its potential environmental impacts to allow agencies and interested parties the opportunity to provide a meaningful response related to the scope and content of the EIR, including mitigation measures that should be considered and alternatives that should be addressed (State CEQA Guidelines 14 CCR Section 15082[b]). The proposed Project location, description, and potential environmental effects are summarized below.

2. Project Location and Setting

The proposed Project site is approximately 1,850-acres and is located approximately four miles west of the City of Ferndale, in Humboldt County, California (Figure 1). The Project site includes the Eel River Estuary Preserve (EREP) owned by The Wildlands Conservancy (TWC) and various parcels owned primarily by Russ Ranch and Timber, LLC and Jack and Linda Russ. The Project site includes the following APN's: 10012105, 10013104, 10014201, 10013103, 10012104, 10012101, 10014209, 10014304, 10014303, 10014221, 10101114, 10014308, 10014208, 10014211, 10014302, 10014301, and 10101105.

The west side of the Project encompasses the near shore dunes of Centerville Beach and extends to the Pacific Ocean. East of the dunes the Project area supports a system of sloughs and pastures that comprise a portion of the Salt River watershed, itself a tributary to the Eel River estuary. The north property line borders the Eel River. The southern half of the Project area includes two perennial tributary streams, Russ Creek and Shaw Creek, and one seasonal drainage referred to as Creamery Ditch.

Much of the southern half of the Project area east of and including former Centerville Slough was reclaimed and has been converted to pasture for cattle grazing. Some of this land represents diked former tidelands separated from the estuarine wetlands by a series of dikes and the Cut-off Slough

tidegates. The project area and some other surrounding parcels comprise an historic reclamation district that operated with a largely unified vision of managing Eel River and Wildcat Hill stream floodwaters.[1]

A partially developed upland area occupies the southeastern portion of the Project, where vehicular access is gained from Russ Lane. Few structures occur on site, but there are two residences: one at the southwestern edge of the Project and another at the southeastern edge; two barns within the upland area near Russ Lane (referred to as the Potato Barn and Quonset Hut); a third barn (North Barn) located between Cut-off Slough and the near shore dunes, approximately midway between the north and south property lines of the EREP; and a fourth barn (South Barn) located in the southwest corner of the EREP. The North and South barns are connected by unimproved roads to the Potato Barn at the Project entrance.[2] Watering troughs and extensive fencing occur throughout the central and southern portion of the Project area. Figure 2 shows existing conditions within the Project area.

TWC owns the EREP which includes agricultural (grazing) land, tidal salt marsh, brackish marsh, riparian scrub, sloughs/open water channels, freshwater ponds and ditches, and nearshore dune ridges and swales. Russ Ranch and Timber, LLC, Jack and Linda Russ, and Harville Ranch, LLC own the parcels of land immediately south of the EREP; this area includes grazing land with managed ditches, open water channels and mixed freshwater and brackish marsh.

The climate is Mediterranean with precipitation most abundant in the winter months, and the average annual rainfall is approximately 48.5 inches. Approximately two thirds of the year, the site is influenced by coastal fog. Prominent water features include Russ Creek, remnant Centerville Slough, Cut-off Slough, and the Western Drainage Ditch (which in turn conveys the flow of Shaw Creek and Creamery Ditch), as well as smaller (seasonal) slough channels and drainage ditches. The northern end of the EREP borders the mouth of the Eel River.

General Plan land use for the Project site is Natural Resources (NR/R) and Agriculture Exclusive (AE) which includes prime agricultural lands. Primary uses of AE are limited to the production of food, fiber, plants, timber, timber agriculturally related uses, and agriculture related recreational uses. Very-low intensity residential uses may be allowed if they are incidental to the property and if they support agricultural activities, or are necessary for the enhancement and protection of the natural resources of the area. Minimum parcel size is 60 acres except divisions to 20 acres may be permitted where the parcel is subject to an agricultural preserve contract or agreement. Zoning for the Project site is NR/R and AE-60/W,F,R,T, which is consistent with the land use designation. Combining zones include Coastal Wetland Areas (W), Flood Hazard Areas (F), Streams and Riparian Corridors Protection (R), and Transitional Agricultural Lands (T).

The EREP portion of the Project is enrolled in a Williamson Act contract entitled “Wildlands Conservancy Agricultural Preserve No. 09-05.” Approximately 648 acres are identified in that

[1] This delicate balancing of conflicting forces was achieved by storing floodwaters from the Wildcat Hills to the south behind a system of levees and tidegates, and then draining that stored water northward (primarily through the Cutoff Slough tidegate) when low tide conditions in the Eel estuary permitted. The proposed project adheres to this approach. Therefore, ensuring that the proposed project does not significantly diminish the storage capacity within the system of levees is a fundamental design criterion for the project.

[2] The only access to the EREP is over an easement owned by TWC, which lies across APN 100-142-002 owned in fee by the Harville Ranch LLC. TWC and the Harville Ranch LLC presently do not agree on whether the easement encompasses the legal right to provide public access to the TWC property.

contract as being “Areas In Grazing.” The parcels south of the EREP, which are now included in the Project site with this Revised NOP, are also enrolled under Williamson Act contracts (APN’s 10014302, 10014303, 10014304, 10014308, 10014211, 10014221, and 10014208). Russ Ranch and Timber Co., LLC. property included in the Project under Williamson Act contract are: APNs 100-142-008, 100-142-011, 100-143-002, 100-143-003, 100-143-008, 100-142-021 and 100-143-004. A Natural Resource Conservation Service (NRCS) Wetland Reserve Easement (WRE) is proposed and will be finalized in 2016 over APN 10014308 owned by Russ Ranch and Timber Co., LLC. A Natural Resources NRCS WRE is also proposed over APN 10012104 owned by TWC.

3. Project Description

3.1.1 Project Goals and Objectives

The goal of the Project is to improve geomorphic and ecosystem function that will enhance habitats for native fisheries and aquatic species, support waterfowl and wildlife species, and benefit agricultural land management, capacity and uses by decreasing and more effectively managing onsite flooding and sedimentation through practices including passive and active sediment management. In addition to articulating habitat enhancement actions, the Project objectives also specify how the Project can design and plan for land uses, agricultural land management, productive capacity and uses, dune enhancement and vegetative communities in anticipation of future climate scenarios and sea level rise.

Specific objectives of the Project include:

- Improve access to restored aquatic habitats for salmonids and other aquatic dependent species by increasing or creating migratory access between estuarine and inland waters and by restoring overwintering and rearing habitat for juvenile salmonids
- Improve drainage efficiency and manage sediment loads more effectively using both passive natural processes and active management approaches, while enhancing tidal influences by reestablishing connectivity of Russ Creek, Shaw Creek and Creamery Ditch to a rehabilitated Centerville Slough
- Enhance agricultural land management, capacity and uses by increasing resiliency to sea level rise and reducing salt water influences to pastures, enhancing drainage and establishing avulsion management areas for Russ Creek and Shaw Creek
- Enhance tidal processes by restoring tidal prism and improve reliability of tidegate infrastructure to provide adaptability for sea level rise and varied land management
- Enhance dune formation to increase resiliency to sea level rise
- Enhance freshwater pond habitat for waterbirds and other native aquatic dependent species
- Facilitate agreement regarding access for continued passive and active agricultural land management, and nature study opportunities consistent with existing conditions
- Suppress invasive species
- Establish long-term Adaptive Management Program to facilitate future permitting of land management activities

3.1.2 Overall Concept

Proposed activities would enhance the Project area transitioning it from a landscape of mostly diked pasture land to a system of pastures and natural habitats, including estuarine and tidal slough channels, freshwater streams, freshwater waterfowl ponds and agricultural pastures. Critical to achieving this goal is an enhancement in tidal flushing to reactivate wetland functions within the Inner Marsh and Centerville Slough. The Project includes design and installation of new muted-tidegates to introduce the muted tidal prism into the Inner Marsh and Centerville Slough occupying historic tidal slough channels that have persisted despite former reclamation efforts, floods and significant tectonic activity. This will enhance aquatic organism passage from the Eel River to Centerville Slough, Shaw Creek and Russ Creek, while improving drainage efficiency. Additionally, retrofitting the existing tidegate structure on Cut-off Slough through replacement of the gates will increase reliability and drainage efficiency. Realignment and geomorphic restoration of Centerville Slough, Russ Creek and Shaw Creek are expected to support introduction of overwintering juvenile salmonids, waterbird habitat and drainage from the landscape, and maintain an existing drainage easement. Improved drainage and habitat conditions will be established along Russ Creek. Creation of sediment management areas requiring continual passive and active management and maintenance are acknowledgement that in the absence of full historic tidal and floodplain functions some processes of the Project site will require ongoing management to maintain agricultural viability, agricultural land management, capacity and uses and ecological function. Similarly, management of the flattened (breached) dune would include actions to protect an existing drainage ditch and agricultural resources, agricultural land management, capacity and uses while furthering science and projects on passive and active dune enhancement and climate change vulnerability. As a retreat strategy to reduce agricultural land vulnerability from sea level rise, proposed placement of set-back berms provide increased resiliency. The longevity of Project benefits depends upon the successful restoration of some natural ecological processes and the frequency and nature of maintenance activities, but would be heavily influenced by availability of long-term funding and uncontrollable natural events within this dynamic, highly altered and geologically unstable watershed. As a result, this Project would include an adaptive management program to provide a feedback mechanism for responses based on monitoring, and then implementation of management actions. Figure 3 illustrates Project activities from the original NOP and Figure 4 illustrates Project activities for the Revised NOP.

3.1.3 Proposed Project Activities

Retrofit Existing Cut-off Slough Tidegates

The existing tidal control structure in Cut-off Slough provides the only conduit of drainage from the project area into the Eel River. The structure is equipped with six (6) top-hinge tidegates that leak and restrict aquatic organism passage from the Eel River. The existing tidal control structure in Cut-off Slough is a dike structure built in 1979. The current structure was intended to replace a former structure installed as part of the original filed 1884 Reclamation District. The levee system is approximately 2 miles in length, and includes the Cutoff Slough tidegate that consists of six (6) top hinge flood control tidegates protecting an estimated 2,000 acres of prime agricultural land or nonprime agricultural lands owned by 5 owners comprised of: 1). Fern Cottage, Inc., 2). Russ Ranch and Timber Co., LLC, 3). The L.D. O'Rourke Foundation, 4). Harville Ranch, LLC, and 5). The Wildlands Conservancy. There is in place an existing Drainage Easement governing this flood and tide control structure. During summer months, the average water surface elevation behind the tidegates is approximately 2.5 feet (NAVD-88) and sustained by groundwater influences, occasional

dune over-wash and tidegate leakage. During winter months periods of prolonged inundation and flooding occur upstream of the tidegate as the backwater influence from the Eel River estuary prevents the gates from opening, during low tide cycles, for extended periods of time. The salt tolerant vegetative communities that have established along the banks of the slough upstream of the tidegate structure corroborate the brackish conditions in Cut-off Slough. Overland drainage from adjoining properties is collected in Western Drainage and Cut-off Slough and ultimately drains through the existing Cut-off Slough tidegates.

Upgraded tidegates retrofitted into the existing structure would allow for improved, but managed, tidal function and improved drainage efficiency in Cut-off Slough and adjoining properties. Use of modified tidegates to mute tides also protects adjacent properties while improving aquatic habitat passage.

Expand Seasonal Tidal Prism to Inner Marsh and Centerville Slough

Referred to as the Inner Marsh, this 150-acre area used now for seasonal grazing is surrounded by dikes and does not function as a closed cell currently, but would after implementation of the proposed Project. The perimeter dike provides an ideal setting for expanding tidal wetland habitat. To achieve this, tidal access would be modified to increase tidal action in this protected environment.

Install New Muted Tidegates

To introduce seasonal tidal flows that are of a higher elevation relative to Cut-off Slough, new tidegates would be installed through the existing Inner Marsh dike. This would include muted tidegate regulators that would allow a muted tidal prism to be introduced into the Inner Marsh and Centerville Slough in addition to providing a redundant outlet. The new muted tidegate would be designed to accommodate a range of muted tidal amplitudes (up to approximately 5 feet, NAVD 88) to enter the Inner Marsh and realigned Centerville Slough. The muted tidegate would be seasonally operated based on biologic, geomorphic, hydrologic and land use objectives with routine monitoring to inform operational scenarios. The EIR would analyze a broader range of tidal elevation options in addition to those recommended for the proposed Project. Under both the existing condition and proposed project alternatives, effective floodwater management necessitates full comprehension of, dedication to and cooperation in the effective actions of all parties to the existing drainage easement. The parties to the proposed Project will develop an Operating Plan that explains floodwater management strategies, and details the proposed operations of the proposed infrastructure. This Operating Plan will include specific tidegate levels and seasonal operation guidelines. The parties to the Project will attempt to finalize the Operating Plan prior to approval of the proposed Project and in collaboration with the other parties previously listed.

Enhance Centerville Slough and Reestablish Connectivity to Russ and Shaw Creek

Historically, Centerville Slough extended south from Cut-off Slough, parallel to the dune network to the community of Centerville at the base of the Wildcat Mountains. Reclamation and the associated reduction in the tidal prism, coupled with actively directed Russ Creek avulsions, resulted in a significant reduction in aquatic capacity. The Western Drainage Ditch is all that remains as a remnant drainage feature. Russ Creek and Shaw Creek which once flowed into Centerville Slough now terminate with avulsion and overland sheet flows over existing pastures.

Enhance Centerville Slough

Freshwater runoff from the Wildcat Hills is collected and conveyed through Creamery Ditch, Shaw Creek and Russ Creek. Western Drainage Ditch running north along the backside of the dunes, collects dune over wash, Creamery Ditch and Shaw Creek flows. The Western Drainage Ditch lies in the path of disturbed dunes and is vulnerable to continued dune over wash and sedimentation.

Approximately 3,000 feet of Western Drainage Ditch would be realigned into the former Centerville Slough. It would then be reconnected to the existing downstream Western Drainage Ditch, and this portion of Western Drainage Ditch would be enhanced and widened for ecological benefit and drainage efficiency. The reestablishment of Centerville Slough would reconnect Shaw Creek, Creamery Ditch and Russ Creek and be re-aligned into the Inner Marsh providing seasonal tidal connectivity separate from Cut-off Slough. During high freshwater run-off events during winter months, the runoff would occupy lands adjoining Cut-off Slough similar to current conditions. Centerville Slough channel would be sized to enable the slough to serve as flood storage, conveyance, and brackish aquatic habitat. The primary sediment area for Russ Creek will be on the EREP.

Reconnection of Russ Creek to Centerville Slough

A graded channel would reconnect Centerville Slough with Russ Creek, thereby improving site drainage, creating in-channel flood storage, reestablishing a long tidal to freshwater ecotone and providing a wetland prism that includes freshwater wetland and/or riparian habitat, as well as habitat connectivity for anadromous fish.

Reconnection of Shaw Creek to Centerville Slough

The realignment of Shaw Creek would re-connect to Centerville Slough providing a long freshwater-brackish water ecotone thereby improving site drainage, creating in-channel flood storage as well as habitat connectivity for anadromous fish.

Develop Primary Sediment Management Area on Russ Creek and Shaw Creek

Leveraging natural flood processes, sediment management areas would be established in avulsion prone areas on both Russ Creek and Shaw Creek. Sediment deposits on the EREP would remain or be seasonally relocated to approved areas and project locations as needed. The sediment management areas themselves would then be seeded and irrigated as needed to enhance agricultural productivity in those areas. Sediment deposited and/or excavated and sediment management on the lands of Russ Ranch and Timber Company, LLC and Jack and Linda Russ would be tilled, seeded, fertilized and irrigated to reestablish or enhance livestock forage and grazing areas.

Develop Secondary Sediment Management Area and Floodplain Swales

Given the highly dynamic nature of Russ Creek and limited capacity of primary sediment management areas, only secondary sediment management areas would be designated on the Russ Creek reach through Russ Ranch and Timber Co., LLC or Jack and Linda Russ properties. Floodplain swales or drainage facilities would allow overland release of over-bank flows to be directed to the secondary sediment management areas, directing

flow and sediment to low lying areas and thereby reducing flood frequency of nearby residents and properties.

Enhance Existing and Create New Off-Channel Habitat

The lack of tidal connectivity across the proposed Project area has led to infilling and reduced availability of brackish and freshwater ponds for waterfowl and fish habitat. Existing depressions in the landscape currently serve as freshwater ponds managed for waterfowl which would be enhanced by deepening and re-configuring with controlled inlets/outlets to minimize maintenance and continue a long tradition of waterfowl hunting on the site. Seasonal rainfall would be the primary means of filling the ponds, while existing wellheads would provide backup supply. New brackish water ponds for overwintering juvenile salmonids would also be created by deepening other existing depressions in the floodplain of a restored Centerville Slough/Russ Creek.

Protect and Enhance Drainage, Land Uses and Habitats

Threats to the richness of existing habitat and land uses include disturbances of dunes; saltwater intrusion; loss of cold water storage capacity and timing; sedimentation of watercourses; subsidence and natural conversion of agricultural pasture; and invasive species. Neighboring properties require drainage through the proposed Project area, and can be negatively impacted by management activities on the proposed Project site. Actions to balance these needs while retaining habitat include active implementation projects, passive restoration, and ongoing management.

Re-establish Dune Configuration

While dunes are generally self-maintaining, their form and dynamics are influenced by vegetation, sediment recruitment, and other factors. Non-native invasive vegetation such as *Ammophila arenaria* (European beachgrass) alters dune mobility and shape. Both natural and anthropogenic influences can disturb dune formation. Over time, the processes of vegetative colonization and wind would likely result in rebuilt dunes. The timescale of this recovery is not known.

Significant disturbance has occurred at two distinct locations within the proposed Project area, a northern area approximately 15 acres located on EREP, and a southern area approximately 20 acres on the Russ Ranch and Timber, LLC property. The movement of this sand unconfined in any remaining dune network threatens the Western Drainage Ditch with infilling, a trend that threatens the safety and land use of the Project site and properties to the south, all of whom are parties to a formal drainage easement over the Project site.

Dune management remains somewhat experimental. Conflicting land use needs often influence restoration/stabilization debates. This proposed Project seeks to create passive and active techniques to identify best practices for maintaining a balance in ecological function and change and limiting land use impacts in dune management. The integrity of the dunefield west of the proposed Project would be reconfigured through actions taken in the proposed Project. The project design will allow for dune migration inland as part of its recovery process.

Improve Quality of Agricultural Pasture

Sea level rise alters groundwater composition and vegetation communities. As soils become increasingly saline and brackish, salt marsh vegetation would dominate. Periodic

dune breaches exacerbate this effect. This is already being observed in the EREP portion of the proposed Project (historic Centerville Slough section), and on approximately 250-acres of the Russ Ranch and Timber, LLC property (Angels Camp). While some areas within the Project site are targeted for wetland increases, other areas would be preserved and protected for agricultural pasture.

Set-back Berms.

Existing berms would be enhanced and new berms constructed to improve overland drainage efficiency and increase resiliency of agricultural land from wave over-wash. The berms would be constructed of excavated soils with gradual side slopes to allow for grazing.

Raise soil elevation.

Sediment excavated from Russ Creek and Shaw Creek would be spread annually over agricultural pasture to improve soil quality, keep grasses above the influence of saltwater within the water table, and thereby support freshwater grasses. Sediment deposited and or excavated and sediment management areas on the lands of Russ Ranch and Timber Company, LLC, and Jack and Linda Russ property would be tilled, seeded, fertilized and irrigated to reestablish or enhance livestock forage and grazing areas.

Designated access routes, culverts and bridges.

Project implementation and future management would require durable yet limited access routes that minimize impacts to the proposed Project area. Some existing access routes, culverts and bridges would be improved and maintained, while others may be decommissioned. Routes would be designed to accommodate a range of vehicle types and weight classes and culverts replaced as needed to increase access reliability for agricultural and proposed Project operations.

Invasive Species Removal

The proposed Project would provide the basis for ongoing invasive species management and suppression using passive and active restoration techniques, and participating when appropriate with local and regional programs.

Public Education and Access

Public access to the entire proposed Project site is currently limited. Russ Ranch and Timber, LLC, and Jack and Linda Russ properties are managed exclusively for agricultural production. TWC property is managed for agricultural production and for outdoor recreation and education opportunities. The EREP hosts an historic private duck hunting club, welcomes invited guests and docent-led group site visits, and uses the site to educate elementary school children about wetland and estuary systems and agriculture as practiced in the coastal zone.[3]

It is unknown whether access will significantly increase as a result of the proposed Project. The Recreation chapter will evaluate this question in detail and propose suitable mitigation and monitoring measures as warranted. The proposed Project includes the following activities

[3] The only access to the EREP is over an easement owned by TWC, which lies over APN 100-142-002 owned in fee by the Harville Ranch LLC. TWC and the Harville Ranch, LLC presently do not agree on whether the easement encompasses the legal right to provide public access to the TWC.

North Barn Parking Area and Interpretive Signage

Minor improvements to the North Barn Parking Area and signage limiting visitors to existing trails will facilitate TWC's outreach and education efforts while minimizing impacts to the proposed Project area. Signs about the cultural, agricultural and natural heritage of the area would interpret the landscape for viewers. A vault toilet would be installed to reduce impacts and traffic back to the entrance.

Dune Walk and Overlook

A short boardwalk and trail with an overlook would take visitors along an existing trail into an intact dunefield for birding and natural observation.

Kayak Put In and Take Out

A kayak put in and take out would be installed near the proposed bridge over restored Centerville Slough and new muted tidegate in order to facilitate post-project monitoring of the Inner Marsh, aquatic educational programs and limited recreational use by visitors.

Road and Pasture Improvements

In order to ensure the viability of continued agricultural operations within and around the proposed Project site, a variety of minor appurtenant structures are proposed, such as new gates, road improvements, lighting and fencing.

No public education or access is proposed for any proposed Project area outside of TWC's property, which constitutes the EREP portion of the proposed Project.

Sediment Re-use

Based on the final outcome of sediment sampling and salinity measurements (anticipated to be completed prior to completion of the Draft EIR), a decision would be made on the potential for sediment reuse for beneficial uses during construction such as:

- Dune reconfiguration and formation of sand dune cores,
- Application to agricultural areas Including spreading, tilling, seeding & fertilization, and irrigation, subject to rising saline groundwater,
- Construction of new berms and rehabilitation of the existing berms and roads, and
- Off haul to other beneficial reuse areas.

4. Probable Environmental Effects

The following discussion evaluates potential adverse effects by resource category based on preliminary review of the proposed Project. The environmental categories presented below are from Appendix G of the CEQA Guidelines. Mitigation measures would be developed in the EIR and presented along with additional and specific site information and analysis. There is the potential for significant impacts to occur as a result of the proposed Project, even with the use of mitigation measures; therefore, an EIR would be prepared to evaluate potential environmental effects as a result of the proposed Project, and would also evaluate alternatives. The EIR would recommend mitigation measures, as feasible, to lessen the significance of any impacts identified as potentially

significant. Per CEQA Guidelines Section 15082 (a)(1)(c), the probable environmental effects of the Project are summarized below.

4.1.1 Aesthetics

Would the project:
a) Have a substantial adverse effect on a scenic vista?
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?
c) Substantially degrade the existing visual character or quality of the site and its surroundings?
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

The Project site is in a highly scenic area and includes tidal wetlands, freshwater marsh, sand dunes, grass lands, agricultural pastures, and beach frontage. Project activities are not anticipated to substantially degrade scenic resources in the Project area, rather they are intended to enhance habitats and provide for community education and enjoyment (on TWC's property and the EREP only). However, the EIR would analyze the potential impacts to aesthetic resources, and if appropriate, include feasible mitigation measures to reduce any potentially significant impacts to a less than significant level.

4.1.2 Agricultural and Forestry Resources

Would the project:
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?
d) Result in the loss of forest land or conversion of forest land to non-forest use?
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

The proposed Project seeks to strike a balance between restoration of critical ecosystem functions and preservation of agricultural resources, including sustaining Prime Agricultural lands and Nonprime Agricultural lands, agricultural land management, capacity and uses. An Agricultural Baseline Assessment is being prepared in cooperation with the UC Extension Service Farm Advisor and will be used by the Coastal Conservancy to help determine the impacts/benefits to agricultural land resources on the Project site and potentially impacted assessment areas and would be used as supporting information for the EIR. A portion of the proposed Project site's agricultural lands are under Williamson Act contract and are intended to remain under contract post-implementation of the proposed Project. Potential impacts could be the loss of Prime Agricultural Land and Nonprime Agricultural lands or the conversion of Prime Agricultural lands and Nonprime Agricultural lands to another use. The EIR would analyze the proposed Project's potential effects on agricultural resources, zoning and potential conversions of uses from implementation of the Project and include

feasible mitigation measures, if needed, to reduce any potentially significant impacts to a less than significant level. The Project site does not include any forest land or land zoned timberland.

4.1.3 Air Quality

Would the project:
a) Conflict with or obstruct implementation of the applicable air quality plan?
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?
c) Result in a cumulatively considerable net increase in any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?
d) Expose sensitive receptors to substantial pollutant concentrations?
e) Create objectionable odors affecting a substantial number of people?

The Project area is located within the North Coast Air Basin (NCAB), which is under the jurisdiction of the North Coast Unified Air Quality Management District (NCUAQMD). The NCAB is currently in attainment (or is unclassified) for all state and federal ambient air quality standards, with the exception of the state standard for particulate matter less than ten micrometers in diameter (PM_{10}). The EIR would discuss the temporary impacts from construction activities and identify potential mitigation measures if needed. The EIR would discuss the proposed Project's conformity with applicable air quality plans and exposure of sensitive receptors to criteria air pollutants and odors, and mitigation measures would be included where applicable.

4.1.4 Biological Resources

Would the project:
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or US Fish and Wildlife Service?
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

A wide variety of wildlife, including special-status species inhabit the Project area, utilize the site and may be affected by implementation of the proposed Project. The Project area also includes wetlands, riparian areas, coastal dunes and uplands that support a diverse array of aquatic and terrestrial biological resources. The EIR would utilize a number of special studies in the preparation of this section such as habitat mapping, rare plant and animal studies, wetland delineations,

vegetation mapping, Biological Evaluations, and other existing reports/studies. The EIR would analyze potential impacts to special status-species, wetlands, riparian habitat, and coastal dunes and include feasible mitigation measures to reduce any potentially significant impacts to a less than significant level. The EIR would also discuss the proposed Project's conformity with local policies or plans protecting biological resources.

4.1.5 Cultural Resources

Would the project:
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?
d) Disturb any human remains, including those interred outside of formal cemeteries?

A Cultural Resources Investigation has been prepared for the proposed Project by Roscoe and Associates to inventory cultural resources and assess potential impacts on these resources from proposed Project activities. Potential impacts may include the destruction of unknown cultural resources. The EIR would include the results from this investigation and include mitigation measures for the inadvertent discovery of cultural resources and the inadvertent discovery of human remains.

4.1.6 Geology & Soils

Would the project:
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.
ii) Strong seismic ground shaking?
iii) Seismic related ground failure, including liquefaction?
iv) Landslides?
b) Result in substantial soil erosion or the loss of topsoil?
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on, or off, site landslide, lateral spreading, subsidence, liquefaction or collapse?
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

A geotechnical investigation, prepared by LACO, will be utilized for the preparation of this section. Geologic and soils issues include potential erosion and sedimentation during and after construction due to proposed grading, dredging, channel reconfiguration, levee reconfiguration, armoring, subsidence, rise of sea level, dune breaches sediment removal, spreading, tilling, seeding & fertilization, and irrigation. The EIR would describe the site's existing geologic conditions and soils based on existing information and technical reports prepared for the proposed Project. Potential

impacts could include soil erosion or the loss of topsoil. The EIR would include an analysis of the geology of the site as it relates to slope stability, earthquake hazards, landslides, subsidence, rise of sea level, dune breaches and any other potential geologic hazards, and recommend appropriate mitigation measures if applicable.

4.1.7 Greenhouse Gas Emissions

Would the project:
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Construction of the proposed Project would cause release of GHG emissions as a result of combustion of fossil fuels used in construction equipment and vehicles from workers commuting to and from the site. The proposed Project construction would require the use of several pieces of heavy earthmoving equipment, and construction commute and utility vehicles. The NCUAQMD has not adopted a threshold for construction-related GHG emissions against which to evaluate significance and has not established construction-generated criteria air pollutant screening levels above which quantitative air quality emissions would be required; however, this potential impact would be further discussed in the EIR and appropriate mitigation measures would be included if applicable. The EIR would also discuss climate change projections and the potential effects of climate change on the proposed Project.

4.1.8 Hazards & Hazardous Materials

Would the project:
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Phase I and II Environmental Site Assessments were completed for the EREP portion of the proposed Project and a Phase I Environmental Site Assessment would be prepared for the Russ Ranch and Timber, LLC and Jack and Linda Russ properties portion of the proposed Project. The

information from these assessments would be used in the analysis of this resource category and appropriate mitigation measures would be incorporated if applicable. Potential impacts could include the discovery of unknown hazardous materials during construction or the release of hazardous materials associated with transport, use and disposal. The EIR would discuss the existing conditions with regard to potential hazards in the Project area, identify appropriate spill prevention measures, identify potential impacts to project workers and recreation users due to potential soil contamination and other potential hazards at the site, and describe necessary mitigation measures.

4.1.9 Hydrology & Water Quality

Would the project:
a) Violate any water quality standards or waste discharge requirements?
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
f) Otherwise substantially degrade water quality?
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
j) Inundation by seiche, tsunami, or mudflow?

The proposed Project could affect water quality through release of contaminants and sediment from construction activities. The proposed Project could alter hydrodynamic processes, which control local salinity levels. The proposed Project could increase turbidity during and after construction, adversely affecting water quality. The proposed Project and water quality could be impacted by subsidence, rise of sea level and ongoing and or new dune beaches. In addition, flows in Centerville Slough and Cut-off Slough are likely to change with the changed tidal prism following restoration; these changed flows could affect water quality, erosion and channel configuration along these waterways, and fisheries use of these waterways. The EIR will discuss these issues and potential effects and incorporate mitigation measure if applicable to reduce potentially significant impacts to a less than significant level.

4.1.10 Land Use & Planning

Would the project:
a) Physically divide an established community?

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

The proposed Project would require a Conditional Use Permit from Humboldt County and a Coastal Development Permit from the Coastal Commission per the Coastal Act. The EIR will describe existing land uses in the Project area, assess proposed Project impacts and identify any potential land use conflicts. The EIR will review the County's General Plan and the Eel River Area Plan and summarize applicable goals and policies and assess the proposed Project's consistency with applicable General Plan and Eel River Area Plan goals and policies, land use designations, and the County Zoning Ordinance. The EIR will detail, address, assess and mitigate as necessary public access issues to the EREP and potential impacts to adjoining private properties.

4.1.11 Mineral Resources

Would the project:
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

There are no mining operations in the Project area. The proposed Project would not require the use of a substantial amount of any mineral resource, and would not result in the loss of availability of known mineral resources of value to the state, region or locally. The EIR would analyze potential effects to mineral resources and incorporate mitigation measures if applicable.

4.1.12 Noise

Would the project:
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?
b) Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Noise levels would increase temporarily during construction activities at the Project site. The EIR would describe the existing noise levels in the Project area and identify any noise sensitive receptors. The EIR would evaluate the potential for temporary noise impacts from construction, including any construction noise impacts to noise-sensitive biotic species. Future noise levels would

be compared to existing noise levels to determine if the proposed Project would cause a significant increase in ambient noise levels and mitigation measures would be included if applicable.

4.1.13 Population & Housing

Would the project:
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

The proposed Project would neither add either new homes nor businesses, nor housing units on the site and no new housing is proposed. The proposed Project would not displace any housing or people, on or adjacent to the site. The impacts are anticipated to be less than significant; however, the EIR will discuss these issues in more detail.

4.1.14 Public Services

Would the project:
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:
Fire Protection?
Police protection?
Schools?
Parks?
Other public facilities?

As otherwise anticipated in the event of an emergency, the proposed Project may place increased material demand on fire and police services from the proposed Project's nominal increases in recreation, education and access opportunities. The proposed Project would not place additional demands on schools, parks, or other services. The proposed Project does not include the construction of residential or commercial structures, and the proposed Project is not anticipated to result in substantial population growth in the area; and therefore would not substantially increase the need or use of public services and amenities.

4.1.15 Recreation

Would the project:
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?
b) Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

The proposed Project is not anticipated to place additional demands on recreational facilities and the proposed Project does not require recreational facility construction or expansion. The proposed Project does include four features, described above, that relate to recreation. These include: 1) North Barn Improvements; 2) the construction of a trail and short boardwalk with an overlook which would take visitors into an intact dunefield for birding and natural community observation on the EREP portion of the Project (Figure 4); 3) A kayak put in and take out in the Inner Marsh and new muted tidegate, and; 4) Minor improvements to existing infrastructure intended to avoid interactions between recreational and agricultural operations. The EIR would analyze potential impacts to recreational resources and identify feasible mitigation and monitoring measures if significant impacts are identified.

4.1.16 Transportation & Traffic

Would the project:
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
e) Result in inadequate emergency access?
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

The proposed Project would result in increased traffic during construction and may result in increased traffic post construction, potentially affecting levels of service on local streets. The EIR would discuss existing and post-implementation proposed Project traffic volumes and level of service in the Project area and recommend mitigation measures (such as the implementation of a traffic control plan) that would ensure any potential significant environmental impacts on transportation would remain less than significant.

4.1.17 Utilities & Service Systems

Would the project:
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	
g) Comply with federal, state, and local statutes and regulations related to solid waste?	

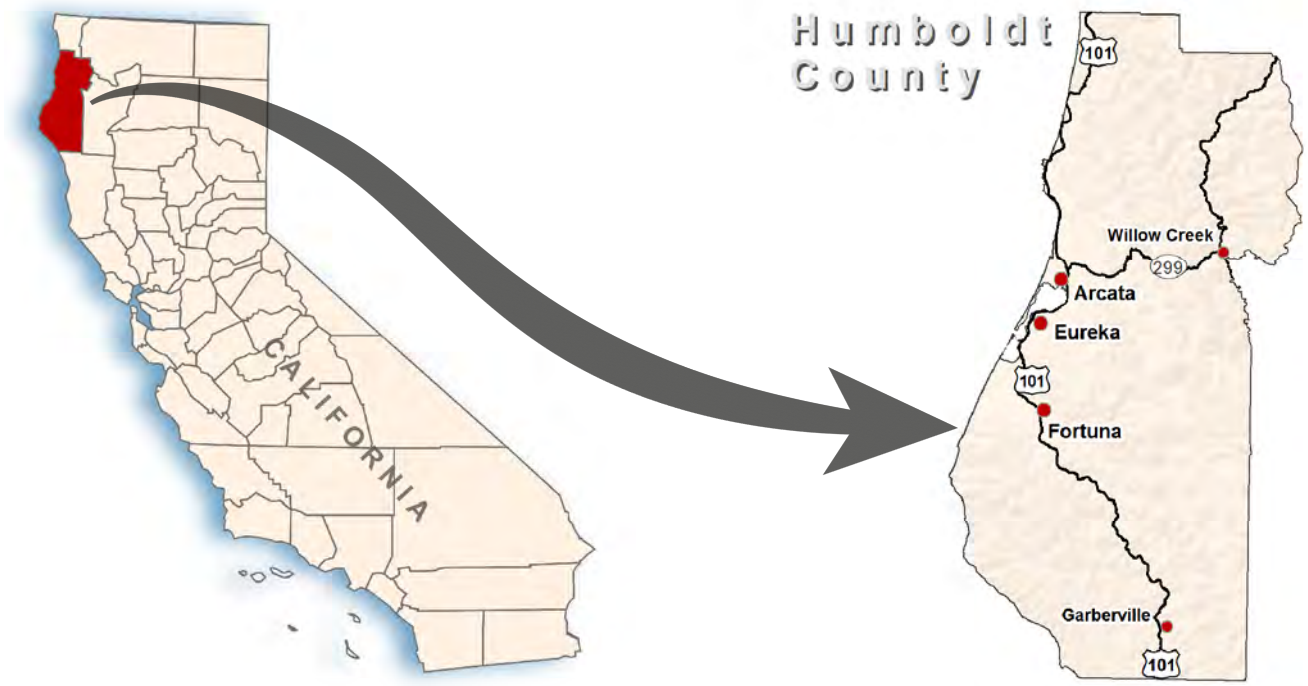
The proposed Project does not include the construction of facilities (residential, commercial, or industrial) that would place additional demands on public water systems, wastewater systems, or landfills. The EIR would include information obtained from the County of Humboldt and applicable utility providers regarding any potential constraints, and if any significant impacts are identified then mitigation measures would be incorporated to reduce any potentially significant impacts to less than significant.

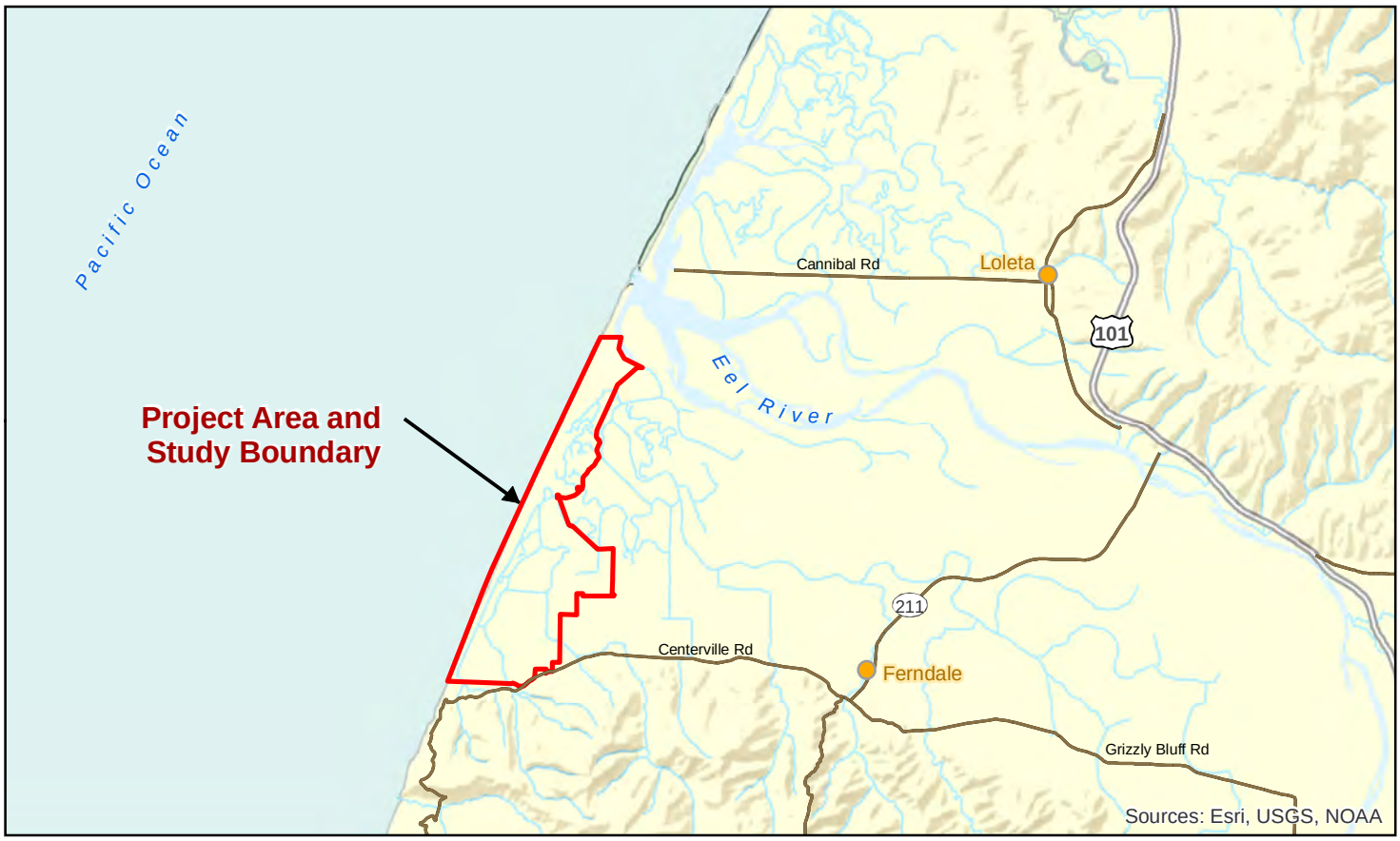
THIS PAGE INTENTIONALLY LEFT BLANK

Appendices

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A - Figures





Project Area
Humboldt County
Counties
Freeway
Highway
Roadway
Streams

Paper Size ANSI A
0 0.5 1 2 3
Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Eel River Estuary and Centerville Slough Enhancement Project Revised NOP

Job Number 8410882.03
Revision 2
Date 09 Nov 2015

Project Vicinity and Location

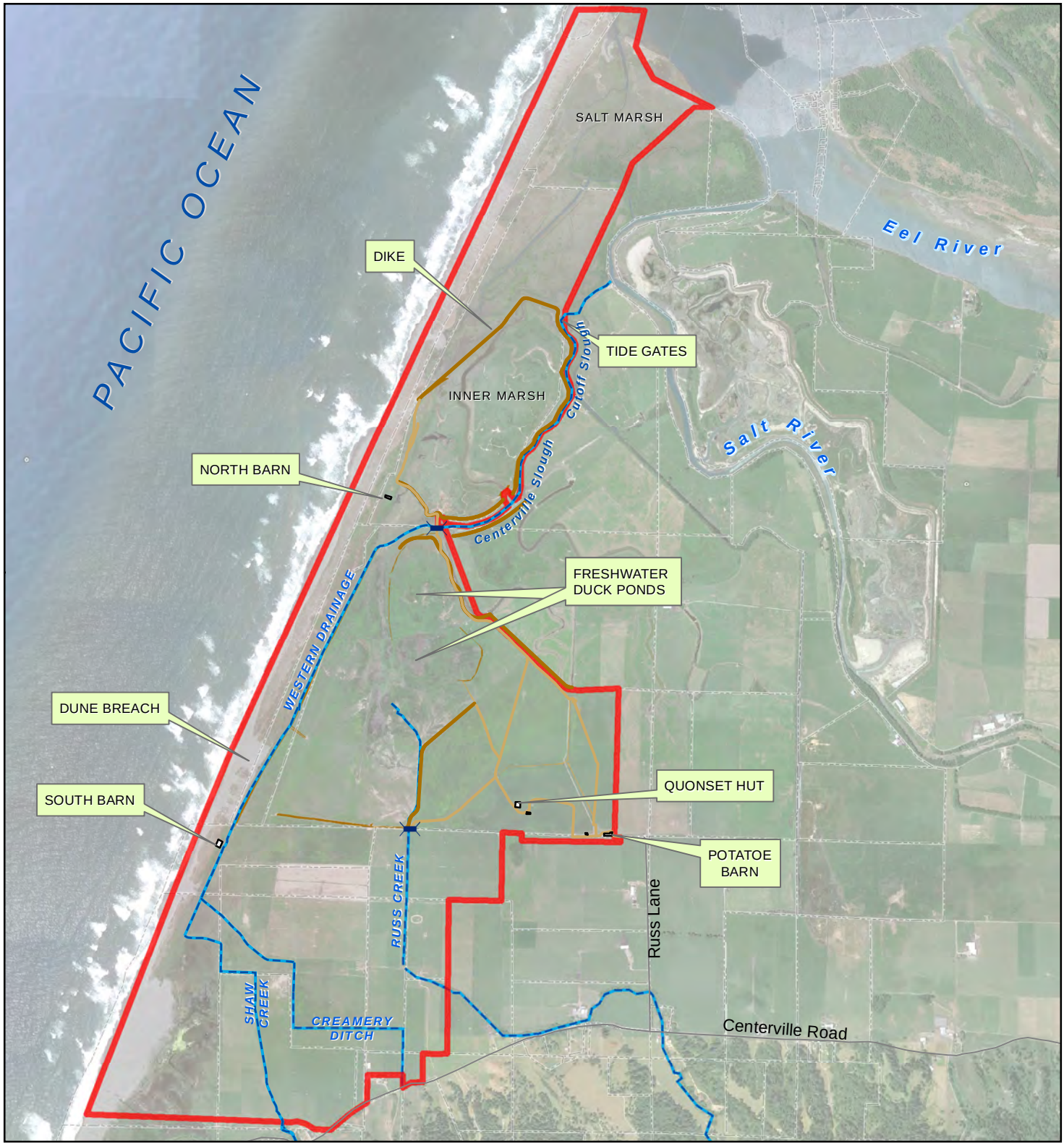
Figure 1

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\NOP\F1_Project_VicinityAndLocation.mxd

© 2015. Whilst every care has been taken to prepare this map, GHD makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; USA Census; Humboldt County transportation data, 2008. Created by:JClark2



Project Area

Property Boundary
(Reference: Humboldt County Parcel Data)

Bridge

Buildings

LocalRoads

Existing Drainage

Existing Access Roads

Existing Levee/Berm

Paper Size ANSI A

0 750 1,500 3,000 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US

N

Eel River Estuary and Centerville Slough Enhancement Project Revised NOP

Job Number 8410882.03
Revision B
Date 13 Nov 2015

Project Area and Existing Conditions

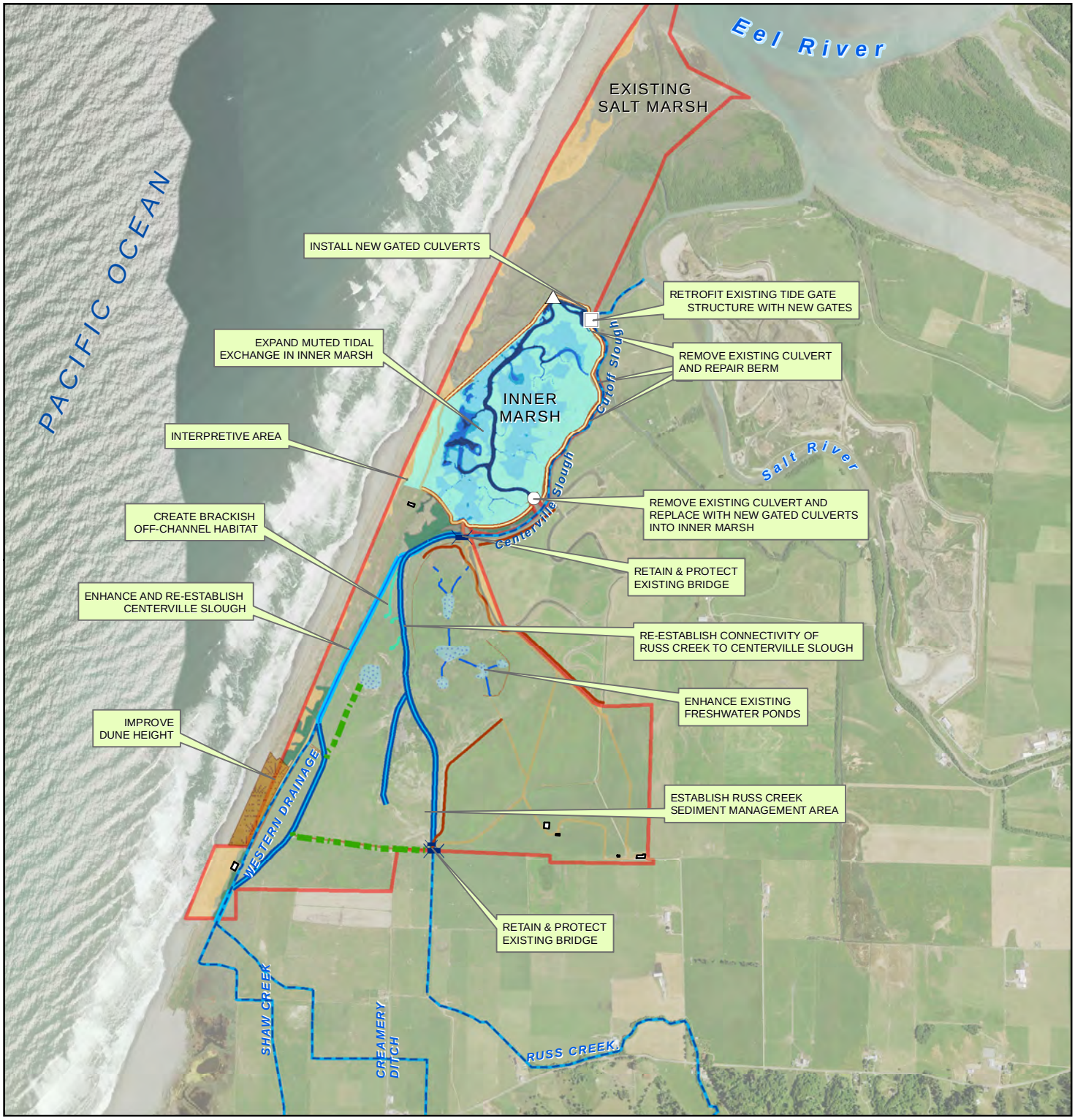
Figure 2

718 Third Street Eureka CA 95501 USA T 1 707 443 8326 F 1 707 444 8330 E eureka@ghd.com W www.ghd.com

\\ghdnet\ghd\US\Eureka\Projects\@GMT-2015.11.13-15.00.02\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\NOP\F2_Project_ExistingConditions.mxd

© 2015. Whilst every care has been taken to prepare this map, GHD makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Google Earth Aerial, 2014; County of Humboldt: administrative boundaries. Created by:porogers



Replace Existing Culverts
New Culvert / Tidegate
Retrofit Existing Tidegate
Bridge

EREP Property Boundary (Reference: Humboldt County Parcel Data)
Buildings

Access Roads
Existing
Proposed
Dike with Improved Access Road
Existing Dike

Proposed Project Components
Existing Drainage
Channel Reestablsh
Channel Enhancement
Historic Drainage to be Abandoned
Freshwater Pond Conveyance

Proposed Project Components
Enhanced Freshwater Complex
Brackish Off-Channel Habitat
Sediment Management Area
Dune Restoration Area

Inner Marsh Muted Tide Levels
< 2.5'
< 3.0'
< 3.5'
< 4.0'
< 5.0'

Paper Size ANSI A

0 375 750 1,500 2,250 3,000 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US

N

Eel River Estuary and Centerville Slough Enhancement Project Revised NOP

Original NOP Conceptual Project Components

Job Number	8410882
Revision	A
Date	13 Nov 2015

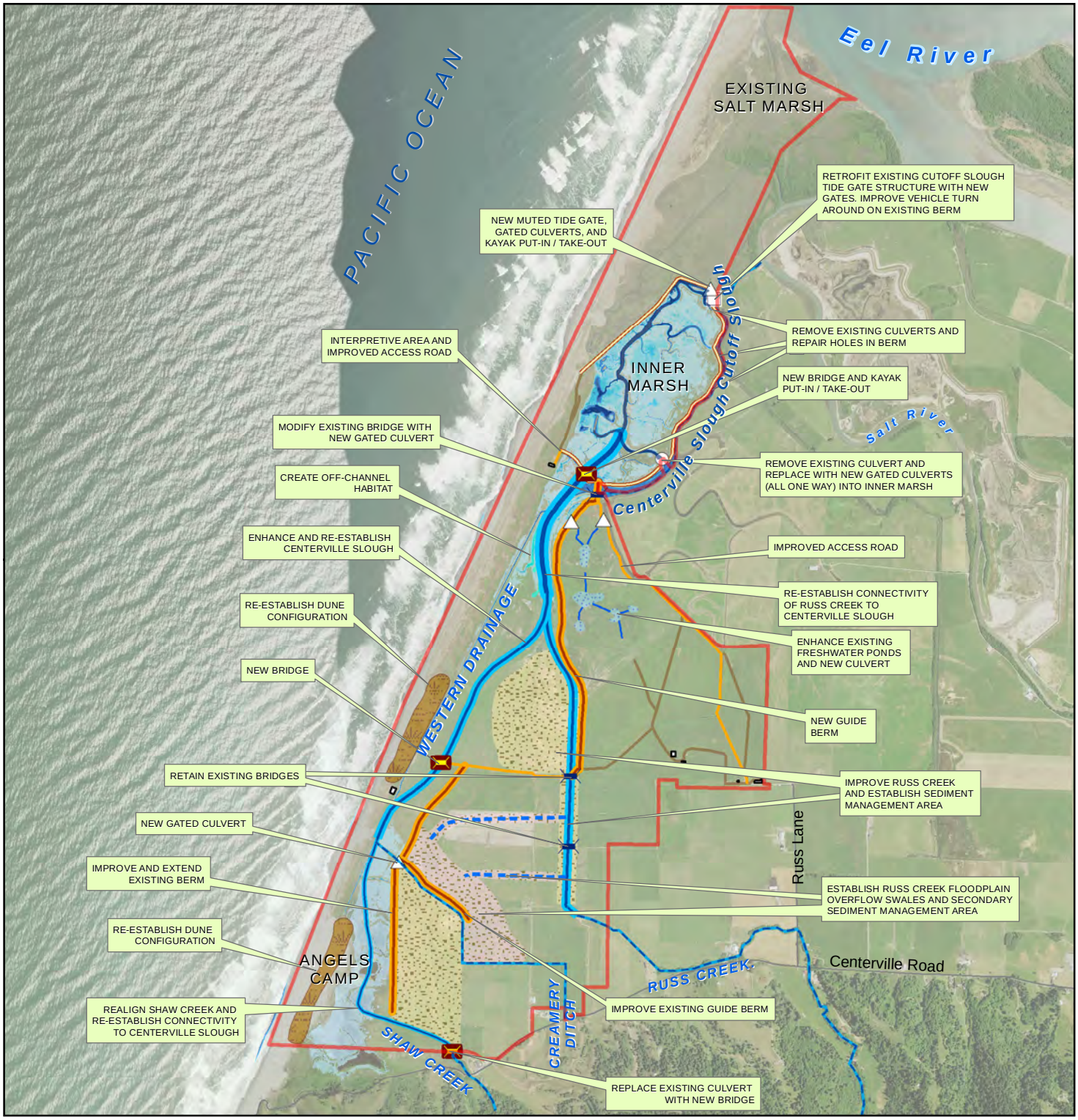
Figure 3

718 3rd Street Eureka CA 95501 USA T 1 707 443 8326 F 1 707 444 8330 E eureka@ghd.com W www.ghd.com

\\ghdnet\ghd\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\NOP\F3_Conceptual Project Components and Alternatives_ANSI A.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers



Existing Features

- Project Area (Reference: Humboldt County Parcel Data)
- Buildings
- Existing Bridge
- Existing Drainage
- Existing Access Route

Proposed Project Components

- Replace Existing Culverts
- New Culvert/Tidegate
- Retrofit Existing Tidegate
- Proposed Bridge
- Improved Access Road
- Berm with Improved Access Road
- Proposed Berm / Guide Berm
- Channel Re-establishment
- Channel Realignment
- FloodplainOverflowSwale
- Freshwater Pond Conveyance
- Enhanced Freshwater Complex
- Brackish Off-Channel Habitat
- Primary Sediment Management Area
- Secondary Sediment Management Area
- Re-establish Dune Configuration
- Existing Ag Exclusive Area Available for Future Sediment Management

Seasonal Muted Tide Levels

(Reference: NOAA Lidar)

- <2.5'
- <3.0'
- <3.5'
- <4.0'
- <5.0'

Paper Size ANSI A

0 900 1,800 3,600 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US

N

Eel River Estuary and Centerville Slough Enhancement Project Revised NOP

Job Number	8410882
Revision	A
Date	13 Nov 2015

Conceptual Project Components

Figure 4

718 3rd Street Eureka CA 95501 USA T 1 707 443 8326 F 1 707 444 8330 E eureka@ghd.com W www.ghd.com

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\NOP\F4_Conceptual Project Components 8.5 x 11.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers

Appendix B Letters in Response to NOP

STATE OF CALIFORNIA
NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West SACRAMENTO, CA 95691
(916) 373-3710
Fax (916) 373-5471

Edmond G. Brown, Jr., *Governor*

January 8, 2015

Michael Brown
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612

RE: SCH# 2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

Dear Mr. Brown,

The Native American Heritage Commission (NAHC) has reviewed the Notice of Preparation (NOP) referenced above. The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA Guidelines 15064.5(b)). To comply with this provision the lead agency is required to assess whether the project will have an adverse impact on historical resources within the area of project effect (APE), and if so to mitigate that effect. To adequately assess and mitigate project-related impacts to archaeological resources, the NAHC recommends the following actions:

- ✓ Contact the appropriate regional archaeological Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check. **SFL Check Completed with Negative Results**
  - A list of appropriate Native American contacts for consultation concerning the project site and to assist in the mitigation measures. **Native American Contacts List attached**
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) Guidelines §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered cultural items that are not burial associated, which are addressed in Public Resources Code (PRC) §5097.98, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, PRC §5097.98, and CEQA Guidelines §15064.5(e), address the process to be followed in the event of an accidental discovery of any human remains and associated grave goods in a location other than a dedicated cemetery.

Sincerely,

Katy Sanchez

Katy Sanchez
Associate Government Program Analyst

CC: State Clearinghouse

RECEIVED
JAN 12 2015
COASTAL CONSERVANCY
OAKLAND, CALIF

Native American Contacts
Humboldt County
January 7, 2015

Blue Lake Rancheria
Claudia Brundin, Chairperson
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
bmobbs@bluelakerancheria-nsn. Tolowa
(707) 668-5101
(707) 668-4272 Fax

Bear River Band of Rohnerville Rancheria
Erika Cooper, THPO
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
erikacooper@brb-nsn.gov
(707) 733-1900 ext 233
(707) 733-1727 Fax

Bear River Band of Rohnerville Rancheria
William Sand, Chairperson
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
(707) 733-1900
(707) 733-1727 Fax

Wiyot Tribe
Brian Mead Tribal Administrator
1000 Wiyot Drive Humboldt Bay
Loleta , CA 95551 Wiyot
Brian@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe
Ted Hernandez, Chairperson
1000 Wiyot Drive Wiyot
Loleta , CA 95551
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe
Stephen Kullman, Environmental Coordinator
1000 Wiyot Drive Wiyot
Loleta , CA 95551
stephen@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe THPO
Tom Torma, Tribal Historic Preservation Officer
1000 Wiyot Drive Wiyot
Loleta , CA 95551
tom@wiyot.us
(707) 733-5055, Ext. 107
(707) 733-5601 Fax

Bear River Band of Rohnerville Rancheria
Edwin Smith, Environmental Coordinator/Cultural
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
edwinsmith@brb-nsn.gov
(707) 733-1900 ext 218
(707) 733-1727 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH #2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

Native American Contacts
Humboldt County
January 7, 2015

Blue Lake Rancheria
Arla Ramsey, Tribal Administrator
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
(707) 668-5101 Tolowa
(707) 668-4272 Fax

Blue Lake Rancheria THPO
Janet Eidsness, Historic Preservation Officer
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
jeidsness@bluelakerancheria-nsn.gov Tolowa
(707) 668-5101
(530) 623-0663 - Cell
707-668-4272 - Fax

Blue Lake Rancheria
Diane Holliday
P.O. Box 645 Wiyot
Blue Lake , CA 95525 Yurok
(707) 668-5635 Tolowa

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH #2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

Page 1. Item 2: 2nd to the last line, under "Salt River Watershed". Comment: To be perfectly clear Salt River is not a River in and of itself, but an abandoned channel of the Eel River which came down the south side of the Delta Plain and as such, is generally back filled as a tidal slough. The whole channel is filled in from extreme sedimentation especially in the upper parts. Anecdotal information says that the '64 flood left five to six feet of sediment at places in the channel. Several small streams from the southern hills currently feed into the Salt River Slough, such as Francis and Reas Creek. This has exacerbated the infilling of the channel, since the streams were channelized to create farmland after the Europeans arrived in 1850. Previously to that, these small streams dumped their sediment loads in alluvial fans where they debouched upon the delta plain.

Sedimentation and infilling of various Eel River channels which can be seen in numerous locations across the delta plain is a totally natural event and should be expected. Eel River is reputed to be the most silt-laden stream in the US when it is high in the winter, carrying a sediment load 15 times that of the Mississippi. All of this really has nothing to do with your project, since Salt River is outside of the footprint, but I wanted to be perfectly clear that there is really no such thing as a Salt River Watershed, unless you count the watersheds of the various small streams that now drain into it.

Page 2. Still under item 2, top of the second page, first line. Should be "east" Comment: and west "of the former Centerville Slough."

Page 2. Paragraph 2 "borders the mouth of the Eel River". Comment: does not currently border the southern side of the mouth of the Eel River

Page 3. Under Item 3, Project Description, section 3.1.1, Comment: third bullet point needs further explanation. Seventh bullet point Comment: should list some of the invasive species such as Chilean Cord Grass and European Beach Grass, etc.

Page 3. Section 3.1.2, line "Restoration of Centerville Slough." Comment: Centerville Slough outboard of the high dike between Occidental ranch and your property as well as a portion of the inboard part of Centerville Slough no longer functions as a waterway due to infilling, probably caused by the dike across the slough. Centerville Slough now drains to Salt River through the tide gates in Cutoff Slough.

Page 3: "Does not limit growth of desired species." Comment: Again listing of those desired species would be valuable.

Page 3. "A sediment management area." Comment: Needs further explanation.

Page 5. 2nd paragraph under "Enhance Centerville Slough". "The reestablishment of Centerville Slough." Comment: Unclear, please refer to comment in section 3.1.2 regarding "Restoration of Centerville Slough."

Page 5. Section 3.1.3 under "Enhance existing and create new off channel habitat". Under "continue a long tradition of waterfowl hunting." Comment: This is a particular hot button for me. Until your party

gained control of the property, the land and waterways north of the northern high dike was open to water fowling between the dike and your northern property line on the Eel River. Your entity has closed the land to hunting. You are unable to close off the tidal channels going into that area, since the Eel River is a Federal Navigable Stream, and the waterways including all the small tidal sloughs are publically accessible to the mean high tide mark. Although I still occasionally hunt waterfowl, it doesn't happen too often anymore and it's been many, many years since I hunted in the aforementioned area. But there are many people who are still avid water fowlers, including to my knowledge, one of the higher ups in your organization. I can see no good reason to close that area to hunting, especially since people can just go in there in a boat and park alongside the slough which has been done many times in the past two or three years. Occasionally, especially on opening weekend, people have camped in the dune areas next to the marsh to enable them to go hunting early in the morning. I personally, in passing by in a boat have never seen any issues associated with these impromptu camping sites, which are ordinarily only used for one or two nights anyway. No debris left behind, no out-of-control fires, etc.

All you are doing in closing this area to hunting is to upset local water fowlers, who have used it for many years.

Maybe your organization doesn't really care if it upsets local people who are pretty much the only ones who hunt in this area, but if you really want to be nice guys, it might be a good idea to reopen this particular area to water fowling.

Page 5. 2nd to the last paragraph, "Salt Water Intrusion." Comment: Much of the land behind the dikes is actually below high tide and will always have a certain amount of salty upwelling. Part of the issue, of course, is that large amounts of sedimentation from floods on the Eel River have not been allowed to happen behind the dikes for the most part, and heightening of the land by sedimentation has not occurred. I personally don't see any way that a certain amount of salt water intrusion could be stopped.

Page 5. Last paragraph, "Dunes are generally self-maintaining". Comment: Good luck on eliminating the huge amount of European Beach Grass covering the dunes. In all probability, if that beach grass wasn't there, the sand would have migrated into what is currently pastureland, lowland, on the east side. I do agree that there should be as little disturbance as possible in the dunes, especially from people recreating with wheeled vehicles. There is, of course, not a heck of a lot you can do about storm surges. So the dunes are pretty much what they are. If you would like to get an idea of the recovery of dune buildup two places come to mind. One is the low spot just to the north of the northerly dike, which has traditionally been a very low point in the dunes, and in fact, in the '64 flood became a 2nd mouth of the river, leaving behind the small lagoon at that place, which itself has been filling in with sedimentation over the years. For as long as I can remember back into the 50's, there was a small lagoon here, and the place was known as "the bathtub", so it's entirely possible that the '55 flood spilled out into this area as well. About 10 years ago, a storm surge overtopped the dunes at that point and since that time the wind-blown sand has been filling it back in again, as you can see. The other place is more current, which I believe you mentioned in the publication, the area to the south, which took out the Russ Barn a couple of years ago.

One thing I would like to address is the apparent loss of what used to be referred to as the "inner beach road", which was mostly for access to the Scotia Gun Club, but also continued on to the north, to the mouth of the river. Although there was a gate which was locked during duck season, at approximately the point where the Russ Barn was destroyed, except for a short distance at Centerville to keep out the riff-raff, the road was available in the sheltered area behind the dunes to access any of the area up to the mouth of the river when weather or tides prevented use of the wave slope. I've been doing Search and Rescue for the Sheriff's Department for 50 years now, and having this road available for emergency use has been invaluable, especially in the event of boats hitting the beach. While there needs to be some way of controlling access to the dunes, having that road available was very much a good thing, and I would certainly hate to see it fade into non-existence.

Page 5. Under Section 4.1.2, center of paragraph "potential impacts could be the loss of Important Farm Land." Comment: It is my understanding that much of the land on your property formerly used as pasture has been withdrawn from that use and the lessee told to bring his business elsewhere. I realize that much of this northerly end of the property is marginal as pasture, but I really hate to see any of the small amount of farmland in Humboldt County withdrawn from that use.

Page 9. Under Section 4.1.5. "Cultural and Historical Resources." Comment: Two things going on on the western side of the property, of which you are apparently unaware – one old and one very old. Under old, the Scotia Gun Club Cabin, which was built in the dunes just to the south of where the northern dike meets the dunes. This was a log cabin serving as a bunk house and clubhouse plus game keeper's residence for water fowling activity on your property, which was formerly conducted by the Scotia Gun Club. The log cabin, I've been told, was built in the 1930's by a person who used to swim in the ocean at that location and found an escaped log boom stacked up on the beach. Although the club has been defunct for many years, there was, the last time I walked through the area, still quite a bit of debris left there after the cabin was burned down, probably by an arsonist.

The other item is, to quote you, a unique paleontological resource. The three or four very large dunes to the south of the old cabin site, were what we called the Indian Mounds when I was a kid. Apparently, an Indian campsite of unknown age. Into the 50's and probably early 60's, before the area became submerged in the migrating sands, it was common to find chips of rocks which were probably left over from arrowhead making. My band teacher, who was a member of the Scotia Gun Club, told me of finding stone net weights at that site in the 30's. So even though any resources may be buried at this time, they are still there, under the dunes.

Page 14. Section 4.1.14, paragraph at top of page. Comment: If your project comes to fruition there will indeed be more traffic on Centerville Road and Russ Lane.

Page 15. Section 4.1.17. Comment: Hopefully you will supply some type of restroom situation for people visiting your property, for the alternative is not very palatable.

From: Zane Ruddy [mailto:zane.ruddy@noaa.gov]
Sent: Wednesday, January 14, 2015 9:06 AM
To: Bowen, Michael@SCC
Cc: Clarence Hostler - NOAA Federal
Subject: Eel River Estuary Preserve Ecosystem Enhancement Project - Comment on NOP

Dear Mr. Bowen,

Thank you for the opportunity to provide comments on the Notice of Preparation (NOP) of a Draft Environmental Impact Report for the Eel River Estuary Preserve Ecosystem Enhancement Project (Project). The National Marine Fisheries Service (NMFS) commends the Coastal Conservancy and partners for taking on this ambitious effort to restore ecosystem processes and improve habitat conditions in former Eel River tidelands. The Project is of particular interest to NMFS due to its potential to support conservation and recovery of Endangered Species Act listed Southern Oregon/Northern California Coast coho salmon, California Coastal Chinook salmon, and Northern California steelhead.

As I noted at the January 12, 2015 public scoping meeting, the NOP's presumed preservation of the Cutoff Slough tidegates appears inconsistent with Project objectives. The NOP states the proposed retrofitted tidegates will protect adjacent properties; however, the basis for this conclusion is not provided. Stated objectives of the Project include improved access for salmonids and restoration of ecosystem functions. The proposed retrofitted tidegates will undoubtedly be an improvement over current conditions; however, the tidegates will continue to mute natural tidal cycles and impede salmonid passage. Therefore, NMFS recommends the Coastal Conservancy analyze the degree to which tidegate removal would allow for attainment of Project objectives, and consider including complete tidegate removal in the EIR alternatives analysis.

We look forward to working with the Coastal Conservancy and other partners to restore the Eel River estuary. For questions regarding these comments please contact Zane Ruddy at (707) 825-5173 or via email at zane.ruddy@noaa.gov.

Sincerely,

Zane Ruddy
Fish Biologist
NOAA Fisheries
U.S. Department of Commerce
Office: (707) 825-5173
zane.ruddy@noaa.gov

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 *Fax* (916) 574-1810
California Relay Service TDD Phone 1-800-735-2929
from Voice Phone 1-800-735-2922

Contact Phone: **(916) 574-1890**
Contact FAX: **(916) 574-1885**

Established in 1938

January 16, 2015

File Ref: SCH # 2014122040

Michael Bowen
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

Subject: Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County

Dear Mr. Bowen:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP for an EIR for the Eel River Estuary Preserve Ecosystem Enhancement Project (Project), which is being prepared by the California State Coastal Conservancy (Conservancy). The Conservancy, as a California public agency proposing to carry out the Project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency because of its trust responsibility for projects that could directly or indirectly affect sovereign lands, their accompanying Public Trust resources or uses, and the public easement in navigable waters. Additionally, because the Project potentially involves work on sovereign lands, the CSLC may also act as a responsible agency. CSLC staff requests that the Conservancy consult with us on preparation of the Draft EIR as required by CEQA section 21153, subdivision (a), and the State CEQA Guidelines section 15086, subdivisions (a)(1) and (a)(2).

CSLC Jurisdiction and Public Trust Lands

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of

all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

Based on the information submitted in the NOP, staff is currently unable to determine the extent, if any, of intrusion on or impact to the State's sovereign ownership interests in the proposed Project area. We request as the Project proceeds, that the Project proponent consult with the CSLC's Land Management Division contact identified below to determine whether the Project or any components of the Project requires a lease or other authorization from the CSLC.

Project Description

The Conservancy proposes to restore ecosystem functions within the Eel River Estuary Preserve (EREP), to enhance habitats for native fisheries and aquatic species, support waterfowl and wildlife species, and to enhance agricultural productivity by decreasing and more effectively managing on-site flooding.

The Conservancy's specific objectives for the Project include:

- Improve access to restored aquatic habitats for salmonids and other aquatic species;
- Improve drainage efficiency and manage sediment loads more effectively;
- Enhance agricultural productivity by increasing resiliency to sea level rise through enhanced floodplain drainage;
- Enhance tidal processes by restoring the tidal prism to the Inner Marsh and by maintaining and improving tide gate infrastructure;
- Enhance freshwater pond habitat;
- Facilitate access for agricultural land management and nature study opportunities;
- Suppress invasive species; and
- Establish long-term adaptive management program.

From the Project Description, CSLC staff understands that the Project would include the following components:

- Installation of new culverts and tide gates at two locations of the existing Inner Marsh to expand the tidal prism within the Inner Marsh;
- Installation of upgraded tide gates retrofitted into existing concrete infrastructure in Cutoff Slough to improve passage for aquatic species;
- Construction of a graded channel to reconnect Centerville Slough with Russ Creek;

- Development of a sediment management area as a high flow bypass to the low flow Russ Creek side channel for enhancement of natural flood processes;
- Realignment of approximately 3,000 feet of the Western Drainage Ditch from the southern EREP boundary northward, into the former Centerville Slough;
- Deepening of existing depressions in the floodplain of Centerville Slough and Russ Creek to create new brackish water ponds for overwintering juvenile salmonids;
- Improvement of dune function through creation of passive and active techniques to identify best practices for maintaining a balance in ecological function and limiting land use impacts in dune management;
- Removal of sediment from Russ Creek and periodic spreading over agricultural pasture to improve soil quality;
- Installation of new fencing to prevent livestock intrusion into restored wetland areas;
- Improvement and decommissioning of existing access routes to accommodate a range of vehicle types and weight classes to minimize impacts to the Project area;
- Use of active and passive restoration techniques for ongoing invasive species management and eradication;
- Minor improvements to the North Barn Parking Area to facilitate outreach and education efforts, such as new signs for interpretation of the landscape;
- Potential re-use of excavated sediment for dune management, agricultural lands, rehabilitation of existing dikes, and off-haul to other beneficial re-use areas.

Environmental Review

CSLC staff requests that the Conservancy consider the following comments when preparing the Draft EIR.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the Draft EIR in order to help CSLC staff determine leasing jurisdiction and facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. The Project Description should be as precise as possible in describing the details of all allowable activities (e.g., types of equipment or methods that may be used, maximum area of impact or volume of sediment removed or disturbed, seasonal work windows, locations for material disposal, construction schedule and staging areas, etc.), as well as the details of the timing and length of activities. Thorough descriptions will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required. Please be as specific as possible regarding all proposed work within CSLC's jurisdictional lands, inclusive of Centerville Slough, Cutoff Slough and, if applicable, below the mean high tide line of the Pacific Ocean. Please also provide additional details regarding proposed passive and active techniques for invasive species management and improvement of dune function.

Biological Resources

2. The Draft EIR should disclose and analyze all potentially significant effects on sensitive species and habitats in and around the Project area, including special-status wildlife, fish, and plants and, if appropriate, identify feasible mitigation measures to reduce those impacts. The Conservancy should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. The Draft EIR should also include a discussion of consultation with the CDFW, USFWS, and the National Marine Fisheries Service (NMFS), including any recommended mitigation measures and potentially required permits identified by these agencies.

3. Construction Noise: The Draft EIR should also evaluate noise and vibration impacts on fish and birds from construction, restoration or flood control activities in the water, on the dikes, and for water conveyance and tide gate structures. Mitigation measures could include species-specific work windows as defined by CDFW, USFWS, and NMFS. Again, staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species.

Cultural Resources

4. Submerged Resources: The Draft EIR should evaluate potential impacts to cultural resources in the Project area. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant. Because of this possibility, please add a mitigation measure requiring that in the event cultural resources are discovered during any construction activities, Project personnel shall halt all activities in the immediate area and notify a qualified archaeologist to determine the appropriate course of action.

5. Title to Resources: The Draft EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the Conservancy consult with Assistant Chief Counsel Pam Griggs (see contact information below), should any cultural resources on state lands be discovered during construction of the proposed Project.

Hydrology and Water Quality

6. In addition to impacts from proposed modifications of Project area hydrology, sedimentation processes, biological resources, and geomorphic channel modifications, the Draft EIR should also analyze potential for these impacts on the affected reaches of the Salt River, Eel River, and coastal processes and potential indirect or cumulative impacts on resources outside of the Project area.

   Please also provide a detailed analysis of how the Project will attempt to plan for sea level rise through enhanced floodplain drainage, capacity, open space, preservation

and enhancement of dune areas, and any potential future conflicts with surrounding land uses, such as agricultural and grazing land uses. In the Environmental Setting section of the Draft EIR, please provide additional detail regarding the Project area's surface hydrology features and characteristics, groundwater characteristics, history of flood events and any known land uses and structures subject to flood hazards, and any flood zone designations for the Project area. Please include a description of the former hydrology and floodplain of the Project vicinity prior to the construction of dikes, tide gates, and other drainage control structures that resulted in the conversion of wetlands and tidelands to other land uses, such as pasture lands for grazing. Please address if the Project will include efforts to restore hydrologic connectivity to former wetland and tideland areas; and conversely, if the Project will result in the infilling or loss of existing wetland, tideland, or floodplain areas.

Alternatives

7. In addition to describing mitigation measures that would avoid or reduce the potentially significant impacts of the Project, the Conservancy should identify and analyze a range of reasonable alternatives to the proposed Project that would attain most of the Project objectives while avoiding or reducing one or more of the potentially significant impacts (see State CEQA Guidelines, § 15126.6).

Thank you for the opportunity to comment on the NOP for the Project. As a trustee and potentially responsible agency, CSLC staff requests that you consult with us on this Project and keep us advised of changes to the Project description and all other important developments. Please send additional information on the Project to the CSLC staff listed below as the Draft EIR is being prepared.

Please refer questions concerning environmental review to Jason Ramos, Senior Environmental Scientist, at (916) 574-1814 or via e-mail at Jason.Ramos@slc.ca.gov. For questions concerning archaeological or cultural resources under CSLC jurisdiction, please contact Assistant Chief Counsel Pam Griggs at (916) 574-1854 or via e-mail at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Ninette Lee, Public Land Manager I, at (916) 574-1869, or via e-mail at Ninette.Lee@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
LMD, N. Lee
DEPM, J. Ramos
Legal, E. Milstein

Humboldt County Farm Bureau

5601 So. Broadway, Eureka, CA 95503 (707) 443-4844

Serving Humboldt County Agriculture Since 1913

January 18, 2015

Mr. Michael Bowen, Project Manager
California State Coastal Conservancy, Lead Agency
1330 Broadway, 13th Floor
Oakland, CA 94612-2530
Also Fax (510) 286-0470

Re: Eel River Estuary Preserve Ecosystem Enhancement Project
Comments on NOP and Scope of EIR

Dear Mr. Bowen:

The Humboldt County Farm Bureau would like to provide the following comments/concerns with the Eel River Estuary Preserve Ecosystem Enhancement Project NOP and Scope of EIR.

- Is this project Consistency with the Williamson Act Contract?
- We would like an explanation of the 'enhanced agricultural production' through 'more effectively managing onsite flooding'.
- We believe there is a need to identify the locations/effects upon the 'approved upland and agricultural locations as needed' (for sediment deposit). If offsite, then agreement with the Property Owner/s.
- Please elaborate on the existing wellheads (as backup) capacities and the effect of withdrawals on groundwater source in the area
- Define the dune migration inland. Where and how much?
- Where is the status/processing of the NEPA document?
- Regarding the Agricultural Baseline Assessment, you need to be sure it is based upon local conditions/history.

- We believe there is a need to include the unique productivity of the agricultural lands in the Delta (versus relying on state wide data that does not pertain to our conditions)

- Dikes/existing drainage facilities. Do they qualify as 'significant historic resources' as defined in State law?

- We believe you should address possible Tsunami effects on improvements.

Please note that there may be revised and additional comments following the release of the Eel River Estuary Preserve Ecosystem Enhancement Project DEIR. Thank you for taking our comments into consideration.

Sincerely,
Andy Albin
Andy Albin
President
Humboldt County Farm Bureau

STATE OF CALIFORNIA
NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West SACRAMENTO, CA 95691
(916) 373-3710
Fax (916) 373-5471

Edmond G. Brown, Jr., *Governor*

January 8, 2015

Michael Brown
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612

RE: SCH# 2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

Dear Mr. Brown,

The Native American Heritage Commission (NAHC) has reviewed the Notice of Preparation (NOP) referenced above. The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA Guidelines 15064.5(b)). To comply with this provision the lead agency is required to assess whether the project will have an adverse impact on historical resources within the area of project effect (APE), and if so to mitigate that effect. To adequately assess and mitigate project-related impacts to archaeological resources, the NAHC recommends the following actions:

- ✓ Contact the appropriate regional archaeological Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check. **SFL Check Completed with Negative Results**
  - A list of appropriate Native American contacts for consultation concerning the project site and to assist in the mitigation measures. **Native American Contacts List attached**
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) Guidelines §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered cultural items that are not burial associated, which are addressed in Public Resources Code (PRC) §5097.98, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, PRC §5097.98, and CEQA Guidelines §15064.5(e), address the process to be followed in the event of an accidental discovery of any human remains and associated grave goods in a location other than a dedicated cemetery.

Sincerely,

Katy Sanchez

Katy Sanchez
Associate Government Program Analyst

CC: State Clearinghouse

RECEIVED
JAN 12 2015
COASTAL CONSERVANCY
OAKLAND, CALIF

Native American Contacts
Humboldt County
January 7, 2015

Blue Lake Rancheria
Claudia Brundin, Chairperson
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
bmobbs@bluelakerancheria-nsn. Tolowa
(707) 668-5101
(707) 668-4272 Fax

Bear River Band of Rohnerville Rancheria
Erika Cooper, THPO
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
erikacooper@brb-nsn.gov
(707) 733-1900 ext 233
(707) 733-1727 Fax

Bear River Band of Rohnerville Rancheria
William Sand, Chairperson
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
(707) 733-1900
(707) 733-1727 Fax

Wiyot Tribe
Brian Mead Tribal Administrator
1000 Wiyot Drive Humboldt Bay
Loleta , CA 95551 Wiyot
Brian@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe
Ted Hernandez, Chairperson
1000 Wiyot Drive Wiyot
Loleta , CA 95551
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe
Stephen Kullman, Environmental Coordinator
1000 Wiyot Drive Wiyot
Loleta , CA 95551
stephen@wiyot.us
(707) 733-5055
(707) 733-5601 Fax

Wiyot Tribe THPO
Tom Torma, Tribal Historic Preservation Officer
1000 Wiyot Drive Wiyot
Loleta , CA 95551
tom@wiyot.us
(707) 733-5055, Ext. 107
(707) 733-5601 Fax

Bear River Band of Rohnerville Rancheria
Edwin Smith, Environmental Coordinator/Cultural
266 Keisner Road Wiyot
Loleta , CA 95551 Mattole
edwinsmith@brb-nsn.gov
(707) 733-1900 ext 218
(707) 733-1727 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH #2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

Native American Contacts
Humboldt County
January 7, 2015

Blue Lake Rancheria
Arla Ramsey, Tribal Administrator
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
(707) 668-5101 Tolowa
(707) 668-4272 Fax

Blue Lake Rancheria THPO
Janet Eidsness, Historic Preservation Officer
P.O. Box 428 Wiyot
Blue Lake , CA 95525 Yurok
jeidsness@bluelakerancheria-nsn.gov Tolowa
(707) 668-5101
(530) 623-0663 - Cell
707-668-4272 - Fax

Blue Lake Rancheria
Diane Holliday
P.O. Box 645 Wiyot
Blue Lake , CA 95525 Yurok
(707) 668-5635 Tolowa

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH #2014122040 Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County.

STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 *Fax* **(916) 574-1810**
California Relay Service TDD Phone **1-800-735-2929**
from Voice Phone **1-800-735-2922**

Contact Phone: **(916) 574-1890**
Contact FAX: **(916) 574-1885**

Established in 1938

December 14, 2015

File Ref: SCH # 2014122040

Michael Bowen
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612

Subject: Revised Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County

Dear Mr. Bowen:

The California State Lands Commission (CSLC) staff has reviewed the subject Revised NOP for an EIR for the Eel River Estuary Preserve Ecosystem Enhancement Project (Project), which is being prepared by the California State Coastal Conservancy (Conservancy). The Revised NOP was prepared due to an expansion of the Project area to include approximately 600 acres to the south. The Project components proposed for the additional 600 acres are similar to those proposed in the original NOP.

Upon review of the Revised NOP, CSLC staff has determined that portions of the Project may be located on State-owned sovereign land under the jurisdiction of the CSLC. These sites include Centerville/Cutoff Slough at the location of the proposed replacement of an existing culvert with a gated culvert and Cutoff Slough at the location of the proposed removal of an existing culvert and berm repair. The Project will also be located on State-owned sovereign land if it extends waterward of the Ordinary High Water Mark of the Pacific Ocean. A lease for the use of sovereign land will be required from the CSLC for any portion of the Project encroaching on State-owned sovereign land, including these locations. Please contact Ninette Lee, Public Land Manager (see contact information below), for information regarding the CSLC's jurisdiction or leasing requirements.

CSLC staff submitted a comment letter, dated January 16, 2015, on the original NOP, which has been enclosed for your reference. The letter included comments on the environmental review for the Project, and these comments remain applicable to the revised NOP, including the additional 600 acres. CSLC staff requests that you consider

the comments in the January 16th letter, as well as the supplemental comments below, during preparation of the Draft EIR.

Tribal Consultation

1. Tribal Cultural Resources: The Conservancy should document and discuss how it complied with the provisions for required consultation with California Native American Tribes pursuant to the requirements added to CEQA by Assembly Bill (AB) 52 (Gatto, Stats. 2014, Ch. 532), which applies to all CEQA projects initiated after July 1, 2015.[1] These new provisions provide procedural and substantive requirements for lead agency consultation with California Native American Tribes and consideration of effects on tribal cultural resources, as well as examples of mitigation measures to avoid or minimize impacts to tribal cultural resources. Additionally, with respect to significance determinations, section 21084.2 states that a project which may cause a substantial adverse changes in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. Lead agencies must avoid damaging effects to tribal cultural resources, when feasible, and shall keep information submitted by the tribes confidential.

Climate Change

2. Sea-Level Rise: A tremendous amount of State-owned lands and resources under the CSLC's jurisdiction will be impacted by rising sea levels. With this in mind, CSLC staff is supportive of the Conservancy discussing in the Draft EIR the effects of sea-level rise on all resource categories potentially affected by the proposed Project. Because of their nature and location, sovereign lands and resources are already vulnerable to a range of natural events, such as storms and extreme high tides. Note that the State of California released the final "Safeguarding California: Reducing Climate Risk, an Update to the 2009 California Climate Adaptation Strategy" (Safeguarding Plan) on July 31, 2014, to provide policy guidance for state decision-makers as part of continuing efforts to prepare for climate risks. The Safeguarding Plan sets forth "actions needed" to safeguard ocean and coastal ecosystems and resources as part of its policy recommendations for state decision-makers.

   In addition, Governor Brown issued Executive Order B-30-15 in April 2015, which directs state government to fully implement the Safeguarding Plan and factor in climate change preparedness in planning and decision making. Please note that when considering lease applications, CSLC staff will (1) request information from applicants concerning the potential effects of sea-level rise on their proposed projects, (2) if applicable, require applicants to indicate how they plan to address sea-level rise and what adaptation strategies are planned during the projected life of their projects, and (3) where appropriate, recommend project modifications that

[1] Sections 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2, and 21084.3 added to CEQA pursuant to Assembly Bill 52 (Gatto, Stats. 2014, Ch. 532)

would eliminate or reduce potentially adverse impacts from sea-level rise, including adverse impacts on public access.

Thank you for the opportunity to comment on the Revised NOP for the Project. As a trustee and responsible agency, CSLC staff requests that you consult with us on this Project and keep us advised of changes to the Project description and all other important developments. Please send additional information on the Project to the CSLC staff listed below as the Draft EIR is being prepared.

Please refer questions concerning environmental review to Holly Wyer, Environmental Scientist, at (916) 574-2399 or via e-mail at Holly.Wyer@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Ninette Lee, Public Land Manager, at (916) 574-1869, or via email at Ninette.Lee@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

Enclosure

cc: Office of Planning and Research
H. Wyer, CSLC
N. Lee, CSLC
J. Garrett, CSLC

STATE OF CALIFORNIA

EDMUND G. BROWN JR., *Governor*

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 *Fax* (916) 574-1810
California Relay Service TDD Phone 1-800-735-2929
from Voice Phone 1-800-735-2922

Contact Phone: **(916) 574-1890**
Contact FAX: **(916) 574-1885**

Established in 1938

January 16, 2015

File Ref: SCH # 2014122040

Michael Bowen
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

Subject: Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Eel River Estuary Preserve Ecosystem Enhancement Project, Humboldt County

Dear Mr. Bowen:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP for an EIR for the Eel River Estuary Preserve Ecosystem Enhancement Project (Project), which is being prepared by the California State Coastal Conservancy (Conservancy). The Conservancy, as a California public agency proposing to carry out the Project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency because of its trust responsibility for projects that could directly or indirectly affect sovereign lands, their accompanying Public Trust resources or uses, and the public easement in navigable waters. Additionally, because the Project potentially involves work on sovereign lands, the CSLC may also act as a responsible agency. CSLC staff requests that the Conservancy consult with us on preparation of the Draft EIR as required by CEQA section 21153, subdivision (a), and the State CEQA Guidelines section 15086, subdivisions (a)(1) and (a)(2).

CSLC Jurisdiction and Public Trust Lands

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of

all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

Based on the information submitted in the NOP, staff is currently unable to determine the extent, if any, of intrusion on or impact to the State's sovereign ownership interests in the proposed Project area. We request as the Project proceeds, that the Project proponent consult with the CSLC's Land Management Division contact identified below to determine whether the Project or any components of the Project requires a lease or other authorization from the CSLC.

Project Description

The Conservancy proposes to restore ecosystem functions within the Eel River Estuary Preserve (EREP), to enhance habitats for native fisheries and aquatic species, support waterfowl and wildlife species, and to enhance agricultural productivity by decreasing and more effectively managing on-site flooding.

The Conservancy's specific objectives for the Project include:

- Improve access to restored aquatic habitats for salmonids and other aquatic species;
- Improve drainage efficiency and manage sediment loads more effectively;
- Enhance agricultural productivity by increasing resiliency to sea level rise through enhanced floodplain drainage;
- Enhance tidal processes by restoring the tidal prism to the Inner Marsh and by maintaining and improving tide gate infrastructure;
- Enhance freshwater pond habitat;
- Facilitate access for agricultural land management and nature study opportunities;
- Suppress invasive species; and
- Establish long-term adaptive management program.

From the Project Description, CSLC staff understands that the Project would include the following components:

- Installation of new culverts and tide gates at two locations of the existing Inner Marsh to expand the tidal prism within the Inner Marsh;
- Installation of upgraded tide gates retrofitted into existing concrete infrastructure in Cutoff Slough to improve passage for aquatic species;
- Construction of a graded channel to reconnect Centerville Slough with Russ Creek;

- Development of a sediment management area as a high flow bypass to the low flow Russ Creek side channel for enhancement of natural flood processes;
- Realignment of approximately 3,000 feet of the Western Drainage Ditch from the southern EREP boundary northward, into the former Centerville Slough;
- Deepening of existing depressions in the floodplain of Centerville Slough and Russ Creek to create new brackish water ponds for overwintering juvenile salmonids;
- Improvement of dune function through creation of passive and active techniques to identify best practices for maintaining a balance in ecological function and limiting land use impacts in dune management;
- Removal of sediment from Russ Creek and periodic spreading over agricultural pasture to improve soil quality;
- Installation of new fencing to prevent livestock intrusion into restored wetland areas;
- Improvement and decommissioning of existing access routes to accommodate a range of vehicle types and weight classes to minimize impacts to the Project area;
- Use of active and passive restoration techniques for ongoing invasive species management and eradication;
- Minor improvements to the North Barn Parking Area to facilitate outreach and education efforts, such as new signs for interpretation of the landscape;
- Potential re-use of excavated sediment for dune management, agricultural lands, rehabilitation of existing dikes, and off-haul to other beneficial re-use areas.

Environmental Review

CSLC staff requests that the Conservancy consider the following comments when preparing the Draft EIR.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the Draft EIR in order to help CSLC staff determine leasing jurisdiction and facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. The Project Description should be as precise as possible in describing the details of all allowable activities (e.g., types of equipment or methods that may be used, maximum area of impact or volume of sediment removed or disturbed, seasonal work windows, locations for material disposal, construction schedule and staging areas, etc.), as well as the details of the timing and length of activities. Thorough descriptions will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required. Please be as specific as possible regarding all proposed work within CSLC's jurisdictional lands, inclusive of Centerville Slough, Cutoff Slough and, if applicable, below the mean high tide line of the Pacific Ocean. Please also provide additional details regarding proposed passive and active techniques for invasive species management and improvement of dune function.

Biological Resources

2. The Draft EIR should disclose and analyze all potentially significant effects on sensitive species and habitats in and around the Project area, including special-status wildlife, fish, and plants and, if appropriate, identify feasible mitigation measures to reduce those impacts. The Conservancy should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. The Draft EIR should also include a discussion of consultation with the CDFW, USFWS, and the National Marine Fisheries Service (NMFS), including any recommended mitigation measures and potentially required permits identified by these agencies.

3. Construction Noise: The Draft EIR should also evaluate noise and vibration impacts on fish and birds from construction, restoration or flood control activities in the water, on the dikes, and for water conveyance and tide gate structures. Mitigation measures could include species-specific work windows as defined by CDFW, USFWS, and NMFS. Again, staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species.

Cultural Resources

4. Submerged Resources: The Draft EIR should evaluate potential impacts to cultural resources in the Project area. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant. Because of this possibility, please add a mitigation measure requiring that in the event cultural resources are discovered during any construction activities, Project personnel shall halt all activities in the immediate area and notify a qualified archaeologist to determine the appropriate course of action.

5. Title to Resources: The Draft EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the Conservancy consult with Assistant Chief Counsel Pam Griggs (see contact information below), should any cultural resources on state lands be discovered during construction of the proposed Project.

Hydrology and Water Quality

6. In addition to impacts from proposed modifications of Project area hydrology, sedimentation processes, biological resources, and geomorphic channel modifications, the Draft EIR should also analyze potential for these impacts on the affected reaches of the Salt River, Eel River, and coastal processes and potential indirect or cumulative impacts on resources outside of the Project area.

   Please also provide a detailed analysis of how the Project will attempt to plan for sea level rise through enhanced floodplain drainage, capacity, open space, preservation

and enhancement of dune areas, and any potential future conflicts with surrounding land uses, such as agricultural and grazing land uses. In the Environmental Setting section of the Draft EIR, please provide additional detail regarding the Project area's surface hydrology features and characteristics, groundwater characteristics, history of flood events and any known land uses and structures subject to flood hazards, and any flood zone designations for the Project area. Please include a description of the former hydrology and floodplain of the Project vicinity prior to the construction of dikes, tide gates, and other drainage control structures that resulted in the conversion of wetlands and tidelands to other land uses, such as pasture lands for grazing. Please address if the Project will include efforts to restore hydrologic connectivity to former wetland and tideland areas; and conversely, if the Project will result in the infilling or loss of existing wetland, tideland, or floodplain areas.

Alternatives

7. In addition to describing mitigation measures that would avoid or reduce the potentially significant impacts of the Project, the Conservancy should identify and analyze a range of reasonable alternatives to the proposed Project that would attain most of the Project objectives while avoiding or reducing one or more of the potentially significant impacts (see State CEQA Guidelines, § 15126.6).

Thank you for the opportunity to comment on the NOP for the Project. As a trustee and potentially responsible agency, CSLC staff requests that you consult with us on this Project and keep us advised of changes to the Project description and all other important developments. Please send additional information on the Project to the CSLC staff listed below as the Draft EIR is being prepared.

Please refer questions concerning environmental review to Jason Ramos, Senior Environmental Scientist, at (916) 574-1814 or via e-mail at Jason.Ramos@slc.ca.gov. For questions concerning archaeological or cultural resources under CSLC jurisdiction, please contact Assistant Chief Counsel Pam Griggs at (916) 574-1854 or via e-mail at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Ninette Lee, Public Land Manager I, at (916) 574-1869, or via e-mail at Ninette.Lee@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
LMD, N. Lee
DEPM, J. Ramos
Legal, E. Milstein

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

DEC 21 2015

Regulatory Division

SUBJECT: File Number 2015-00448N

Mr. Michael Bowen
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, California 94612

Dear Mr. Bowen:

This letter is written in response to a request for comments on the Revised Notice of Preparation of Draft Environmental Impact Report concerning your project Eel River Estuary and Centerville Slough Enhancement Project as described in the document from GHD Inc. dated November 2015. Your project is located near the Eel River Estuary near Centerville Beach approximately 4 miles west of the city of Ferndale, Humboldt County, California. Since this activity may involve slough enhancement, culvert replacement, tide gate improvements, and various other marsh improvement projects and, therefore, impact a water of the U.S.; the Corps of Engineers will need to review those portions of your project.

All proposed work and/or structures extending bayward or seaward of the line on shore reached by: mean high water (MHW) in tidal waters, or ordinary high water in non-tidal waters designated as navigable waters of the United States, must be authorized by the Corps of Engineers pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403). Additionally, all work and structures proposed in unfilled portions of the interior of diked areas below former MHW must be authorized under Section 10 of the same statute.

All proposed discharges of dredged or fill material into waters of the United States must be authorized by the Corps of Engineers pursuant to Section 404 of the Clean Water Act (CWA) (33 U.S.C. Section 1344). Waters of the United States generally include tidal waters, lakes, ponds, rivers, streams (including intermittent streams), and wetlands.

Your proposed work appears to be within our jurisdiction and a permit may be required for your project. Application for Corps authorization should be made to this office using the application form in the enclosed pamphlet. To avoid delays it is essential that you enter the File Number at the top of this letter into Item No. 1 of the application. The application must include plans showing the location, extent and character of the proposed activity, prepared in accordance with the requirements contained in this pamphlet. You should note, in planning your project, that upon receipt of a properly completed application and plans, it may be necessary to advertise the proposed work by issuing a Public Notice for a period of 30 days.

Commencement of work before you receive our notification will be interpreted as a violation of our regulations.

The Corps regulatory program supports the national goal of "no overall net loss" of wetlands. For permitted activities that result in unavoidable losses, the Corps requires replacement wetlands to offset those losses. The U.S. Army Corps of Engineers and U.S. Environmental Protection Agency released a new Compensatory Mitigation Rule on April 10, 2008, to clarify how to provide compensatory mitigation for unavoidable impacts to the nation's wetlands and streams. A copy of this rule can be found on our Headquarters website: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/mitig_info.aspx The new rule changes where and how mitigation is to be completed, but maintains existing requirements on when mitigation is required. The rule also preserves the requirement for applicants to avoid or minimize impacts to aquatic resources before proposing compensatory mitigation projects to offset permitted impacts. Regulatory Guidance Letter 08-03 in the enclosed pamphlet provides guidance on minimum monitoring requirements for compensatory mitigation projects, including the required minimum content for monitoring reports.

A jurisdictional survey (delineation) should be illustrated on a scaled topographic map or site plan. When this document is forwarded with the application, the Corps staff will validate and authenticate the limits of Corps jurisdiction. While it is not necessary to confirm all boundary points, the Corps will verify the jurisdictional boundary along one or more transects and may visit random intermediate points. All delineations of wetlands must be conducted in accordance with the *1987 Corps of Engineers Wetlands Delineation Manual*, or appropriate Regional Supplement, and submitted to the District for review and verification. Two Regional Supplements have been approved for use within the boundaries of the San Francisco District: the *Arid West Supplement*, and the *Western Mountains, Valleys and Coast Supplement*. Copies of these documents are available to download on our website: http://www.spn.usace.army.mil/Missions/Regulatory/JurisdictionDeterminations.aspx.

The Corps of Engineers receives thousands of requests each year to perform wetland delineations for potential applicants for permits under Section 404 of the Clean Water Act. Due to limited staff and resources, response time can be several months or longer. To expedite this process, the San Francisco District encourages applicants to use consultants to conduct wetland delineations, especially for large and/or complex areas. The San Francisco District is not authorized to recommend any private consulting services and advises applicants to check references and referrals of prospective consultants before contracting services.

The Corps also suggests that you contact the appropriate Regional Water Quality Control Board and California Department of Fish and Wildlife office to ensure they review your project relative to their permitting requirements for activities that may impact aquatic resources.

You may refer any questions on this matter to Ms. Cameron Purchio of my Regulatory staff by telephone at (707) 443-0855 or by e-mail at Cameron.R.Purchio@usace.army.mil. All correspondence should be addressed to the Regulatory Division, North Branch, referencing the file number at the head of this letter.

Sincerely,

for
Tori White
Acting Chief, Regulatory Division

Enclosures

Copy Furnished:

CA DFW, Arcata, CA
CA RWQCB, Santa Rosa, CA

RECEIVED
DEC 24 2015
COASTAL CONSERVANCY
OAKLAND, CALIF

December 17, 2015

California State Coastal Conservancy
Michael Bowen, Project Manager
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

Re: Eel River Estuary and Centerville Slough Enhancement Project. Comments on revised N.O.P.

Sorry I was unable to make your public meeting on December 9, but here are my comments as the resident Salt River and environs "expert."

Page 2, under project location and setting, I have a problem with the term "Salt River Watershed", for as I'm sure you know Salt River is not an actual river in and of itself but an abandoned channel of the Eel River that used to come down the south side of the Delta Plain before the Europeans arrived in the 1850's. At that time the so called watershed in the south hills consisting of the several streams and probably for most of the year didn't even reach the Salt River Slough channel, for high water sediment was dumped at the base of the foothills during the winter in an alluvial fan, and the streams themselves dispersed into marshy areas. After the Europeans arrived, the streams were channelized and now carry that sediment for the most part into the Salt River Slough channel. So, to go back to the beginning, Salt River is not and was not a river. Possibly the old term of Salt River Slough would be more appropriate.

Page 3, paragraph 3regarding the north end of the EREP. Additional information: There are several large sloughs and spoils channels in that area. The main ones being Jack Slough from the Salt River Slough channel and the channel from the end of that to what is known as the bath tub, just to the north of the northern dike.

Page 4, number 3.1.1: regarding rehabilitated "Centerville Slough"- a goodly portion of the former Centerville Slough lies outside the project area on the Occidental Ranch stretching to the Salt River Slough Channel, and you might put hereinafter SRSC.

Bullet 3. Needs more information as to just how these ideas are going to be accomplished, considering that much of the area is below tidal influence and if not for the dike on the north end would be flooded by tides much of the time

Bullet 8. "Suppress invasive species. The two main ones in that area being Chilean Cord Grass and European Beach grass. There are such huge populations of both of these plants that it is doubtful you would ever be able to eradicate them from the area, and the dunes, as was planned by the Europeans in 1900, are being more or less held in place by the European Beach Grass. There is also an endangered native plant issue in the dunes, which I will address later.

Page 5, item 3.1.3 "a dike structure built in 1979" The current multi-gated flood and tide gate structure which replaces a single gated one now buried in the dike was actually built in 1977. I have a very clear recollection of that, because in October of 1977 there was a tremendous storm tide out here and I was in my boat checking things out. At that time they had just finished digging the channel from cut off slough to the new tide gates with a drag line which was parked there on the dike. The tide was so high during that event that the tidewater was flowing across the dike underneath the drag line, so I got ahold of the responsible party and advised them of the fact.

For your information, a week ago there was another very large storm tide event in which the water was at least 1 ½ feet over the road where I live on an 8' book tide, which ordinarily does

not come near the road along Morgan Slough. Unfortunately I didn't go down and check out the tide gates to see how high the water got at that point, but I assume someone from the Wildlands Conservancy must have observed the situation.

Page 8 under "Protect and enhance drainage, etc." The mention of subsidence- in the early 90's when the whole SRSC project originally started, geologists estimated the valley floor sank 10 to 12' during the last mega subduction earthquake in January 1700 and by borings around the delta plain discovered there had been at least five of these major subductions at 300+ year intervals. Hoping we'll never see another subduction quake, but it's been 300 years since the last one, so we are due. If that happens with the extreme subsidence involved this whole thing will be for naught. Just a thought.

Item 4, probable environmental effects. Item 4.1.15, Words "muted tide gates" a little more explanation as to what exactly that is would be in order. I've been told that the current vertically opening and closing tide gates would be replaced by ones closing horizontally in order to allow better fish passage. That may be all very well and good from a university/environmentalist standpoint; however, the current weighted gravity and water pressure operated gates are open for fish passage when the water is higher behind the gate than it is in front of it, usually at low tide. I have not enquired as to exactly how horizontal tide gates would work; however, it seems to me that some use of springs, etc. would have to be involved, thereby increasing the mechanical components of the system, which only increases the likelihood of failure, especially with the corrosion of metal parts in the salty estuarine environment.

Item 4.1.17 does not address exactly where potable water for the EREP would be coming from. Suggest you correct that.

Two items from my personal experience in that area going back to the early 1950s. The first would come under #3 project description, item 3.1.3 Reestablished dune configuration. Two things here, having been involved with the Sheriff's Department here since 1964 as a volunteer Search and Rescue person, the deletion of the inner road behind the dunes is not a good thing. There have been several incidents mostly involving boats large and small coming ashore between Centerville and the mouth of the Eel River which required a response by various agencies either for rescue or clean up or salvage. During the winter the ocean beach is often inaccessible due to storms, high tides and beach erosion. The inner road, which started just north of the Centere4ville parking lot so that it was not accessible to most traffic, was maintained in part by the Scotia Gun Club to access their cabin in the dunes and continued on up behind the dunes to the mouth of the river for those who needed that access. There is, of course, the potential for accessing some of the more northerly area across the conservancy property and dike at the bathtub, but as far as reaching much of the area, if the wave slope is impassible, the inner road is the only access and may at times even be regarded as a life and property saving piece of infrastructure. Personally, I would like to see the road gated at the southern end and at least minimally maintained for access between Centerville and the mouth of the river.

This, of course, is my personal opinion, but is derived from 50+ years of doing Search and Rescue in Humboldt and adjoining counties.

Under Reestablished dune configuration. First I would like to note that not mentioned is the dune blow out that occurred in the area of the Bath tub. Like any of the other storm tide overtoppings of the dunes such as the two blow outs mentioned to the south, it has filled in considerably with windblown sand and as time goes along will probably be recolonized by the European Beach Grass.

That particular area, it should be noted, has for a long time been a low spot in the dunes and in fact, durig the 64 flood was the site of a second mouth, which took winds and tides several months to fill back in again. The other thing I'd like to mention regarding the dunes and European Beach Grass are two California endangered native species plants. Many years ago, probably 30 or more, I happened to be walking through the dunes in the area we call the Indian Mounds , which are the very large dunes to the south of the Bathtub area, and which I pointed out to your people as a site of former Indian encampments where Neolithic artifacts were sometimes found. I was at the time quite interested in botany (and for that matter still am), and was trying to identify as many of the plants in the estuary as possible. As I traversed that area, I noted two different flowering plants growing there near the dune tops and sheltered by the European Beach Grass.

These were plants with which I was unfamiliar. Since I knew I would be seeing Dr. Doris Niles, at that time Humboldt County's resident expert in Botany, within the next couple of days and not finding the plants right away in my key, I took two small samples which I subsequently showed to her. She identified the plants as Beach Layia and Beach Gilia, and mentioned that one of them at that time was on the endangered list. Because the area was quite a ways out of my usual path of travel I never went back and checked on them. However, after reading through your revised NOP, I looked up both of these plants and while I'm not really much up on computers I was able to find the following information about these two. Beach Layia-Layia carnosa- is listed as Federal and State endangered and the range is from Fresh Water Lagoon to Santa Barbara. Beach Gilia-Gilia penuiflora-is state threatened and federally endangered. But the very interesting thing about this particular one is that its range is supposedly only in the central California Coasst/Monterey area.

Hopefully some of your people can check this out before anything is done in the dunes, which might further increase the threat to these plants. And that's assuming they are even still there after these many years.

The last thing I have to say about this I've touched on before, although I've never received any definitive information about it one way or the other. The former Scotia Duck Club used to extend north to Jack Slough until part of the area (the present remnant salt marsh north of the tide gate to the bathtub site was abandoned). At that time the duck hunters who had formerly used the area north of Jack Slough, including the large lagoon where the former mouth of the river had been for duck hunting, also began using the remnant salt marsh area since the tidewater now free flowed through that marsh. As I'm sure you know, Eel River tidewater areas are public access partly because the Eel River is a navigable stream and as far as I know, no attempt was ever made to make water fowlers cease using the area. Except for one incident many years ago when the so called land manager of the Connick properties dumped a lot of wire fencing in the sloughs in an apparent attempt to keep boaters from passing. Aside from the fact that I personally use those waterways, I was also doing my natural history tours of the area by boat. Interestingly enough, after advising a Captain of the Department of Fish and Game who I knew, the fencing had disappeared, and there have not been any like incidents since.

Until the Wildlands Conservancy bought the Connick Property, that whole salt marsh area north of the bathtub remained open to water fowling. Most people came by boat, but some of them, especially on opening weekend came down the beach on 4-wheel drives and camped on the edges of the marsh. After the wildlands Conservancy bought this property, they kicked off the relatively few campers and beach hunters from the land area, which of course is their right as the owners of the property. While I myself was formerly an avid duck hunter and still occasionally hunt duck, I haven't for many years gone into that marsh area, although I do pass through there in my boat either for personal boating or on my natural history tours.

I could see there might be a problem if the campers were littering or starting beach fires or any other thing which might be inimical to the property, but I never saw any evidence of this.

Since the landowners cannot stop the duck hunters from going through the area through the tidal channels where they hunt out of their boats, it seems to me that this whole issue of kicking out the very few hunters that would like to hunt from the land is rather petty.

I realize that these hunters are not giving any income to the Wildlands Conservancy, such as they derive from the Centerville Club whose ponds are maintained by the Conservancy and noted in this RNP, but most of the hunters, in a large part young folks (I myself started duck hunting at age 13) are not able to participate with the relatively well to do and avid hunters of the Centerville Club.

So, why not allow hunters the use of the relatively small area of beach which they formerly used? I would also like to note, although I don't hunt jack snipe myself, the grassy dune area north of the bathtub was probably the best area for hunting jack snipe around the Eel River Estuary.

Looking forward to your reply on these issues,
Yours truly,

Bruce Slocum

Bruce Slocum
285 Morgan Slough Road
Ferndale CA 95536
707.786.4187

RECEIVED
DEC 21 2015
COASTAL CONSERVANCY
OAKLAND, CALIF

Harville Ranch, LLC
546 Washington Street
Ferndale, California 95536

December 18, 2015

VIA FACSIMILE: (510)286-0470
AND FIRST CLASS MAIL

Michael Bowen
Project Manager
California State Coastal Conservancy
1330 Broadway, 13th Floor
Oakland, California 94612-2530

Re: Eel River Estuary and Centerville Slough Enhancement Project, Comments on Revised NOP

Dear Mr. Bowen:

Please consider the following comments related to the scope and content of the Environmental Impact Report for the Eel River Estuary and Centerville Slough Enhancement Project, submitted on behalf of Harville Ranch, LLC.

Harville Ranch, LLC is the owner of a parcel of real property identified as Humboldt County Assessor parcel number 100-142-002, with an address of 590 Russ Lane, Ferndale, California 95536. The Harville Ranch, LLC parcel is located adjacent to and south of The Wildlands Conservancy's lands that are included within the project area.

The Revised Notice of Preparation refers to an access easement owned by The Wildlands Conservancy across the Harville Ranch, LLC parcel in footnotes 2 and 3, recognizing that there is an ongoing dispute regarding use of the easement.

Harville Ranch, LLC's position regarding use of the easement is as follows: The easement was created by a deed from Bertha Russ Lytle to Edythe Russ Connick and Harris Russ Connick (all blood relatives), dated May 9, 1941. The easement is described as, "A right of way for road uses…" Based on the deed itself and the surrounding circumstances, this easement is for a private road, not a public road. When an easement is created by a grant in general terms, as is the case here, the permissible use is determined first by the intention of the parties and the purpose of the grant. Once the easement has been used for a reasonable time, the extent of its use is established by the past use. Thereafter, the easement owner cannot make changes in that use that would substantially modify or increase the burden. This easement is over seventy years old and has never been used for public access. This is a private easement intended for access for the landowners for agricultural purposes. Clearly, public access over these easements was not something contemplated in 1941, and public access over these private ranchlands will result in

an unreasonable burden on the lands. The increased burdens will include increased traffic, a change in the character of people and vehicles using the easement, changes in the timing of traffic along the easement and the inherent conflicts that arise whenever the public is exposed to commercial agricultural operations.

Harville Ranch, LLC objects to The Wildlands Conservancy using this private easement for public access and intends to protect its interests against any use that exceeds the legal purposes of the easement.

Using public funds to enhance public access over an easement that cannot be used for such purposes is inappropriate. Public access should be focused where the public clearly has access rights. The EIR should evaluate impacts from public access in alternative locations other than over the private easement where public access is not legally available. The Wildlands Conservancy's lands extend to the public easement along Centerville Beach. The EIR should consider the impacts of public access along Centerville Beach as a project alternative. The EIR should also evaluate any other alternative public access opportunities potentially available to The Wildlands Conservancy that will not depend on the Harville Ranch, LLC easement.

The proposed project has the potential to result in impacts to agricultural lands in the area including those owned by Harville Ranch, LLC. The project area has historically been devoted primarily to the production of agricultural products. This project proposes to change the use of significant portions of the area to uses that do not produce commercial agricultural products. Such changes conflict with the purposes of the local Williamson Act contracts. Establishing uses such as tidal wetlands and wildlife habitat out of prime agricultural lands will begin what may become a trend of converting farmland to nature preserves or virtual parklands. The EIR should consider such direct and regionally cumulative impacts as significant, and appropriate mitigation measures need to be considered.

The proposed project has the potential to result in adverse traffic impacts. Publicly funded improvements accessed via the private easement over the Harville Ranch, LLC parcel will likely result in increased traffic over Centerville Road, Russ Lane and the private access road. These narrow, quiet, rural roads do not generally experience high levels of traffic. The project proposes to enhance outdoor recreation and public education opportunities which inherently involves more people, and more traffic. The EIR needs to consider these impacts and incorporate mitigation measures to address them.

Sincerely,

Harville Ranch, LLC

Renee Jackson

Renee Jackson, Managing Member

RECEIVED
DEC 22 2015
COASTAL CONSERVANCY
OAKLAND, CALIF

NOTICE OF PREPARATION OF DRAFT ENVIRONMENTAL IMPACT REPORT FOR EEL RIVER ESTUARY AND CENTERVILLE SLOUGH ENHANCEMENT PROJECT SCH# 2014122040

December 17, 2015

California State Coastal Conservancy
Attn: Michael Bowen
1330 Broadway, 13th Floor
Oakland, CA 94612-2530

RE: Concerns over proposal

Dear Mr. Bowen:

Thank you for giving us the opportunity to review your NOP for the Eel River Estuary and Centerville Slough Enhancement Project. The following are concerns we presently have regarding the proposal:

The redirection of Russ Creek from its historical path
The removal of Centerville Slough from its historical connection to Cut Off Slough
The corresponding lack of fresh water to Cut Off Slough
The unknown size of the berm on the East side of Centerville Slough
The unknown amount of water that will be forced on our property from the berm
The method of drainage from our property with the new berm

We appreciate your including us in your discussions on this project and look forward to working with you as additional information becomes available. We know you will work to answer our concerns as you move forward.

Sincerely,

Don Hindley
Manager
L.D. O'Rourke Foundation
PO Box 877
Ferndale, CA 95536-0877
707-786-9946

Denver Nelson

December 18, 2015

Revised Notice of Preparation of Draft Environmental Impact Report for the

Eel River Estuary and Centerville Slough Enhancement Project

SCH# 2014122040

These are my comments on the Eel River Estuary and Centerville Slew enhancement project.

The problems of the eel River watershed are multiple and include intrusion of the ocean because of failing dikes and floodgates and future sea level rise caused by global warming, increased sediment in streams and estuaries caused by natural forces and/or by human practices upstream, water quality issues caused by natural run off and/or by human activities and degraded streamflow caused by human activities. This project obviously cannot deal with all these problems but hopefully will deal successfully with a small portion.

My main concern is that the goals of the project may not be met on a long-term basis especially if the other problems in the Eel River watershed are not dealt with. There do not appear to be provisions for ongoing long-term outcome monitoring which needs to be financially supported either by stakeholders or by some sort of tax base. There needs to be financial support for further project construction activities into the future.

Appendix C Dune Assessment

DRAFT

EEL RIVER COASTAL PLAIN DUNES ASSESSMENT AND RESTORATION FEASIBILITY ANALYSIS, HUMBOLDT COUNTY, CALIFORNIA

Prepared For:

GHD

By:

Kamman Hydrology & Engineering, Inc.

September 2015

On the Cover: Landsat Multispectral Scanner Image showing turbid waters entering Pacific Ocean
28-March-1975

DRAFT

TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	1
2.0	PHYSICAL SETTING	3
2.1	Topography and Bathymetry	3
2.2	Geology	4
2.3	Existing and Historic Dune Morphology	5
2.3.1	General Dune Setting	5
2.3.2	Regional Shoreline Change	7
2.3.3	Assessment of Eel River Coastal Plain Dune Conditions	7
3.0	NEAR/ONSHORE COASTAL CONDITIONS AND PROCESSES	14
3.1	Wave Characteristics	14
3.2	Beach Morphodynamics	16
3.3	Aeolian Sand Transport and Deposition	16
3.4	Wave Runup and Overwash	17
4.0	OFFSHORE COASTAL CONDITIONS AND PROCESSES	20
4.1	Eureka Littoral Cell Sand Budget	20
4.2	Variability in Eel River Sediment Supply	22
4.3	Coherence of Storms and Sediment Delivery	24
4.4	Sediment Dynamics on the Continental Shelf	26
4.5	Coastal Currents	29
5.0	POTENTIAL IMPACTS FROM CLIMATE CHANGE	31
5.1	Anticipated Changes Associated with Climate Change	31
5.1.1	Sea Level Rise (SLR)	31
5.1.2	El Nino Southern Oscillation (ENSO) Activity	31
5.1.3	Global Warming	33
5.2	Potential Impacts to the Eureka Littoral Cell and Coastal Dunes	34
5.3	ENSO Extremes – Driver for Episodic Change of Coastal Dunes	35
6.0	DUNE RESTORATION APPROACHES	37
6.1	Causes for Dune Instability and Destruction	37
6.1.1	Removal of Wrack	37
6.1.2	Damage to Vegetation – Driving and Trampling	38
6.2	Dune Restoration Techniques and Applicability to Project	38
6.2.1	Accommodating Natural Dune Building Processes	38
6.2.2	Mechanical Dune Construction	39
6.2.3	Sand Fence Installation	39

DRAFT

TABLE OF CONTENTS (continued)

Page No.

6.2.4 Large Wood (Wrack) Placement 40
6.2.5 Planting Native Vegetation 40
6.3 Recommended Dune Restoration Approach, Design and Management 41
6.4 Special Foredune Restoration Design Considerations 43
6.4.1 Wave Runup and Overwash 43
6.4.2 Native vs. European Beach Grass 43
6.4.3 Soil Development 44
6.4.4 Recommendation for Additional Data and Study 44

7.0 REFERENCES 45

LIST OF TABLES

Table 1 List of maps and imagery reviewed 8
Table 2 Estimated volumes of sources and sinks of sand to Eureka Littoral Cell 21

LIST OF FIGURES

Figure 1 Study area with key geographic, bathymetric and plate-tectonic features
Figure 2a Bathymetry of the northern California continental margin and physiographic feature terminology
Figure 2b Morphology of continental-margin off the Eel River mouth
Figure 3a Regional Geology of Eel River coastal plain
Figure 3b Local Geology of Eel River coastal plain
Figure 4 Coastal dunes found between Centerville Beach and the Little River (circa 1954)
Figure 5 USGS estimated long- and short-term shoreline change rates for the Eureka region
Figure 6 Shaded relief map of Eel River coastal plain dune fields
Figure 7 Long profile along of Eel River coastal plain foredunes, Centerville Bch to Table Bluff
Figure 8 Dune/beach profiles along Eel River coastal plain, Centerville Beach to Table Bluff
Figure 9 Chronology of Eel River inlet location relative to Profiles 4 and 5
Figure 10 Monthly wave height and wave period information for WIS buoy 83048 (1980-2011)
Figure 11 Calculated daily wave power energy for period 1980 through 2011
Figure 12 Seasonal cycle of beach change at South Beach, Crescent City
Figure 13 Definition sketch of wave runup
Figure 14 Calculated maximum and significant wave runup for period 1980 through 2011
Figure 15 Oceanic Nino Index (ONI) rating the relative strength of El Nino and La Nina events from 1950-2015
Figure 16 Mean annual flow and annual peak discharges for Eel River at Scotia, CA
Figure 17 Mean daily flow versus suspended sediment discharge rating curve for the period 1960-1980

DRAFT

TABLE OF CONTENTS (continued)

Figure 18 Estimated and measured total annual suspended sediment discharge (tons/yr) from Eel River to Eureka littoral cell
Figure 19 Conceptual model of typical storm plume dispersal and deposition at the Eel River mouth
Figure 20 Maps indicating monitored flood deposit thickness for storms
Figure 21 Water depth-dependent variations in exceedance probabilities for values of near-bed orbital velocity (Ub)
Figure 22 Calculated daily near bottom wave orbital velocity at water depth of 60 meters for period 1980 – 2011
Figure 23 Exceedance probability for near bottom wave orbital velocity at various water depths for the period 1980 – 2011
Figure 24 Major seasonal ocean current patterns off California
Figure 25 Estimated rates of Sea Level Rise
Figure 26 Schematic depicting anticipated increase in shoreline static water level (SWL) and associated runup heights associated with 1-meter of sea level rise (SLR) at Profiles 1 & 3
Figure 27 Photographs of large wood along beach and dunes of Eel River coastal plain near Profile 3

APPENDICES

Appendix A: Profile Imagery
Appendix B: Eel River Mouth Imagery
Appendix C: WIS Wind and Wave Roses, Buoy 83047

DRAFT

Chapter 1: Introduction

This report, prepared by Kamman Hydrology & Engineering, Inc. (KHE), presents the results of a planning and technical feasibility study for coastal dune restoration between the Eel River mouth and Centerville Beach (Figure 1). This study was completed as part of the Eel River Estuary Preserve (EREP) Ecosystem Enhancement Project (hereafter referred to as "the Project") on behalf of the California Department of Fish & Wildlife Fisheries Restoration Grant Program and the California State Coastal Conservancy through a contract with the GHD. Although the focus of restoration efforts lie south of the Eel River mouth (labeled "Project Area" on Figure 1), this study evaluated physical coastal conditions and processes within the entire Eureka littoral cell lying between Trinidad Head and False Cape (Figure 1).

The main goal of this study was to evaluate the feasibility for dune restoration along the project coast and develop dune restoration alternatives to support Project CEQA and design. For purposes of this report, the term "dune restoration" means the return of the beach/dune physical condition and geomorphic processes to a close approximation of its condition prior to disturbance. In addition, restoration in the context of Project also includes natural and man-made enhancements and creations that maximize ecological benefits along with providing resiliency to sea level rise. The specific elements and objectives of this study included the following.

A) Characterize historic trends in dune and beach conditions through review and synthesis of available maps, aerial photographs, and data (esp. related to storms). This work focused on evaluating and documenting changes in dune and beach extent/size over time and to determine causes for change; identify current trends in dune stability, with particular attention to vegetation history (i.e., introduction of European beach grass or other introduced species); research anthropogenic efforts to stabilize/build dunes; and characterize current dune and beach conditions in comparison to historic conditions. Historic beach building/stabilization efforts were investigated through interviews with local area residents.

B) Determine and quantify the current and historic sand supply supporting beaches and dunes within the study area. Through review of available data and reports on river sediment supply, this study investigated historic changes in sediment supply to the Eureka littoral cell. Part of this study was also to evaluate how seasonal storm and wind patterns effect littoral sand transport and supply to project dunes.

C) Characterize seasonal and long-term trends in the process of beach/dune construction and destruction. This analysis identified linkages between beach/dune morphology and ocean wave forces through the analysis of available offshore meteorological and deep water wave data from available buoys. These data were evaluated to identify and quantify how seasonal- and storm-induced changes in near-shore wave height and energy effect beach/dune construction and degradation as well as dune overwash. A desired outcome of this analysis was to identify the associated specific wave height/energy conditions detrimental to dune stability and aid in development of design criteria to stabilize dunes.

DRAFT

D) Through review of available literature, this study identified potential construction techniques and management plans for dune restoration along the project coastline. The criteria for stable dunes (e.g., height, width, slope, etc.), that protect against wave over-wash were evaluated from local reference sites, available literature and results of study elements that quantified local sand supply and wave energy. Proposed dune protection and enhancement methods and alternatives are described based on professional experience, discussion with project team members and professionals as well as from review of available literature. Because dunes and beaches are dynamic features that change on a seasonal and storm basis, the longevity/stability of engineered and/or natural dune enhancement measures were also evaluated. The effects of seasonal beach profile changes, sea level rise, wind patterns, increasing storm intensity (associated with global warming), and tectonics will all play a role in the longevity of any proposed dune/beach enhancements. This analysis attempts to evaluate the performance of potential enhancement methods under these anticipated long-term changes.

DRAFT

Chapter 2: Physical Setting

2.1 Topography and Bathymetry

The Project area lies on the broad, flat alluvial coastal plain formed by the Eel River. The Eel River coastal plain is approximately 8-miles wide along the coastline and extends inland for nearly 12 miles to the confluence with the Eel and Van Duzen Rivers. Elevations on the coastal plain are close to sea level and tidal influence in the Eel River extends approximately 4-miles inland. The higher elevation Table Bluff, an intervening upland separating the Eel River coastal plain from Humboldt Bay, forms the northern topographic boundary of the coastal plain, while the Wildcat Mountains are located along the southern margin.

The 2009-2011 California State Coastal Conservancy LiDAR Project data was used to develop an on-shore digital elevation model (DEM) and one-foot contour map for the project study area. The data coverage includes the entire coastline and extends landward 500 m from the shoreline. Data was collected between September 2009 and October 2010. The Conservancy's LiDAR has resulted in the collection and processing of high resolution 1-meter nominal post spacing. The horizontal datum for the control is the North American Datum of 1983 (NAD83, NSRS2007) and vertical datum is the North American Vertical Datum of 1988 (NAVD88). The Conservancy's LiDAR ground-return point data was obtained via the USGS's Center for LiDAR Information Coordination and Knowledge (CLICK; http://lidar.cr.usgs.gov/).

Extending 20- to 30-kilometers offshore of the Eel River coastal plain is a broad, relatively smooth and flat continental shelf that is punctuated by the deep submarine Eel Canyon (Figure 1). For purposes of this report, Figure 2a presents the terminology for bathymetric physiographic features located offshore of the study area. Offshore of the Eel River and Humboldt Bay coastal plains, the continental margin is composed of a continental shelf (0-200 m water depth), plateau slope (200-500 m), marginal plateaus referred to as the Klamath and Eel Plateaus (500-1000 m) and continental slope (1000-3000 m) (Figure 2a). The plateau and plateau slope are incised by the Eel Canyon, a steep, narrow meandering canyon. Three zones on the continental shelf are also routinely mentioned: inner shelf (0-60 m depth); mid-shelf (60- 90 m depth); and outer shelf (90-200 m depths) (Smith, 1995 and Traykovski et al., 2000).

Figure 2b presents a long profile of the ground and bathymetric surface running perpendicular to the coastline, extending from the Wildcat Mountains, across the onshore Eel River coastal plain and offshore across the continental shelf to the plateau slope. This profile was prepared from bathymetry and topography obtained from NOAA's National Geophysical Data Center (NGDC) U.S. Coastal Relief Model (CRM) (*http://www.ngdc.noaa.gov/mgg/coastal/crm.html*). The CRM integrates offshore bathymetry with land topography into a seamless representation of the coast. These data were used to create the bathymetric contours and shading plotted in Figure 1. The CRM spans the West Coast, reaching out to, and in places even beyond, the continental slope. Bathymetric and topographic data sources used to generate the CRM include: NGDC's NOS hydrographic surveys, multibeam bathymetry, and trackline bathymetry; the U.S. Geological Survey (USGS); and other federal government agencies and academic institutions.

The shorelines adjacent to the Eel River coastal plain and Humboldt Bay are comprised of beaches backed by dunes of varying size. South of False Cape and north of Trinidad Head, the

coastline is rocky cliffs devoid of beaches and dunes. Within the study area, the beach-dune complex displays the narrowest width south of the Eel River mouth, and becomes somewhat wider between the Eel River mouth and Table Bluff. The beach-dune complex is widest adjacent to Humboldt Bay.

2.2 Geology

The seismic setting of the Project area is unique due to its location near the junction of three tectonic plates known as the Mendocino Triple Junction (see Figure 3a). South of the triple junction the Pacific plate meets the North American Plate along a boundary marked by the San Andreas Fault Zone (Clarke, 1990; Clarke and White, 1980; Kelsey and Carver, 1988; and Field et al., 1980). North of the Triple Junction, including the area just offshore from the proposed Project area, the Gorda plate meets the North American plate at a boundary forming the southern end of the Cascadia subduction zone. Physiographic characteristics of the region reflect structural deformation caused by the underthrusting of the Gorda Plate and northward migration of the Triple Junction. A key local feature of this deformation is the tectonic uplift of the Wildcat Mountains consisting of steep mountainous terrain that rises high above the broad subsiding coastal plain of the Eel River delta. Ongoing deformation is driven by tectonic interactions among the Gorda, Pacific and North American plates.

The entire Eel River delta and coastal plain is underlain by the large Eel River syncline, whose axis trends about N 80 W (indicated by the dashed line with converging arrows plotted on Figure 3b). The syncline has been a site of deposition since at least the mid-Miocene (Ogle, 1953; McLaughlin et al., 2000; and Kelsey and Carver, 1988). The south flank of the syncline is steeper than the north flank (Figure 3a). The Eel River syncline is filled with a sequence of deposits ranging from Miocene to Pleistocene aged sedimentary rocks of the Wildcat Group (QTw on Figure 3a and 3b; McLaughlin et al, 2000; Ogle, 1953; and Everson, 1959). Sediments composing the Wildcat Group were deposited in the Eel River embayment approximately between 4 and 11 million years ago (Ogle 1953; Kennedy et al., 1987) and have an aggregate thickness of about 150 m (Field et al., 1980). The Wildcat Group is divided among five discrete formations with rock types that include mudstone, siltstone, and sandstone. Mudstone is the most common rock type (Ogle, 1953). These rocks are exposed in the upland Wildcat Mountains but buried by more recent alluvial deposits within the Eel River coastal plain. The Eel River Basin extends from 50 km inland in the lower Eel River, offshore across the shelf, plateau slope, and plateaus (named the Eel plateau Figure 2a). The Wildcat Group rocks described onshore probably underlies the basin offshore as well (Field et al., 1980).

Surficial geology of the Eel River delta portion of the Salt River basin is divided between alluvium and terrace deposits Quaternary in age (Qal, Qm and Qt on Figure 3b). The terrace deposits and alluvium deposited near the Eel River channel are typically composed of coarser material such as sand and gravel. Alluvium typically fines to clay and silt in the existing and historic tidal marshes. The total thickness of alluvium may reach up to 30 meters. Groundwater is very shallow throughout most of the low-lying study area, lying within 1-2 m of the ground surface.

The alluvial Eel River basin is bounded to the north and south by a pair of fault zones including the Little Salmon and Russ Fault zones. The Little Salmon fault is a steep to moderately low-

DRAFT

angle thrust fault zone south of Eureka, displacing shallow marine Pliocene strata of the Wildcat Group. The fault zone was examined in some detail during seismic hazards investigations at the Humboldt Bay nuclear reactor site south of Eureka, where it was found to displace strata of Holocene age and to cut the surface (McLaughlin et al., 2000). The Russ fault zone juxtaposes Miocene and younger strata (QTw) of the Eel River basin with older strata of the structurally underlying accretionary complex of the Yager and Coastal Terranes (Figure 3a). Onshore mapping suggest that the Russ fault is a steep southwest-dipping reverse fault.

McLaughlin et al. (2000) also map the intervening Ferndale Fault Zone along the foot of Wildcat Mountains (See Figures 3a and 3b). The Ferndale fault zone is mapped as a high angle thrust fault that likely behaves as a normal fault at the ground surface with the downthrown block lying on the south side of the fault. Of significance to this study is that, although the mapped alignment of the Ferndale fault zone does not extend to the coastline (see Figure 3b), its trend aligns with the Angel's Camp area, and the chronic dune overwash feature located immediately north of Centerville Beach. The movement along this fault may contribute to the accelerated subsidence beneath the overwash feature relative to other locations along the coastal dune front.

Geologic studies of the surrounding region suggest that the processes of subsidence continue under present conditions. Ongoing subsidence of the Eel River delta has been estimated to average 1- to 3 mm/yr (Li and Carver, 1992). Li and Carver (1992) interpreted depositional patterns in delta sediments as evidence of episodic subsidence events that lower the delta surface. The conclusions of their study indicate that although average rates of subsidence range from 1- to 3-mm/yr over the past 2000 years, most or all of the subsidence occurred suddenly during five or more sudden subsidence events resulting in 1- to 2-meters of net permanent subsidence per event. Based on carbon-14 age dating of buried organic material, Li and Carver (1992) dated these episodic subsidence events at about 300, 800, 1500 and 2000 years before present. This data suggests repeated episodes of subsidence at a return frequency between 300 and 500 years. The sudden subsidence events are associated with seismic slip on the southern part of the Cascadia subduction zone. A final important finding from their study is that subsidence rates have not been uniform across the Eel River basin, as net subsidence has been greater on the south side of the axis of syncline than to the north (McLaughlin et al, 2000).

2.3 Existing and Historic Dune Morphology

2.3.1 General Dune Setting

Within the bounds of the Eureka littoral cell, beaches and dune fields exist between the Little River to the north and Centerville Beach to the south with narrow interruptions at the entrance to Humboldt Bay and Eel River mouth (see Figure 4). A description of dunes from north to south follows.

- In 1967, Cooper described the northernmost dunes as follows: "*A strip of dunes are found on a narrow foreland between the Little and Mad Rivers. The outer dune ridge is approximately 6 m above the high tide and is covered mostly by pioneer vegetation. The inner, more massive dune ridge reaches a maximum height of 15 m and is, in part, more densely vegetated – the unvegetated portions are active*."

- Between Mad River and the mouth of Humboldt Bay the north spit is relatively flat with low dunes near the south end rising gradually to higher, heavily wooded dune masses at the north end (Patsch and Griggs, 2007). For a distance of 8 km south of Mad River the dunes rest upon an alluvial surface close to sea level. South of Manila, the dunes form a barrier between Arcata/Humboldt Bay and the Ocean. North of Samoa, the dunes are continuous except for a breakthroughs by active sand lobes. The axis trend of the lobes indicates effective wind direction of N. 19° W. Dune crest heights average 12-15 m with maximum dune height of 25 meters. On the more extensive lobes of open sand, systems of transverse ridges are present. Along a three mile stretch north of the entrance to Humboldt Bay, the north spit has advanced seaward as much as 1000 meters adjacent to the north jetty to no changes at the northern end since jetty construction (Patsch and Griggs, 2007).

  In 1954, Cooper (1967) noted that these dunes bear forest of varying density, mainly of shore pine and Sitka spruce. South of Samoa there has been much disturbance, with irregular rejuvenation and artificial stabilization. Everson (1959) reports that the dunes are best developed along the North Spit between the entrance to Humboldt Bay and the mouth of the Mad River, where they reach an altitude of more than 70 feet (21 meters) and attain a maximum width of three-fourths of a mile (1.2 kilometers). The dune sand is loose, subangular to subrounded, fairly well sorted, fine to coarse grained, and gray or brownish gray. The overall thickness of the dune deposits is uncertain, but it may be more than 100 feet as it forms an important aquifer. Most wells penetrate the fresh-water lens overlying the ocean water. They supply water for domestic, municipal, and industrial purposes.

- South of the entrance to Humboldt Bay to Table Bluff a spit 200-400 m wide bordered South Bay in 1954. Patsch and Griggs (2007) note that, "In contrast to the wide north spit, the south spit is narrow, low and mostly unvegetated. Cooper (1967) also noted that the spit was largely bare, with a narrow, frequently-interrupted strip of strand vegetation along the inner edge. Patsch and Griggs (2007) report that an extensive monitoring project of the beaches and dunes on the north and south spit was undertaken by Winkelman, et al (1999) analyzing changes in sand volume on the beaches and dunes from 1992-1998. During this 6-year period the south spit's subaerial beach and dune system gained a total of 1.6 million cubic yards of sand, or ~270,000 yds3/yr (Winkelman et al., 1999, cited in Patsch and Griggs, 2007). The dune alignment in the south spit remained stationary or moved seaward during the course of the study. The majority of the beaches and dunes along the north spit, however, decreased in both volume and width over the 6-year period, losing a total of 1.05 million yds3, or ~175,000 yds3/yr.

- South of Table Bluff a barrier ridge borders the lower valley of the Eel River for 15 km to Centerville Beach. The Eel River enters the ocean at about the halfway point. Along its entire length, the barrier beach and dunes rests on the alluvial surface, less than 3 m above sea level and cut by numerous tidal sloughs. North of the River mouth is a spit bounding North Bay (McNulty Slough), a lagoon tributary to the river. In 1954, Cooper noted that the dunes north of the river mouth were covered with fairly dense strand

DRAFT

vegetation and cut by numerous "breakthrough" (assumed wave overwash) channels. Several of the wider ones have overwash fans at their inner ends. Some very wide gaps are due to complete destruction of vegetation by "washover" action. Review of available aerial photography of the dunes North of the River mouth do not indicate much, if any, overwash activity. This is likely due to significant dune widening observed since Cooper's field work, as discussed in greater detail below in Section 2.3.3.

- In his report, Cooper (1967) reported that the barrier beach/dune system south of the river mouth is almost without vegetation. At that time, he stated, "*The shore between the mouth of Humboldt Bay and Centerville Beach is thus destitute of all but rudimentary dunes subject to destruction at frequent intervals.*"

2.3.2 Regional Shoreline Change

The USGS completed a regional assessment of long- and short-term shoreline change in Northern California, including the beaches/dunes along the Eureka littoral cell (Hapke et al., 2006). The study included measuring changes in shoreline position over a series of consecutive periods as determined by review and processing of available aerial photography, T-sheets and LiDAR. The Eureka study included comparison of shorelines for the following periods: 1854-1870; 1929; 1956-1968; and 2002. Long-term rates of shoreline change were calculated based on changes observed in all four shoreline positions from the earliest (1800s) to the most recent (derived from LiDAR). Short-term rates of shoreline change were calculated based on comparison of the 1970s and most recent (LiDAR-derived) shoreline positions. The findings from this study are presented in Figure 5.

The findings for short-term shoreline change presented in the USGS study are very compatible with the findings from this study (presented below in Section 2.3.3). Both studies indicate significant beach erosion south of the Eel River mouth with average shoreline loss of approximately -1.0 m/yr (maximum of -2.25 m/yr) and high accretion rates for the beach north of the River mouth, averaging around 2.0 m/yr (maximum approaching 3.0-m/yr). However, in total, the USGS study determined that the long-term net shoreline change rate for the entire Eureka region was an accretional trend, averaging 0.7 m/yr. Virtually all of the shoreline was accreting at a long-term average rate of 0.7 m/yr, observed along 96% of the measured shoreline. The highest long- and short-term accretion rates occurred in a pair of locations, including the north side of the Eel River mouth and along Little River State Beach, both of which are backed by a substantial dune system. This finding may provide an important and informative design criteria for restoration of coastal dune systems in the project area that a healthy and sustainable dune system needs a minimum dune field width, preferably backed by an existing dune field.

2.3.3 Assessment of Eel River Coastal Plain Dune Conditions

<u>Methods</u>

In order to better evaluate changes in coastal dune conditions over the past 100-years within the project study area, KHE obtained and reviewed a number of historic topographic maps and aerial imagery available for within the project area. An inventory of the document type reviewed and representative year is provided in Table 1. Documents were analyzed and compared to identify notable changes in the beach and dune position and morphology. In order to better quantify changes in beach/dune conditions, a number of maps and aerial images were georeferenced and

compared in the ArcGIS platform. Detailed analysis was completed at six dune transects aligned perpendicular to the coastline within the study area. Four dune profiles were completed south of the Eel River mouth and two to the north of the River mouth. Profile locations are indicated in Figure 6. The overhead and oblique aerial photograph comparisons for each profile are provided in Appendix A and discussed below.

TABLE 1: List of maps and imagery reviewed.

Year	Date	Imagery Type	Imagery Source
1869	NA	U.S. Coast Survey	T-sheet of Eel mouth
1888	NA	U.S. Coast Survey	T-sheet of Eel mouth
1916	NA	USGS Quadrangle	USGS
1940	12/13/1940	aerial photograph	KHE
1945	NA	USGS Quadrangle	USGS
1948	6/22/1948	aerial photograph	CDF
1953	NA	USGS Quadrangle	USGS
1955	NA	USGS Flood Map	USGS, HA-78
1956	9/13/1956	aerial photograph	KHE
1963	8/14/1963	aerial photograph	Humboldt County DPW
1965	8/29/1965	aerial photograph	CVL
1972	7/15/1972	aerial photograph	Humboldt County DPW
1972	NA	oblique aerial photograph	California Coastal Records
1973	1/22/1973	aerial photograph	KHE
1973	4/4/1973	aerial photograph	KHE
1974	1/24/1974	aerial photograph	KHE
1977	1/4/1977	aerial photograph	KHE
1978	5/8/1978	aerial photograph	KHE
1979	October	oblique aerial photograph	California Coastal Records
1980	6/27/1980	aerial photograph	KHE
1982	7/8/1982	aerial photograph	KHE
1985	8/28/1985	aerial photograph	KHE
1986	9/10/1986	aerial photograph	California Coastal Records
1988	7/15/1988	aerial photograph	Humboldt County DPW
1987	June	oblique aerial photograph	California Coastal Records
1993	6/12/1993	aerial photograph	NAPP
1993	6/16/1993	aerial photograph	California Coastal Records
1998	8/27/1998	aerial photograph	NAPP
1998	NA	aerial photograph	Google Earth
1999	8/2/1999	aerial photograph	NAPP
2000	3/31/2000	aerial photograph	Humboldt County DPW
2002	11/5/2002	oblique aerial photograph	California Coastal Records
2004	NA	aerial photograph	Google Earth
2005	NA	aerial photograph	NAIP
2005	10/5/2005	oblique aerial photograph	California Coastal Records
2009	9/27/2009	oblique aerial photograph	California Coastal Records
2009	NA	aerial photograph	NAIP
2010	NA	aerial photograph	NAIP
2012	NA	aerial photograph	NAIP
2013	9/2/2013	oblique aerial photograph	California Coastal Records
2014	NA	aerial photograph	NAIP

In addition to high resolution aerial imagery from 2010, Figure 6 includes shaded relief for elevations between 5- and 10-meters (NAVD88) to accentuate the relief within the coastal dune fields. The shaded relief superimposed in Figure 6 was generated from the site DEM, derived from the on-shore Coastal LiDAR (discussed above). A longitudinal profile along the apex of the entire Eel River coastal plain dune field between Centerville Beach and Table Bluff was prepared using the project DEM. In addition, cross-sectional transects were prepared along each profile from the 2010 DEM. The longitudinal and cross-sectional dune profiles are presented in Figures 7 and 8, respectively. In addition, detailed dune elevation cross-sections at each profile location were extracted from an Army Corps topographic map prepared in 1968. The Corps 1968 topographic map was surveyed in response to the catastrophic flooding that occurred throughout the Eel River delta in 1964. Dune elevation profiles from the 1968 survey (corrected from NGVD29 to NAVD88 datums) are also plotted on the Figure 8 profiles for direct comparison to 2010 conditions.

Findings

In general, the changes in dune and beach conditions found from this analysis are consistent with those presented in the USGS regional shoreline change study (Hapke et al., 2006). A summary of the detailed findings at each of the study profiles follows. One of the most interesting findings resulting from the analysis (this Study) is the episodic nature in the large-scale changes associated with both beach/dune degradation and beach/dune construction.

Profile 1: Review of aerial and map imagery identified the conditions and changes at Profile 1, located through the center of the existing large wave overwash fan in the vicinity of Angel's Camp. The Western Drainage ditch was created sometime between 1916 and 1940. There is a larger disturbed area evident in the 1940 aerial, but the geometry does not look like a typical overwash fan and it may reflect human manipulation (grading) of an overwash fan or some other type of disturbance, such as alluvial fan deposition from Shaw Creek. A pair of wave overwash fans 100 m in diameter are first evident in the 1963 aerial image. As a result of the dune overwash, there is no well- developed band of associated dune vegetation extending parallel to the coastline through this area as occurs along the dunes immediately north and south of the overwash. The same pair of overwash fans persist through 1978 but become obscured from vegetation growth by 1985. There is a significant loss of vegetation and seaward dune between 1988 and 1993. Comparison of these aerial images suggest an episodic 20- to 30-meter narrowing of the dune field and associated vegetation. A new pair of dune overwash fans appear in 1998 of similar size and location to the pair that existed in 1963. The size and extend of dune overwash increases progressively in the 2005, 2009, 2010 and 2012 aerial images. By 2010, individual sand lobes have coalesced into one single large overwash fan. The beach and dune front also appears to be eroding with the coastline shifting eastward since 1998. The dune overwash fan does not change in size significantly between 2012 and 2014. In addition, the area behind the fan appears saturated and vegetation is likely being impacted by high salinity water associated with overwash flooding this area.

DRAFT

Comparison of the 1968 and 2010 dune profiles reveal an approximate 100 m eastward shift of the dune front (Figure 8). The 2010 dune height has been dramatically lowered by almost 3 m in comparison to the 1968 profile (Figure 8). Review of the 2010 longitudinal profile indicates that over 1000 m of dunes have been lowered in association with the Angel's Camp Overwash (Figure 7). In profile view (2010), the dispersal of sand eastward due to wave overwash creates a wide tapered lobe of sand that extends around 150 m eastward of the former location of the Western Drainage Ditch. In summary, the foredunes at Profile 1 are currently in state of destruction. However, 1968 and 2010 dune profiles indicate that the change is predominantly a redistribution of foredune sand inland constructing a flatter and more widely distributed overwash fan. Visual comparison of the cross-sectional area of the 1968 and 2010 dunes don't suggest a significant net change in total sand volume. Thus, the change is best described as a landward shift and smearing of the dune field, not a net loss of sand to the ocean.

Profile 2: Profile 2 is centered on the Russ Barn overwash fan (Figure 7). Review of the dune profile (Figure 8) indicates that approximately 200 m of dune front has been lowered by as much as 4 meters. Profiles and aerial imagery indicate that the dune/beach face has shifted approximately 100 m eastward sometime between 1993 and 2005. Based on review of overhead and oblique aerial imagery (Appendix A), there do not appear to be any historic wave overwash events before around 2002 at this location. After 2002, the size and extent of the overwash fan has incrementally increased in area through 2014. Thus, similar to the dunes at Profile 1, the dune field at Profile 2 are in a state of destruction.

Another notable finding from this analysis is the changes in dune/beach vegetation patterns at this particular location since 1940. The 1940 and 1948 aerial images indicate multiple distinct, long, narrow, linear rows of vegetation along and within the coastal dune field. Some of these long linear strips of vegetation stop rapidly and consistently along rows or are off-set relative to lineations lying to the north or south. After 1948, vegetation within the dune field becomes more dense and homogeneous in distribution. One hypothesis for these patterns and changes is that these vegetation features capture active planting of European beachgrass (*Ammophila arenaria*) on the south dunes of the Eel River Coastal plain, concomitant to aggressive planting on the North Spit of Humboldt Bay around 1939[1] (Pickart, 1997; Buell, 1992).

Profile 3: Profile 3 is located perpendicular to the coastline and dune field at the EREP Barn (also referred to as North Barn). With the exception of a dune face erosion event between 1993 and 2005, the dune field at this location remains relatively stable. This is demonstrated best in the comparison of the 1968 and 2010 dune profiles plotted in Figure 8. Aerial images from the 1980's and 1990's reveal two distinct vegetation patterns observed on the foredunes: 1) areas of dense vegetation that

[1] Although introduction of *Ammophila arenaria* to the North Coast of Humboldt County likely began in 1901 (Buell, 1992), Pickart indicates that its rapid expansion on the North Spit occurred after 1939.

completely cover the dune (e.g., between meter stationing 2+00 to 2+75 on Profile 3; and; 2) a band of less dense vegetation that appears as distinct clumps in a band parallel to the coastline between stationing 2+75 and 3+00. This latter outer seaward band of vegetation disappears in the 2005 aerial and is absent on all subsequent aerial images through 2014. Thus, it is believed that there was some sort of high energy, beach and dune erosion event between 1993 and 2005 that eroded this outer band of vegetation. The small inland shift of the dune face depicted in the 1968 and 2010 cross sectional profiles is consistent with the erosion event observed in aerial imagery. However, the relatively stable configuration of the overall dune field width and height as revealed in the sections at Profile 3 suggests that the dunes in this location are in a relative state of equilibrium.

Profile 4: Profile 4 is located approximately 2700 m south of the current Eel River Mouth. Review of aerial imagery and the long foredune profile (Figure 7) indicates the presence of two distinct dune features between Profiles 3 and 4: 1) a narrow dune breach and associated dune overwash fan that forms sometime between 1993 and 2005; and 2) a dune blowout, located a short distance north of the overwash fan. The blowout is less evident in aerial imagery as it does not display the characteristic lobate sand deposit associated with dune overwash. Instead, there appears to be a thin opening through the dune with ribbon of sand blown out onto the back-marshplain aligned with a narrow dune breach (blowout). This feature may be associated with a social trail through the dune field. Douglas (1990) states that overwash occurs initially at low spots in the dune crest elevation. These low crest areas are often associated with pedestrian pathways to the beach where the vegetation has been killed and the wind has created a "blowout" in the dune crest line (Ibid).

The dunes to the north of Profile 4 are heavily influenced by the river mouth inlet, which has migrated over 3500 m (2.2 miles) over the last century between Profiles 4 and 5. In addition to the aerial and map imagery provided in Appendix A, Appendix B presents imagery and maps covering the entire Eel River Mouth between Profiles 4 and 5. Review of these images provides a chronology for the position and migration of the Eel River inlet over the last 100+ years, which is summarized in Figure 9.

The dune morphology at Profile 4 is dominated by the position of the Eel River mouth. In general, the periodic migration of the inlet north and south destroys the foredunes, followed by the rejuvenation of dune buildup as the inlet migrates away. As a result of the inlet movement within its migration zone, the dune heights adjacent to the estuary become gradually lower when moving toward the center of the migration zone (see Figure 7). The changes in dune and back marsh morphology at Profile 4 are most dramatic from 1945 through 1956, when the Eel River inlet was located a short distance north of Profile 4 (Figure 9). Since that time, the inlet migrated over 3500 m northward, almost to Profile 5 by 1993 and then returned southward to a more central location where it has fluctuated slightly since 2009. The recovery or buildup of the dunes over time after migration of the

DRAFT

inlet away from Profile 4 is displayed in the dune profile plotted in Figure 8, which indicates the increased dune width and height in 2010 as compared to 1968. In summary, much of the foredunes located at and in the vicinity of Profile 4 are undergoing a phase of construction or buildup since the Eel River mouth was located adjacent to this site.

Profile 5: Profile 5 is located on a relatively stable and persistent sand spit that forms between McNulty Slough (also referred to as North Bay) and the Pacific Ocean. Up through 1985, the width of the sand spit and position and morphology of the dunes remain relatively constant. The 1985 aerial image (Appendix A) and cross-sectional dune profile from 1968 (Figure 8) indicate that the dune crest is located at station 0+50 with dense dune vegetation extending westward to station 1+00. In 1993, the mouth of the Eel River inlet is located at Profile 5 (Figure 9). The 1993 aerial image set in Appendix B illustrates considerable sediment aggradation and westward expansion of the beach along the coastline immediately north of the inlet. In the preceding 2005 aerial image there is a notable and significant westward shift in the position of both the sand spit and dune field when compared to the earlier images (esp. 1985). Post-2005 aerial imagery suggest a relatively constant position of both the dunes with the vegetation front extending westward to station 2+00. Comparison of the 1968 and 2010 topographic profiles (Figure 8) indicates an approximately 120 m seaward shift of the spit and dunes while the general cross-sectional area and height of the dunes remains constant. From a geomorphic perspective, the uniform shape and size of the dunes suggests a dune and spit at equilibrium with sediment supply and dune/beach morphodynamics – a stable morphology does not translate to static position. Similar to the episodic nature of beach and dune destruction observed at Profiles 1 and 2, the rapid change in dune position at Profile 5 occurred over a very short period between1993-2005 and is also considered episodic.

Profile 6: Profile 6 is the northern most profile analyzed and is located between the Eel River mouth and Table Bluff. For the most part, aerial imagery and the 1968 topographic profile suggest a fairly stable dune field consisting of a single set of foredunes up to 7 meters in elevation. However, similar to what is observed at Profile 5, there a dramatic change in dune morphology between 1993 and 2005. This period at Profile 6 is a period of dune construction, in which a second and completely independent foredune ridge forms west of the original foredune. This seaward dune field construction is referred to as dune progradation. Based on comparison of the 1968 and 2010 topographic profiles (Figure 8), the new foredune expands approximately 80 m further west and the crest approaches 9 meters in elevation. Aerial imagery indicate that dune vegetation expands westward over a similar distance and the size and extent of the new foredune ridge system remains constant between 2005 and 2014. The extent of the foredune ridges located north of the Eel River mouth are also evident in the shaded relief map of Figure 6. The outer (western) ridge extends from the inlet to Table Bluff and is the completely new foredune constructed sometime between 1993 and 2005. The inner ridge, located behind (east) of the outer ridge is older and is truncated at its south end near the

DRAFT

intersection with McNulty Slough. Prior to 1993, this older inner ridge used to be a single and continuous ridge extending from Table Bluff to the Eel River inlet, until the south end was truncated by the northward migration of the Eel River mouth to Profile 5 in 1993.

In summary, review of aerial imagery and available topography maps indicate that the dunes in the Eel River coastal plain experienced periodic overwash events followed by reconstruction and revegetation between 1940 (date of earliest aerial image) and 1993. Over this time, there was no significant shift in foredune alignment or beach width. Sometime between 1993 and 2005 there was one or more episodic events that imparted significant changes along the south end and northern half of the Eel River coastal plain dune. These changes include the onset of dramatic wave-induced dune overwash and beach retreat in the south and foredune construction and beach/dune progradation to the north. Apart from continued wave overwash and dune destruction in the south adjacent to Angel's Camp, dunes along the remainder of the coastal plain outside of the direct effects of the river inlet appear to be stable and unchanging in position and form since the episodic changes.

DRAFT

Chapter 3: Near/Onshore Coastal Conditions and Processes

3.1 Wave Characteristics

Wave analyses completed as part of this study are based on elementary linear wave theory. The reader is referred to the U.S. Army Corps Shore Protection Manual (1984) and Chapters 1-4, Part II of the Corps Coastal Engineering Manuals (2002) for more in-depth introduction and information related to wave mechanics, wave climate and surf zone hydrodynamics.

The waves most important to beach and dune formation and destruction are generated by winds blowing for sufficient duration from a constant direction over a long-enough fetch (open water distance) to create wind waves. The wave climate off the Northern California coast is influenced primarily by atmospheric-ocean interactions over the North Pacific Ocean. The wave climate acting on the Eel River Coastal beach and dunes over the recent past is characterized by wave data available through the Army Corps Wave Information Studies (WIS) Project for the period 1980-2012. The Wave Information Studies (WIS) is a U.S. Army Corps of Engineers (USACE) sponsored project that generates consistent, hourly, long-term (20+ years) wave hindcast climatologies along all U.S. coastlines, including the Great Lakes and U.S. island territories. Unlike a forecast, a wave hindcast predicts past wave conditions using a computer model and observed wind fields. By using wind fields derived from combine ground and satellite wind observations, hindcasted wave information is generally of higher accuracy than forecast wave conditions and is more representative of observed wave conditions. The WIS wave data stations located offshore of the project study area are indicated on Figure 1. The primary variables analyzed to characterize the wave climate acting on the project beach/dune system are wave height, wave frequency or period and wind/wave direction. Definitions of these variables follow.

- Significant wave height (H_o) is calculated as the average of the highest one-third of all wave heights during a 20-minute monitoring period. Wave heights are the vertical distance between wave trough and crest.

- Wave period (TM) is calculated as the mean wave period or average time interval between the passage of two successive wave crests or troughs at a given point.

- Wind/wave speed and direction (degrees clockwise from True north).

- Wavelength (L_o) is defined as the distance between two successive wave crests and calculated with the following equation (U.S. Army Corps, 1985).

$$L_o = g*TM^2/2\pi$$

Where: g = gravitational acceleration (9.807 m/s^2); and
TM = wave period (s).

Figure 10 plots values for mean monthly wave height, maximum monthly wave height, and mean monthly wave period for offshore buoy 83048 over the 1980-2012 period. Both wave height and period display a seasonal pattern of highest values during the winter months and lowest values during summer. The implications of this seasonal distribution on beach and dune morphology are discussed in greater detail in Section 3.2 of this report.

Since both wave height and wave period influence wave energy, a useful way to evaluate the historic trends in wave energy acting on the beach is to calculate the wave power or the rate of transfer of energy from waves to beach and dunes. In deep water (water depth is greater than half the wavelength), wave power is calculated using the following wave power formula (U.S. Army Corps, 1984 and 2002), which is the product of both wave height and waver period.

$$P=\gamma g^2/64\pi * H_o^2 * TM$$

Where: P = wave power energy in kW per meter of crest length;

γ = water density (1000 kg/m^3);

g = gravitational acceleration (9.807 m/s^2);

H_o = total significant wave height (m); and

TM = wave period (s).

The formula states that wave power is proportional to the wave energy period and to the square of the wave height. When the significant wave height is given in meters, and the wave period in seconds, the result is the wave power in kilowatts (kW) per meter of wavefront length.

The wave power computations were completed on daily WIS data for buoy 83048 and plotted as points on Figure 11. To better identify trends in the historic wave power acting on the Eel River coastal dunes, a 90-day running average of daily values was computed and plotted as the red line on Figure 11. As would be expected from the similar seasonal pattern in wave height and period, there is a general seasonal cycle of higher wave power energy in winter and lower wave power in summer expressed as a sinusoidal shape to the annual plot of wave energy.

The wave power results plotted in Figure 11 identify years of extreme wave energy acting on the Eel River delta coastline, most notably the El Nino winters of 1982/83 and 1997/98. It is also important to note that the winter of 1997/98 was bracketed by the winters of 1994/95 and 1998/99, which also experienced above average wave power. The implication is that the 1995-99 period of above average seasonal wave energy coincides with the period in which the most notable and episodic changes in beach and dune morphology observed along the Eel River delta coastline as described above in Section 2.3.3.

3.2 Beach Morphodynamics

Although not evaluated as part of this study, the seasonal beach morphodynamics along the Eel River coastal plain likely follow the typical cycles of beach destruction and construction in response to the seasonal wave climate observed and documented elsewhere along the northern California coast. Well established empirical relationships between wave climate and beach/dune morphology indicate that periods of maximum wave height and period have the greatest destructive effect on a beach. Along the northern California coast, maximum wave height, period and power accompany storms as indicated by the highest observed and calculated wave climate values recorded during the winter months (Figures 10 and 11). During storms, sand is moved alongshore and offshore with the net result being erosion of the beach and dunes (Douglas, 1990). As a result, beaches experience erosion and narrowing during winter months. Periods of long wave period (swell) and low to modest wave height typically dominate in summer and result in the construction of wider beaches during the calmer summer months (Hapke et al., 2006). The rate and amount of beach erosion can occur rapidly during large storms. Subsequent recovery is less rapid, often requiring several months for the beach to achieve its pre-storm configuration. Beaches without a low sand supply take much longer to recover than beaches with large sand supply (Hapke et al., 2006).

Figure 12 illustrates the seasonal change in beach profile monitored at South Beach, Crescent City during the period 1965-66 (Roberts et al., 1967). This seasonal cycle of beach change is typical of beaches along the northern California coast. Roberts et al. (1967) report that South Beach profile near Crescent City is cyclic in nature over their 1965-66 monitoring period, building seaward during summer and retreating landward in response to winter conditions. They report that the observed 7-feet of vertical change in the beach profile is relatively small when compared to beaches elsewhere in California.

3.3 Aeolian Sand Transport and Deposition

Coastal dunes form where there is sufficient sand supply, persistent onshore winds, and enough area inland of the coastline to accommodate dune formation (Mossa and Meisburger, 1992). Sources of dune sand are usually the dry portion of beaches. The wider the beach, the greater the surface area exposed to wind transport and the greater the volume of material available to form dunes. Transportation of wind-blown (aeolian) sand only occurs when the wind speeds reach a velocity sufficient to overcome the forces that resist sand movement. The forces resisting sand increase with increasing: sediment size and density; beach moisture content; beach/dune slope; and percent vegetative cover (Mossa and Meisburger, 1992). Sand transport from the beach to dune areas occurs only when wind blows in an onshore direction.

The presence of vegetation or other obstructions to aeolian sand are important in trapping sand and building sand dunes. The Corps (2002b) state: "*Foredunes are the first line of dunes landward of the shoreline. These dunes often result from the natural accumulation of wind-blown sand originating on the beach face; however, they may also be man-made. Whether natural or man-made, they are subject to continued growth, alteration, and movement due to natural wind transport processes*."

The Corps Shore Protection Manual (USACE, 1984) presents measured average rates of wind-blown sand accumulation throughout the United States that range between 2.5 to 25 m^3/m per year. On the west coast, the USACE Coastal Engineering Research Center measured dune growth rates in Catsop Spit, Oregon at 12.79 m^3/m per year (USACE, 2002b). Thus, in areas with strong year-round or seasonal onshore winds, substantial volumes of sand can be blown inland from the beaches and deposited as a foredune or within a larger dune complex. Within the Eureka littoral cell, sand dunes constitute a significant sink to the overall cell sediment budget (Patsch and Griggs, 2007).

As described in Section 3.2 above, seasonal beach and dune changes in Northern California are caused by annual variations in wave climate that produce narrow, steeper beaches during winter months and wide, flatter beaches during the calmer summer months. Significant beach/dune erosion can also occur during large storms. Subsequent dune rebuilding is typically slow, often requiring several months for the beach to achieve its pre-storm configuration (Hapke, 2006). Beaches and dunes without an abundant sand supply take much longer to recover (Ibid). For example, Larson et al. (2003) report that after storm erosion, the buildup of the dunes through wind-blown sand may take decades to achieve full recovery. Patsch and Griggs (2007) also report that the cycle of severe storm induced erosion and subsequent recovery occurs at very different rates along the North Coast - one major multi-day storm event can erode foredunes to a degree that would take years to decades of subsequent dune growth to recover to pre-storm conditions.

Moss and Meisburger (1992) state that the stability of dunes depends primarily on the amount of vegetation cover. They indicate that dunes found in arid climates are usually not vegetated and tend to be mobile, while vegetated coastal dunes in non-arid climates are more stable. Vegetation cover stabilizes dunes because many dune plants have long roots, rhizomes, and runners that help hold sand in place. In addition dune plants also increase the likelihood of deposition of aeolian sand by changing local aerodynamic conditions (Moss and Meisburger, 1992). The Corps Coastal Engineering Manual (2002b) states that once established, dunes create wind pattern changes that lead to dune growth. The benefits of dunes include (USACE, 2002b):

They provide protection from flooding by high-water levels and wave overtopping;
Sand stored in dunes is available as a sacrificial contribution to the increased erosion and sand transport during storms, reducing the landward movement of the shoreline during storms; and
Dunes can reduce wave heights and damage in developed landward areas by causing waves to break as they propagate up the dune face.

3.4 Wave Runup and Overwash

Of particular interest to this study, is understanding the conditions required to generate wave overwash along the Eel River coastal dunes. As described by Donnelly et al. (2004), overwash begins when the runup level of waves, usually coinciding with storm surge, exceeds the local beach and dune crest height. Donnelly et al. (2004) further define the overwash process – "*As the water level in the ocean rises such that the beach or dune crest is inundated, a steady sheet of water (called sheetwash) and sediment runs over (overwashes) the barrier. Overwash is distinct from washover, which is the sediment deposited inland of a beach by overwash.*" They also state, "*Severe overwash primarily occurs in association with a large storm"* and *"Overwash is also believed to be a major process in the retreat mechanism of some coastal barriers in response to*

sea level rise."

Runup is the maximum elevation of wave uprush above still-water level (SWL) (U.S. Army Corps, 2002). Runup (R) is defined in Figure 13 as a local maximum or peak in the instantaneous water elevation at the shoreline. The upper limit of runup is an important parameter for determining the active portion of the beach profile and potential for overwash.

Using the WIS wave climate data, KHE calculated the maximum and significant wave runup elevations for selected dates between 1980 and 2011 per the approach outline by the U.S. Army Corps (2002) for regular, breaking waves. The wave runup calculations used in this analysis are based primarily on laboratory data available on breaking waves (Douglas, 1990). The first step of this analysis was to calculate the wave Surf Similarity Parameter using the following formula.

$$E_o = \tan B \, (H_o/L_o)^{-1/2}$$

Where: E_o = Surf similarity factor (subscript *o* denotes deepwater condition);

$\tan B$ = beach slope ($\Delta h/\Delta l$), as determined from profiles in Figure 8[2];

H_o = total significant wave height (m); and

L_o = wavelength (m).

Maximum runup (R_{max}) and significant runup ($R_{1/3}$; the average of the highest 1/3 of the runups) are calculated from the following equations.

$$R_{max} = 2.32 \, E_o^{\,0.77}$$
$$R_{1/3} = 1.38 \, E_o^{\,0.70}$$

Calculated runup values were then added to the still-water levels, which, for this study, were the recorded maximum daily water levels (NAVD88 datum) recorded by NOAA at the North Spit tide gauge. For purposes of this analysis, runup was only calculated on days having a maximum tide level at or above 2.5 meters (8.2 ft) NAVD88.

The calculated maximum and significant wave runup elevations for the 1980-2011 period are plotted on Figure 14. The highest maximum runup elevations calculated were approximately 6.5 m (21.3 ft) and 5.5 m (18.0 ft) during the winters of 1982 and 1983, respectively. The winter of 1982/83 was a very strong El Nino year. Since that winter, the maximum runup elevations did not exceed 5.0 m (16.4 ft), with the highest runup events occurring during El Nino and La Nina winters (see Figure 15). The runup calculations also indicate that waves routinely reach an elevation of 4.5 m (14.8 ft) on an estimated 2-year recurrence interval. Given that the southern dune overwash area at Angel's Camp has a dune crest elevation of approximately 5-m (circa

[2] The slope estimates presented in Figure 8 are based on the NOAA CRM bathymetry, which stops at the coastline. The coarseness of the point/grid spacing of this bathymetric surface may also introduce error in the calculation of the actual slope.

2010; Figure 8) and has experienced multiple if not annual overwash events between 1998-2012, suggests that the runup estimates generated by this study may be underestimating the actual magnitude of runup.

More accurate runup estimates may be generated based on a more accurate and representative beach profile survey and/or runup equations that incorporate more complex wave dynamics and/or empirical data measured on prototype beaches (Douglas, 1990). In order to comply with the California Coastal Act Local Coastal Program (LCP) and prepare a project-specific Coastal Development Permit (CDP), design estimates of future wave runup, overwash and dune erosion under future sea level rise (SLR) projections should follow the approach and best available science guidance provided in the California Coastal Commission's SLR policy guidance (CCC, 2015). This document provides specific guidance on selecting SLR projects and calculating still-water levels and beach/dune runup values.

DRAFT

Chapter 4: OffShore Coastal Conditions and Processes

Much of the information presented in this section of the report is a synthesis of prior studies. From the mid 1990's through 2000, several studies were completed which describe the continental margin and shelf off the coast of the Eel River. One large study, STRATFORM (STRATA Formation on Margins), focused on understanding the processes controlling sediment deposition along the continental shelf and slope (Nittrouer, 1999). In addition to the references cited throughout the text below, a bibliography of other relevant papers and reports is included in the second half of the References section of this report.

4.1 Eureka Littoral Cell Sand Budget

Along the coast of the Eureka Cell, a longshore or littoral current is developed parallel to the coast as the result of waves breaking at an angle to the shoreline. Sand is in constant motion along the coastline, and only resides "temporarily" on an individual beach. The longshore current, and the turbulence of the breaking waves, which suspends the sand, are essential in moving sand along the shoreline. Littoral drift or transport in the Eureka Cell can occur alongshore only in two possible directions – north or south depending on the dominant angle of wave approach. Because of the shifting wind directions and associated angle of wave attack on beaches, the direction of longshore transport within the Cell varies seasonally.

Patsch and Griggs (2007) and Moffatt & Nichol (2013) provide in-depth narratives about the sand budget of the Eureka Littoral cell. Much of the following overview is summarized from their reports. As indicated earlier, the Eureka littoral cell is an approximate 40 mile-long zone bounded by Trinidad Head to the north and False Cap to the south (see Figure 1). Sand transport across these rocky headlands is restricted. The primary source of sediment feeding this cell comes from the Eel, Mad and Little Rivers. Table 2 presents a summary of the sand[3] budget for the Eureka cell, including estimated average annual sand contributions from the three primary rivers discharging into the Cell (from Patsch and Griggs, 2007). Moffatt & Nichol (2013) present slightly different source and sink values, but not significant enough to alter the findings provided by Patsch and Griggs. The sand which moves within the shallow coastal waters within this discrete cell supplies the beaches within the cell. Other sand is lost from the system or cell through cross-shelf transport and/or interception by submarine canyons.

[3] The Patsch and Griggs study focused on sand sized material within the littoral transport zone, which is a subset of the entire total sediment load delivered by contributing rivers. Willis and Griggs (2003) note that only suspended sediment sizes coarser than 0.062 mm are relevant contributors to beach and dune sand. They indicate that the percent of sediment coarser than 0.062 mm was calculated from suspended sediment grain size distributions and this average value was used to calculate the volume of beach sand being discharged within the total annual suspended sediment loads (Willis and Griggs, 2003).

TABLE 2: Estimated volumes of sources and sinks of sand to Eureka Littoral Cell (source of data from Patsch and Griggs, 2007).

Source/Sink of Sand	SOURCE (yd^3/yr)	SINK (yd^3/yr)
Little River	53,000	0
Mad River	486,000	0
Eel River	2,300,00	0
Dunes	175,000	270,000
Humboldt Bay Dredge	0	465,000
Offshore Losses	0	2,279,000
Totals	3,014,000	3,014,000

In the middle of the Eureka Cell is the inlet to Humboldt Bay which intercepts and captures sediment traveling along the coastline as littoral drift. Historically, the entrance channel has required routine and extensive dredging to remain open. Between 1955 and 2000, the long-term average volume of sand dredged from the bar and entrance channel was approximately 465,000 cubic yards per year (CY/yr) (Patsch and Griggs, 2007). Moffatt & Nichol (2013) report maintenance dredging generates approximately 1.17 million CY/yr of sand and 50,600 CY of finer sediment, a value over twice as high as the earlier Patsch and Griggs estimate. This material has been disposed of e continental shelf (4-5 miles offshore) at the Humboldt Open Ocean Disposal Site since the 1940's and is assumed to be removed from the littoral zone. Thus the inlet to Humboldt Bay is a sink in the Eureka Cell sediment budget.

Dunes are also storage areas of sand and their growth or recession can act as a source or sink in the littoral cell sediment budget. As described above in Section 2.3.3, large fluxes of sand between dune and littoral cell have occurred over very brief periods, likely closely linked to major storm events. Although foredune erosion has typically been recognized to occur over brief storm periods, it is a common understanding that foredune reconstruction takes a much longer period, typically years to decades (Patsch and Griggs, 2007).

With regard to the Eureka Cell sediment budget, Patsch and Griggs (Ibid) note that the beaches north and south of the Eel River are quite narrow, and the beaches south of Centerville Beach are "non-existent except for the occasional pocket beach." They speculate that such small beaches are not what would commonly be expected around the mouth of a river discharging an average of over 2 million cubic yards of beach-sand-sized sediment annually. Based on review of their running, mile-by-mile sand budget for the Eureka littoral cell, Patsch and Griggs estimate that approximately 10% of the Eel River sand supply is stored on the coastal plain beaches north of the river mouth and less than 3% on the beaches located south of the mouth. These sand budget figures corroborate the diminutive beach and dune sizes observed south of the Eel River, as described above.

Based on review of beach sediment size and composition within the littoral cell, Patsch and Griggs (2007) demonstrated a significant difference between mean grain sizes north and south of the entrance to Humboldt Bay, indicating different source material. Ritter (1972) concluded that sand north of the Humboldt Bay inlet is supplied by the Mad and Little Rivers and sand south of Humboldt Bay inlet is supplied by the Eel River. With respect to their sediment budget, Patsch and Griggs estimated that dune deflation of the North Spit was contributing 175,000 cubic yards per year of sand to the littoral cell budget, while dune growth along the beaches north of the Eel River were acting as a sediment sink, estimated at 270,000 yd^3/yr (Table 2).

Patsch and Griggs (2007) concluded that the dimensions of the estuary around the Eel River and Humboldt Bay are not large enough to accommodate the heavy sand load from the Eel without rapidly infilling. They also conclude that the Eel canyon is located too far offshore to serve as a significant sink for littoral sized sand. Thus, they, along with Ritter (1972), conclude that the Eel River must deposit most of its sand load on the continental shelf. This conclusion is consistent with a summary of research presented below. Patsch and Griggs also speculate that littoral drift moving south of the Eel River mouth may be deflected offshore into deeper water and then travels around False Cape and is deposited in the Mattole and Mendocino submarine canyons (see image on cover to this report). They point out that this theory would necessitate changing the southern boundary of the Eureka Cell.

4.2 Variability in Eel River Sediment Supply

There has been some debate about the annual contributions of sediment from the Eel River to the Eureka littoral cell. However, in their study focused on Eel River sediment supply to the Eureka littoral cell, Sommerfield et al. (2007) conclude the following.

> *A sediment budget is a quantitative statement of the relations between sediment production, transport, storage and permanent burial for a sediment dispersal system. In addition to fluvial sediment, coastal erosion, seafloor scour and biological production provide source materials that may be quantitatively significant on shelves. As defined earlier, sediment-trapping efficiency provides a measure of material sequestration (or alternatively dispersion) within a dispersal system, and insight about how it is partitioned among fluvial, shelf and slope sub environments. Naturally, the usefulness of a sediment budget rests on the accuracy of the source and sink terms, the quantification of which almost always requires some degree of spatial and temporal averaging. The Eel dispersal system is especially amenable to sediment budgeting due to its quantifiable sediment loads and negligible onshore sediment storage.*

Although Patsch and Griggs 2007 sediment budget for the cell addresses littoral sand-sized material, most other studies addressing sediment yields from the Eel River speak in terms of total suspended sediment loads, which constitute material smaller than the littoral sand size. Reported annual average long-term suspended sediment yields from the Eel River range from 11.9- to 19.0 million tons per year (Mt/yr) (Sommerfield et al., 2007; Sommerfield and Nittrourer, 2014; Brown and Ritter, 1971; Warrick, 2014; and Farnsworth and Warrick, 2007). This range of long-term average values are relatively consistent as they fall within fairly narrow range relative to the variability in measured and estimated annual sediment yields presented below.

In order to evaluate the historic amount of sediment yield from the Eel River for comparison against observed changes in beach and dune conditions, KHE estimated total annual suspended sediment discharge from the Eel River for water years 1912 through 2014 for the period in which daily mean discharge data was available for the USGS Scotia stream flow gauge. A plot of the average annual and annual maximum flow rates on the Eel River at Scotia are presented in Figure 16. Mean daily suspended sediment discharge data was available with concurrent mean daily flow discharge data for the period 10/2/1959 through 9/29/1980. These data were plotted against each other to generate a mean daily suspended sediment rating curve (Figure 17). A best trend was fit to the data using the LOESS local regression algorithm with a LOESS smoothing parameter of 0.25. The best fit trend is not representative below a mean daily discharge of 100 cfs due to lack of data on the low flow region.

Mean daily discharge data was then obtained for water years 1912 through 2014 from the Scotia Gauge (USGS 11477000) and the suspended sediment rating curve was applied to this data to calculate a mean daily sediment discharge values in tons/day for the period of record. KHE then summed the daily sediment discharge estimates by water year to get a total annual sediment discharge from the Eel River at Scotia for the period 1912 – 2014 in tons per WY (Figure 18)[4]. In order to evaluate the accuracy of the sediment yield estimates, the USGS measured mean daily sediment discharge values for the Scotia gauge were obtained and summed to compare with the calculated totals plotted on Figure 18. Significant findings from this exercise to estimate a long-term record of Eel River suspended sediment discharge include the following.

- Apart from the 1964 flood, the estimated annual sediment yields agree well with the measured values.
- Annual total suspended sediment yield ranged from approximately 20,000- to almost 200 Mt/yr between WY1912-2014. Disregarding the extreme wet (1964) and dry (1977) years, the range in annual sediment yields over the period of record ranged from 0.70 Mt/yr to 49.3 Mt/yr. The calculated long-term average annual sediment yield from this exercise is 14.6 Mt/yr while the long-term median estimated yield is 9.3 Mt/yr.
- Based on visual observation of the estimated sediment yield data, there appears to be a trend (most evident when sediment yield axis if viewed on logarithmic scale) of increasing annual sediment delivery from 1927 through 1964. Nittrouer (1999) notes that the annual sediment discharge has fluctuated by almost three order of magnitude during the 20th Century, with a trend toward increased annual discharge from the first to second half of the 20th Century.
- There are also a pair of more recent periods where there are a series of years that go from high sediment yields to low. These periods or trends occur from 1982-1994 and 1995-2009.
- There were three years of relatively high sediment yield (1995, 1997 and 1998) that occur within the same general period (1993-2005) of large-scale episodic changes in the dune morphology along the Eel River coastal plain.

[4] These sediment discharge values do not include watershed contributions (e.g., Van Duzen River) downstream of Scotia. The main objective in quantifying sediment discharge is to identify changes in the relative magnitudes between years and identify long-term trends. Including the sediment yields for watersheds below Scotia would not generate significant differences in annual values that would effect this type of semi-quantitative analysis.

Sommerfield et al. (2007) state that studies of the Eel River watershed suggest that the sediment yields of some tributary basins increased approximately 20% to 60% above predicted natural yield rates in the 1950s due to timber harvesting practices. They also report that the average excess yield for the South Fork Eel and the Van Duzen River was roughly 33%, and the average for nine other coastal basins was 48%. Willis and Griggs (2003) studied and quantified the impacts of dams on sand and gravel discharge from California coastal streams. In their analysis of the main rivers contributing sediment to the Eureka littoral cell, they calculated a 2% reduction in coarse (sand and gravel) sediment yield due to sediment trapping behind dams constructed in the Eel, Little and Mad River watersheds. This change reflects a 9% reduction from the Mad River and 1% reduction from the Eel River (there were no reductions calculated for Little River). In either case of timber harvesting and dams, the estimated increases in associated sediment yield in the Eel River watershed are small percentages relative the long-term variability in total annual loads. Thus, their effect on littoral sand supply and contribution to beach/dune supplies would be difficult to differentiate from normal background variability, if significant.

4.3 Coherence of Storms and Sediment Delivery

Northern California experiences regional shifts in meteorological and climatic conditions that yield two wave climate seasons. In the summer a broad area of high pressure is located over the ocean, its center well to the west of the California coast. From April to November, clockwise circulation around the high causes winds to blow from the north, and precipitation is minimal. (Hill et al., 2007). During winter, the Aleutian Low develops in the north Pacific and pushes the high-pressure center to the east. This shift exposes northern California to intense low-pressure systems moving onshore from the Pacific (Ibid). These lows have counter-clockwise circulation, and their approach is signaled by strong winds blowing from the south. After the passage of the lows, winds shift around to blow from the north. This stormy, wet period within the project area typically extends from November through March.

Wind and wave direction data recorded along the project coastline were collected from the offshore WIS buoys and evaluated. Plots of wind and wave rose pairs for average annual and average monthly conditions experienced at buoy 83047 (see Figure 1) over the 1980-2011 period are presented in Appendix C. The wind roses provide a radial compass plot of daily average wind speeds and the frequency of occurrence, while the wave rose plots present the frequency of occurrence for a range of significant wave heights. Review of these plots indicate the seasonal shift in the frequency and magnitude of wind and wave direction. During May through September, the winds are dominated from the north to north-northwest and resulting wave direction is from the northwest, which yields a southerly littoral transport direction. Beginning in October, there is a gradual increase in the frequency and magnitude of southerly winds interspersed into a normal pattern of northerlies. The increased southerly winds are attributable to the passage of low pressure weather systems that bring winter storms to the North Coast, a pattern that persists from December through March. With the southerly winds come waves and swell from a more westerly and lesser southwest direction. Regardless, the littoral transport direction during southerly winds is to the north. The occurrence/frequency and magnitude of southerly winds and waves wanes through April returning to a northerly pattern of the dry season. These seasonal and storm-induced patterns of littoral transport direction are evident throughout many of the aerial images provided in Appendix A and B. The image on the front

cover illustrates reversal in north to south littoral transport with the passage of storm system on March 28, 1975. In this case the cover image reflects northerly winds and southward littoral transport on the receding limb of storm flows on the Eel where flow and suspended sediment concentrations peaked on March 20th and 26th, 1975.

An important finding from multiple studies of Eel River sediment dispersal studies is that the sediment-laden discharge from the Eel River inlet enters the ocean as a buoyant freshwater plume and is transported northward within the inner shelf zone due to southern winds stresses and associated currents during most storm events (Kniskern et al., 2011; Geyer et al., 2000; Traykovski et al., 2000; Ogston et al., 2000). During these storm periods, sediments are subsequently transported to the mid-continental shelf via sediment settling from the plume and wave-supported gravity flows (Kniskern et al., 2011; Wheatcroft et al., 2006; Warrick et al., 2004; Geyer et al., 2000; and Ogston et al., 2000). A conceptual model of this phenomenon is provided in Figure 19. The synchronicity of atmospheric and oceanographic conditions that drive the sediment plume northward leads to preferred deposition of storm-derived sediments on the continental shelf northwest of the Eel River inlet. Figure 20 demonstrates this repeated pattern and location of storm sediment deposition based on monitoring of flood deposits during the January 1995, March 1995 and January 1997 storms (Hill et al., 2007).

The following paragraphs from Sommerfield et al. (2007) in tandem with Figure 19 provides a good summary of the coherence between storms and sediment delivery to the continental shelf.

> *The majority of sediment discharge by the coastal rivers takes place during storm-generated rainstorm events in winter, so the wind-driven shelf flow during these times has a disproportionate impact on the initial fate of suspended matter. For example, mean annual winds over the Eel shelf are northerly, which force southward surface currents, yet southerly winds are statistically most prevalent during times of river peak flow and floods. During these times, wind-driven northward flow of shelf surface water prevails on the shelf and slope of the northern California margin, transporting river sediment far northward from points of discharge. Consequently, the coincidence of southerly storm winds and elevated river discharge tends to produce large sediment fluxes to the north (at least initially) during flood events. It is not uncommon for the wind direction to switch to northerly as storm cells pass over land, forcing southward shelf flow and sediment transport. In addition to wind forcing, the presence (or absence) of buoyant river plumes during storms contributes to along-shelf variability in current magnitude.*
>
> *The Eel exhibits hydrographs that are dominated by rainstorm runoff events in winter, placing sediment on the shelf during the period of peak wave energy. In the face of large storm waves and turbulence, deposition on the shelf is reduced by resuspension and breakup of flocs (decreasing settling velocity), and elevated currents (due to buoyancy effects or strong winds) disperse suspended matter over appreciable distances. During these times, deposition on the middle shelf occurs largely because the bottom boundary layer is overwhelmed by high concentrations of suspended sediment.*

DRAFT

4.4 Sediment Dynamics on the Continental Shelf

During periods of strong southerly winds, the plume is confined to the inner shelf (0-50 m depth) within about 7 km offshore, with sediment transported up to 30 km northward from the river mouth (Geyer et al., 2000). Occasional northerly winds arrest the northward motion of the plume and caused it to spread across the shelf. During northerly (upwelling-favorable) winds, most of the sediment falls out within 5 km of the mouth, and negligible sediment was carried offshore, even though the low-salinity plume extended beyond the 60-m isobaths (Ibid). Geyer et al. (2000) notes that, "*Although sediment deposition from the plume is confined to the inner shelf, the stratigraphy indicates that the principal flood deposits on the adjacent continental shelf occur in a patch between the 60- and 90-m isobath. Thus, the deposition on the inner shelf is ephemeral, and some mechanism other than plume transport delivers the sediment from the inner shelf to the mid-shelf*." Based on extensive monitoring of storm deposits during 1997-1998, Traykovski et al. (2000) found that the river discharges sediment onto the inner shelf at a rate faster than it can be transported across the shelf to deeper water. The riverine sediment was stored on the inner shelf for about one week.

Geyer et al. (2000) note that, based on sedimentological observations and measurements completed as part of their study, there is little mud deposition on the inner shelf, suggesting that gravity flows of accumulated material or resuspension after storms remobilizes the sediment to be deposited elsewhere. Kniskern et al. (2011) note that once sediment is deposited to the continental shelf, gravity flows and wave energy may mobilize/resuspend and mobilize the sediment as gravity flows (Figure 19). They hypothesize that the Eel River deposits would be most likely to experience gravity flows during December through January when flood loads and peak wave-generated bottom energy were greatest.

Wiberg and Sherwood (2006) report that wind-generated waves on water induce orbital motion within the water column to a depth roughly equal to half the wavelength of the surface waves. When water depth is less than half the wavelength, this wave-induced orbital motion extends to the bed. Wave-generated water motion that reaches the ocean floor can induce shear stress on bed sediments that, if strong enough, will mobilize the sediment. The occurrence and strength of bottom orbital velocities are directly proportional to wave height and depend inversely on water depth.

Sommerfield et al. (2007) report that storms contribute to highly energetic swell and sea waves off the Eel River coastal plain during the months of November through to March, and wave-generated orbital stresses play an important role in reworking bottom sediment (significantly more so than tidal currents) in ≤ 50 to 60 m water depths. They also note that mean annual significant wave height off the Eel River is ~2.4 m with a dominant period of 10.9 s, but annual peak wave heights are significantly larger at 6 to 8 m (Ibid). They estimate that under the latter conditions, wave-orbital velocities in water depth up to ~110 m exceed the threshold for sediment resuspension.

Along areas like the West Coast, with narrow shelves exposed to large ocean storms, Wheatcroft et al. (2007) report that wave height and period remain relatively constant across much of the continental shelf. Wave-generated shear stresses on the ocean floor, however, vary as a function of water depth. Wheatcroft et al. (Ibid) explain that surface waves produce an oscillatory

movement of water at the seabed, if water depth is less than about half the wavelength, L, of the wave. For example, they state that long-period swell (waves with periods greater than about 10 s) will generate oscillatory (orbital) motion at the seabed in water depths as great as 100 to 200 meters.

Work by Wiberg (2006) and Wheatcroft (2006) indicates that near-bottom wave orbital velocities (U_b) greater than 0.14 m/s (corresponding bed shear stress of about $0.12Nm^2$) resuspend sediment typically found deposited on the continental shelf off the Eel River mouth. Based on an a return-period analysis of annual maximum wave heights and a calculated U_b at various depths, Wheatcroft et al. (2006) generated a plot (Figure 21) of depth-dependent exceedance probabilities for a suite of U_b values ranging from 0.15 to 0.50 m/s. This probability plot demonstrates that the relative intensity of near-bed wave orbital velocities (U_b) decreases with depth (i.e., seaward across the continental shelf).

In an effort to reproduce and extend the analysis of near bed wave orbital velocities offshore of the project area, KHE calculated daily near bed orbital velocities using the 1980-2011 WIS date for offshore buoy 83048 (see Figure 1 for buoy location). Through analysis of previous approaches at estimating bottom orbital velocities, Wiberg and Sherwood (2006) present a method for estimating bottom orbital velocity from significant wave height and wave period using the following formula:

$$U_b = H_o\pi/TM*\sinh(kh)$$

Where: U_b = near bottom wave orbital velocity (m/s);

H_o = total significant wave height (m);

TM = wave period (s);

k = *wavenumber* $(2\pi/L_o)$;

sinh = hyperbolic sine of number

L_o = wavelength (m); and

h = *water depth (m).*

Figure 22 presents the daily and 90-day average near bottom wave orbital velocities (Ub) calculated for offshore areas with 60 m water depth. Similar to the wave power estimates discussed above, these near bottom orbital velocities are directly related to wave height and period, thus the orbital velocities display and clear seasonal pattern of higher values in winter and lower in summer. Even the relative magnitude of interannual values mimic the relationships seen for wave power presented in Figure 11.

Subsequent computations of average daily near bottom orbital velocities were computed for water depths ranging from 20- to 100-m for the 1980-2011 period. The daily orbital velocity estimates are plotted as a suite of exceedance probability curves in Figure 23. For comparison,

Wiberg's (2006) sediment resuspension threshold of 0.14 m/s is also plotted as a horizontal red line on Figure 23. Based on these results and comparison, the long-term wave climate on the continental shelf offshore of the project area is capable of mobilizing and suspending sediment as follows: 99% of the time at water depths of 20m; 84% of the time at 40m depth; 60% of the time at 60m depth; 40% of the time at 80m depth; and 24% of the time at 100m depth. When compared to the exceedance probabilities presented in Wheatcroft et al. (2007) (presented as Figure 21, this report), the near bottom orbital velocities estimated by this study are somewhat higher. Possible reasons for this discrepancy is that this study uses a different equation to calculate near bed orbital velocity and/or the wave climate data and frequency of calculations are different. Regardless, the main findings from this analysis is that the energetic wave climate introduces significant opportunity to resuspend and mobilize sediment that deposits on the offshore continental shelf.

Monitoring of 1997-1998 storm deposits by Traykovki (2000) indicate that the initial riverine storm deposits temporarily stored on the inner shelf were transported downslope through development of a wave-induced near bottom turbid layer that increased in both thickness and sediment concentration over time. With time the turbid layer behaves like a gravity current flow, which flows in a downslope (offshore) direction until it runs out of wave energy in the mid-shelf at a water depth of 90 to 110 m (Ibid). The landward boundary of the mid-shelf deposit is not constrained by this gravity flow process – instead it is controlled more by the ability of the waves to resuspend material of various grain size of inner and mid-shelf deposits.

Sommerfield et al. (2007) describe an abrupt transition from sandy silt to clayey silt at 50 to 60 m water depths on the Eel shelf. Landward of 50–60 m water depths, sediments are poorly preserved owing to physical mixing by wave-orbital flows. Seaward, storm waves are less effective in bed reworking, both because of a weaker wave-orbital flow (due to deeper water depth), and because of cohesive shear strength imparted by the muddy strata (Ibid). Consequently, physical reworking of middle–outer shelf strata is low compared with the more energetic inner shelf. Wheatcroft et al. (2007) elaborate further and state, "*On the inner portion of the continental shelf, landward of the sand–mud transition (located at a depth of ~55 m on the Eel shelf), the seabed is a non-cohesive silty sand, with wave-generated ripples and possibly larger-scale bedforms at the surface. Seaward of the sand–mud transition, the fine-grained bed sediment behaves cohesively and surface roughness is dominantly biogenic. Grain-size-related differences in consolidation, critical shear stress and settling rates across the shelf cause differences in sediment erodibility and availability that affect the volume of sediment in transport and the depth of physical reworking at the bed surface. However, for sediments typical of muddy regions of the continental shelf, the effect of grain size on critical shear stress becomes less important than the effects of cohesion and consolidation.*"

Based on the studies completed on the dispersal of Eel River sediment, Hill et al. (2007) believe the Eel River system behaves consistently as a closed sediment budget, where:

- The inner-shelf storage accounts for 10% of the annual discharge of fine sediment by the river;
- The mid-shelf flood deposit contains 20–25%, and the slope stores 10–20%;

- An unknown quantity of sediment exits the Eel margin to the north, carried by the buoyant coastal current. This loss term probably amounts to a few percent of the Eel discharge; and
- If along-shelf export beyond the margin is assigned a value of 5% of the discharge, 45–55% of the Eel's load must be accounted for. This quantity is similar to the estimated storage of sediment in the Eel Canyon.

Sommerfield et al. (2007) reported similar findings and elaborated as follows.

> *"Of the total 19 × 10^6 tons yr−1 of suspended sediment supplied to the coast, on average, ~10% is trapped on the sandy inner shelf, 20% is trapped on the middle–outer shelf, and another 20% can be accounted for on the open slope (between 150 m and 600 m). Last, at least 12% is sequestered in the upper Eel Canyon. Accordingly, the unaccounted ~38% must be dispersed along-margin to north ward and southward, and farther seaward, especially to deeper portions of Eel Canyon. Recall that ~15–30% of the flood-generated load in 1995 and 1997 was trapped on the shelf, which is comparable to the 100-yr shelf trapping efficiency of ~20–30%. The similarity of these results suggests that most of the fluvial sediment load escapes the shelf during wet-storms, rather than through subsequent redistribution of temporary shelf deposition. This latter condition was observed by Drake et al. (1972) following the 1969 flood of the Santa Clara River (southern California), the only similarly documented case study available for comparison. The key insight is that the decadal– centennial sediment mass balance of the dispersal system is set at the time-scale of oceanic storms and river floods, because of the disproportionate influence of these conditions on sediment delivery and across-shelf transport."*

4.5 Coastal Currents

The major oceanic circulation north of Cape Mendocino consists of the southward-flowing California Current and the northward-flowing Davidson Current (Sommerfield et al., 2007; see Figure 24). The California Current flows southward year round between the shelf break and ~1000 km seaward of the coast at mean speeds of about 10 cm/s (Ibid) creating upwelling conditions along the Oregon and California coastline (Kniskern et al., 2011). Resulting summer along-shelf mean currents are strongest near the surface with decreasing velocity to near-zero mean values at the bottom (Wheatcroft, 2007). The Davidson Current flows northward from Point Conception, CA in autumn and winter at speeds of 5–10 cm/s over the continental shelf, which results in down welling-favorable conditions (Sommerfield et al., 2007 and Kniskern et al., 2011). During winter, mean currents tend to be more uniform through the water column, yet their direction and magnitude vary along and across the shelf (Wheatcroft, 2007). Although these currents occur well offshore at the edge of the shelf, they do exert some influence on coastal circulation patterns by setting up a pressure gradient (Kniskern et al., 2011).

The regional physical oceanography of the northern California shelf and slope is conducive to widespread dispersal of fine-grained river sediment (Kniskern et al., 2011). Currents also act as the advection mechanism for sediment resuspended under combined wave– current flows (Wheatcroft et al., 2007). Interannual variations in the frequency structure of currents on the continental shelf may be a reflection of climate-scale fluctuations (e.g. ENSO and Pacific

DRAFT

Decadal Oscillation - PDO), causing patterns of storm tracks to shift spatially and in magnitude. This level of variability can be of great importance to the ultimate fate of suspended particles by changing the locations of sediment flux convergences/divergences (Ibid).

DRAFT

Chapter 5: Potential Impacts from Climate Change

The report sections above discuss the primary components (e.g., wind/wave energy, sediment/sand supply, littoral drift, and offshore sediment dispersal patterns, etc.) at play within the Eureka Littoral Cell. The interplay of these littoral cell components control dune stability along the Eel River Coastal Plain. In turn, there is significant interplay between a wide range of regional meteorological, hydrologic, geomorphic and hydrodynamic conditions and processes that influence littoral cell conditions and processes. This section of the report focuses on identifying how climate change will likely influence the Eureka littoral cell.

5.1 Anticipated Changes Associated with Climate Change

5.1.1 Sea Level Rise (SLR)

Based on a review of available literature, warming oceans are leading to rising sea levels. Any scientific debate regarding this subject is related to the rates at which eustatic sea level rise (global or regional average) and relative sea level rise (local rate incorporating tectonic activity) are occurring currently and in the future. A simple review of water level records maintained by NOAA at the Humboldt Bay North Spit tide gauge reveals an estimated recent eustatic sea level rise rate of 3.68 mm/yr (see Figure 25). Psuty and Silveira (2013) state, "*Under most of the modern-day scenarios of rising sea level and diminished sediment supply, both natural and human-induced, the result is an eroding shoreline, a narrowing beach, and an attenuation of coastal dunes on the beach profile.*"

There have been a number of local SLR studies completed, most notably the Coastal Regional Sediment Management Plan (Moffatt & Nichol, 2013) and studies completed as part of Humboldt Bay Sea Level Rise Adaption Planning (HBSLRAP) project (NHE, 2015 and Laird, 2015). The NHE (2015) study presents estimates for SLR based on, "*The combined effects of global sea level rise, regional sea level height variability from seasonal to multidecadal ocean-atmosphere circulation dynamics (e.g. El Niño Southern Oscillation), and relatively large tectonic vertical land motions associated with the Cascadia subduction zone (CSZ).*" In summary, NHE (Ibid) found that Humboldt Bay has the highest local sea level rise rate in California, approximately two to three times higher than the long-term global rate. The higher relative sea level rates observed in Humboldt Bay are reportedly due to high rates of local land subsidence (termed *"Vertical Land Motion"*) working in tandem with rising eustatic sea levels. For example, they calculate a relative sea level rise rate for North Spit of 4.61 mm/yr, which results from a regional mean sea level rise rate of 2.28 mm/yr and subsiding vertical land motion rate of -2.33 mm/yr. As a result, NHE concludes that, *"Global rise in sea levels will affect Humboldt Bay faster than other parts of U.S. west coast; and within the bay the southern end will be affected sooner than the northern portions of the bay."* Moffatt & Nichol (2013) cite NOAA's local sea level rise rate of 4.7+/1.5 mm/yr, which is very similar to the NHE rate reported above. The reader is directed to these studies for more information regarding SLR.

5.1.2 El Nino Southern Oscillation (ENSO) Activity

ENSO stands for El Nino/ Southern Oscillation. The ENSO cycle refers to the unified and sometimes very strong year-to-year variations in sea- surface temperatures, convective rainfall, surface air pressure, and atmospheric circulation that occur across the equatorial Pacific Ocean. The term El Nino refers to the large-scale ocean-atmosphere climate phenomenon linked to a

periodic warming in sea-surface temperatures across the central and east-central equatorial Pacific while La Nina refers to cooling of water temperatures in the equatorial Pacific. El Nino and La Nina represent opposite extremes in the ENSO cycle.

El Nino and La Nina are naturally occurring phenomena that result from interactions between the ocean surface and the atmosphere over the tropical Pacific. Changes in the ocean surface temperatures affect tropical rainfall patterns and atmospheric winds over the Pacific Ocean, which in turn impact the ocean temperatures and currents. The El Nino and La Nina related patterns of tropical rainfall cause changes in the weather patterns around the globe. The most notable winter conditions in Northern California associated with El Nino is the dominance of a low pressure off the Pacific Coast allowing for a persistent extended Pacific Jet Stream and amplified storm track into the southern west coast. Weather is typically warmer and wetter than normal. During a La Nina, there is a blocking high pressure off the coast, directing the polar jet stream north to Alaska and more variable Pacific jet stream directed into the Pacific Northwest. Winters are typically more cool and dry. A historic record of timing and relative strength of ENSO events is summarized in Figure 15.

Hapke et al. (2006) states that, along the Eel River coastal plain, mean annual wave heights are 0.3 m to 1.2 m higher than normal winter months during El Niño winter months. El Niño driven storms typically approach from the west or southwest and may cause local littoral drift to the north. La Niña winter months have slightly higher than average wave height values of 0.1 m – 0.4 m whereas during the summers wave heights are smaller than average (Ibid). Sommerfield et al, (2007) provides additional detail regarding the climatic and hydrologic effects of ENSO events in the following three quotations.

1. *Longer time-scale climatic variations such as the El Niño–Southern Oscillation (ENSO) or Pacific Decadal Oscillation (PDO) can modulate wave heights (Seymour, 1998; Allan & Komar, 2002). For example, the winters of 1997–98, an El Niño period, and 1998–99, a La Niña period, were marked by a particularly large number of extreme storms along the Pacific Northwest (Oregon and Washington) margin (Allan & Komar, 2002). This is also evident on the Eel shelf, where more than 30 days during each of these winters had daily significant wave heights greater than two standard deviations above the 20-yr mean (1982-2002; NDBC Buoy 46022)*

2. *Interestingly, it has been postulated that large increases in flood magnitude and frequency can result from modest changes in climate, for example, variations in mean annual temperature of merely 1–2°C and precipitation of ≤10–20% (Knox, 1993). Recurrent climatic phenomena such as El Niño–Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) are now known to significantly increase runoff and terrigenous sediment flux over mean conditions (Inman & Jenkins, 1999; Farnsworth & Milliman, 2003; Warrick & Milliman, 2003); there is marine stratigraphic evidence to suggest that El Niño has been a persistent climatic feature of the late Quaternary (Bull et al., 2000).*

3. *A significant climatic phenomenon relevant to streamflow and sediment discharge in some dispersal systems is ENSO, which has two recurrent phases, El Niño and La Niña*

(Cayan et al., 1999). During a strong El Niño, triggered by a weakening of easterly winds in the equatorial Pacific and the arrival of warm ocean water off western South America, winter storms off North America tend to track farther south, with heavy and persistent rainfall in southern California. In contrast, El Niño usually brings relatively dry conditions to regions northward (Oregon and Washington). During La Niña, major winter storms track through these regions, producing cool, dry weather in southern California, and wet, stormy weather in the Pacific North-west. In association with La Niña, atmospheric blocking of westerly storm tracks has produced some of the most intense flood-producing rainstorms on record in western North America (Hirschboeck, 1987; Ely et al., 1994), including the 1955 and 1964 megafloods described later. The northern California coast happens to be located midway between the regions where ENSO imparts characteristic rainfall and stream-flow signals (Schonher & Nicholson, 1989; Cayan et al., 1999). For instance, the wettest (1983) and driest (1977) years on record for the Eel River watershed were both El Niño years. Accordingly, a characteristic ENSO signal is not apparent in sediment discharge records for coastal rivers of northern California and Oregon (Wheatcroft & Sommerfield, 2005), unlike southern California (Inman & Jenkins, 1999).

5.1.3 Global Warming

In their 2012 and 2014 reports, Flint and Flint note that ongoing changes in climate are having adverse hydrologic and ecologic effects across the western United States. Their 2012 and 2014 reports presents regional studies of how climate change affects water resources and habitats in the San Francisco Bay area and all of California, respectively. Both studies relied on historical climate data and future projections of climate, which were applied to regional water-balance models. Changes in climate, potential evapotranspiration, recharge, runoff, and climatic water deficit were modeled.

Results indicated large spatial variability in climate change and the hydrologic response across the region. Of high significance is the fact that warmer air temperatures are expected under all climate change projections while potential change in precipitation by the end of the 21st century differed according to climate model. As a result, study hydrologic models predicted reduced early and late wet season runoff for the end of the century for both wetter and drier future climate projections, which could result in an extended dry season - summers are projected to be longer and drier in the future than in the past regardless of precipitation trends. Model simulations also revealed that water demand is likely to steadily increase because of increased evapotranspiration rates and climatic water deficit during the extended summers. Their analyses have shown that regardless of the direction of precipitation change, climatic water deficit is projected to increase, which implies greater water demand to maintain current agricultural resources or land cover.

Findings in another study by Thorne et al. (2012) came to the same conclusions, including*: "Overall, increases in potential evapotranspiration dominate other influences in future hydrologic cycles. Increased potential evapotranspiration drives decreasing runoff even under forecasts with increased precipitation, and drives increased climatic water deficit, which may lead to conversion of dominant vegetation types across large parts of the study region, as well as have implications for rain-fed agriculture. The potential evapotranspiration is driven by air*

temperatures." As seen in the sediment yield estimates completed as part of this study, a decrease in runoff from the Eel River will likely yield a decrease in sediment yield to the Ocean.

5.2 Potential Impacts to the Eureka Littoral Cell and Coastal Dunes

Based on the information presented above, the following section summarizes how climate change would likely alter meteorological and oceanic conditions and/or processes in the East Pacific Ocean, and how these changes could impact dune stability and morphology along the Eel River coastal plain.

1. Global Sea Level Rise: Sea level rise by itself will not change the wave climate (e.g., wave heights and period). However, SLR would raise static water level (SWL), increasing elevation of wave runup relative to land-based beach and dune heights. This will lead to increased beach and dune erosion as well as dune overwash unless beach/dune construction can keep pace with rising sea level. Rhind et al. (2013) reports that sea level rise will tend to increase the erosional state of dunes and may lead to increased mobility of dunes over time. Figure 26 illustrates how a SLR-induced rise in SWL will cause waves to break at higher elevations on dune faces, consequently increasing the potential for dune erosion. Two site-specific examples of increased wave runup are provided in Figure 26: the upper figure a) is dune Profile 3 located at the Wildlands southern barn (see Figure 6 for Profile locations); and the lower figure b) is dune Profile 1 located within the Angels Camp dune overwash area. The current SWL and dominant wave runup heights depicted in Figure 26 were calculated as part of this study (see Section 3.4). Also plotted on Figure 26 are the estimated SWL and wave runup heights assuming 1-meter of SLR. Although the magnitude of wave runup does not change between current and SLR conditions, the upward 1-meter shift allows waves to break higher up on the dune face. This results in increased erosion of the entire beach and dune face, causing it to retreat inland.

   Figure 26 also highlights how differences in dune height and morphology affect the amount of potential dune face erosion and inland retreat under SLR conditions. The foredunes at Profile 3 are much higher and wider than at Profile 1. As a consequence, the horizontal distance SLR wave runup extends inland is less at Profile 3 than at Profile 1. Assuming the beach and dune area below wave runup is eroded, the potential volume of dune erosion is notably greater at Profile 1 than Profile 3. This suggests that the degree of inland beach and dune migration associated with SLR is greater at wave overwash areas than areas where the dunes are intact and display a natural morphology.

2. Increased water temperature of Pacific Ocean:
   a. Could lead to increased frequency/duration/strength of El Nino events, which result in increased wave height and period, leading to increased episodic beach/dune erosion and wave overwash events.
   b. Increased occurrence and/or strength of El Nino events could lead to increased storm water and sediment runoff from Eel River watershed, increasing sediment supply to littoral cell. Could lead to local sand supply to beaches and dunes.
   c. Increased thermal expansion of water leading to sea level rise (see impacts above).

DRAFT

d. Potential to alter wind and ocean circulation patterns, leading to altered wave directions/energy that change balance of seasonal shifts in littoral sediment transport. Altered wave and currents could change dispersal of sand from Eel River, possibly altering the current balance of sand exchange with beaches and dunes. Any reduction in sediment supply may have significant consequences to the dune system south of the Eel River mouth as it already has a very low sand supply as described in Section 4.1 above.
e. Increased storm activity, leading to increased magnitude and/or duration of low pressure systems and increased storm swell and height of storm surge with potential to erode beaches and dunes.

3. Increased air temperatures over Northern California: Would lead to increased evapotranspiration and reduced surface water runoff. Implications are reduced sediment yields to littoral cell, reducing sand available to sustain beaches and berms. As discussed above, this impact would result regardless of climate model predictions for increased or reduced rainfall.

5.3 ENSO Extremes – Driver for Episodic Change of Coastal Dunes

A key finding of this study is the episodic nature of large-scale changes in dune field morphology along the Eel River coastal plain. Identifying this finding begs the question of what are the physical controls and processes driving these rapid and large scale changes. Review of the wave energy, runup and near-bottom orbital velocity results show a strong correlation to El Nino events. The strongest recent (60 years) El Nino event occurred in the winter of 1997-98 (see figure 15). Not surprisingly, this winter also corresponds to periods of the highest wave power (Figure 11) and wave runup (Figure 14) values calculated for the study period. We hypothesize that the large scale erosion experienced by the dunes south of the Eel River inlet between 1993 and 2005 is likely attributable to this event.

North of the Eel River inlet is a different story as this dune system prograded during the same general period that erosion was occurring on the south-of-inlet dunes. One major difference may be related to sediment supply. In this case, the annual Eel River sediment discharges were all very high during the winters of 1995, 1997 and 1998 and the mouth was located at or near the northern-most maximum extent of its migration zone. Based on the sediment discharge plume studies completed on the Eel River sediment dispersal system, it is likely that the majority of sediment was discharged and remained north of the inlet during the 1997-98 El Nino period. It is hypothesized that sediment loads and grain sizes discharged and accumulated near the mouth of the Eel River between 1995 and 1998 were relatively high and were redistributed onto the north beach and dune system by the high wave energy during the 1997-98 El Nino. In short, this theory suggests that in sediment starved coastal systems, El Nino events can (and do) erode the coastline, while where sediment supply is very high, the same wave climate conditions contribute to rapid beach construction.

The far south end of the project area continues to experience wave overwash since the 1997-98 El Nino, likely because the dunes were lowered during the event to the extent that less intense storms and/or El Nino events contribute wave overwash to a compromised dune field. In

addition, the dunes in this areas have not had sufficient time to recover (rebuild) in such a low sand supply coastal environment.

There has also been a higher than normal frequency of La Nina events (98/99, 99/00, 07/08, and 10/11) since 1997/98 which could also be contributing to erosion or at least slowing the recovery process. This conclusion stems from the observation that these La Nina events have a high correlation to periods of very low sediment inflow from the Eel River. Under sediment starved conditions, there is low to no littoral transport to the southern overwash areas (i.e., sand is bypassing the beaches). Taken a step further, it is possible that the greater than normal southern littoral transport during a combination of La Nina and low sediment supply periods could be preferentially transporting sand off the south-of-inlet beaches leading to continued erosion.

DRAFT

Chapter 6: Dune Restoration Approaches

The purpose of this chapter is to summarize available information on the approaches for coastal sand dune restoration. This synthesis of available information will focus on foredune restoration. Foredunes are the dunes fronting the ocean, formed by aeolian sand deposition in plants above the spring high tide line (Martinez et al., 2013). Foredunes are the main dune type found along the Eel River coastal plain south of the Eel River mouth and are represented by the single, continuous and symmetrical dune. They are essentially devoid of vegetation on the face fronting the ocean but are typically well vegetated on the landward side of the dunes. As indicted above, there are two locations (Profiles 1 and 2, Figure 6) within the Project area where the foredunes are degraded due to extensive and repeated wave overwash. Dune restoration[5] approaches presented herein will focus on treatments for these degraded Project areas. The main objectives for dune restoration include: 1) restoration of a healthy and self-sustaining ecological system; 2) reduced flooding impacts to adjacent lands; and 3) controlling subsequent negative human actions. Based on the information presented below, the recommended approach for achieving these dune restoration objectives is to restore natural physical and biologic conditions and processes with particular emphasis on dune stabilization through planting and maintenance of native species.

6.1 Causes for Dune Instability and Destruction

6.1.1 Removal of Wrack

On beaches, wind-blown sand accumulates at the seaward-most vegetation and wrack lines that form on the backshore (Nordstrom and Jackson, 2013). A wrack line is typically composed of debris left on the beach by high tide. The larger wrack (logs, stumps, and timber) typically accumulates above the main beach on the shelf or foot of the foredune and is deposited during storm surge (see Figure 27). Review of historic aerial imagery indicates considerable large wood deposited on the beaches north and south of the Eel River inlet after storms, with the highest density of material located closest to the inlet. Anecdotal accounts from local area residents suggest that, historically, large wood wrack is scavenged from the Eel River coastal plain beaches. The only public access to these beaches is at Centerville Beach, located in close proximity to the large wave overwash areas, which would suggest wrack from these areas is preferentially removed over the wrack located on more distal portions of the beach located between Centerville and the Eel River mouth. Removal of wrack eliminates the opportunity to capture sediment and, in the case of large wood, natural structures that protect the dunes from wave erosion.

NOTE: KHE TO EXPAND ON THIS SECTION PENDING DISCUSSION WITH LOCAL AREA RESIDENT TIM GRINSELL. JAY RUSS PROVIDED TIM'S CONTACT INFORMATION AND SUGGESTED HE IS A GOOD PERSON TO SPEAK WITH ABOUT HISTORICAL CENTERVILLE DUNE MAINTENANCE.

[5] Again, the term "restoration" as applied through this report means the return of the beach/dune physical condition and geomorphic processes to a close approximation of its condition prior to disturbance. In addition, the term restoration also includes natural and man-made enhancements and creations that maximize ecological benefits along with providing resiliency to sea level rise.

6.1.2 Damage to Vegetation – Driving and Trampling

Vehicles driven on beaches and dunes destroy young dune vegetation and destroy sparse nutrients (Nordstrom and Jackson, 2013). Vehicles compact the sand, preventing seed germination and animal burrowing (Ibid). . Acosta et al. (2013) report that the most destructive activities to dunes in the Mediterranean is motorcycling and pedestrian trampling. These impacts constitute a serious threat to both plant assemblages and the structural integrity of the dunes themselves. In their study on the recovery of dunes in Italy from human trampling, Acosta et al. evaluated the effectiveness of fencing to restrict human access. They found that after 4 years, there was a 30-40% increase in vegetation cover, increase in species richness and development of spatial (sea-inland) vegetation zonation. Arens et al. (2013) state that the stress factors (wind, salt spray, coastal erosion, slow soil development, etc.) are especially high in the foredune and the removal of vegetation is capable of releasing huge quantities of sand that blows inland. For example, removing beachgrass from coastal backdunes along the shoreline in Point Reyes National Seashore resulted in a rapid and mass inland movement of dune over at least 25 m in a single winter season (Greg Kamman, personal communication).

6.2 Dune Restoration Techniques and Applicability to Project

A consistent recommendation throughout the dune restoration literature is for the restoration of geomorphic and biological processes that form and maintain natural foredunes. The main mechanisms to promote foredunes are through maintaining a supply of wind-blown sand and promoting and sustaining methods to capture and retain the sand in the dunes. The following sections summarize the main foredune restoration approaches applicable to the Project area and discusses the suitability/feasibility for application to the Eel River coastal plain.

6.2.1 Accommodating Natural Dune Building Processes

As indicated above, a primary goal of natural dune restoration is the capture of wind-blown sand. Without a mechanism to capture sand, beaches and dunes will erode and/or destabilize. Nordstrom and Jackson (2013) report, "*On many human-altered shores that are eroding, the presence of infrastructure close to the water restricts backshore width, requiring artificial nourishment to provide the wider sediment source for aeolian transport and greater protection for newly formed dunes from wave erosion*." The south end of the Eel River coastal plain beach and foredune system has experienced significant narrowing, reducing the beach width that provides the source of sand transported by wind to the dunes. Under natural conditions, a wide beach-dune zone allows for a suite of distinct habitats, from pioneer species on the seaward side to woody shrubs and trees on the landward side (Nordstrom and Jackson, 2013) (e.g., North Spit of Humboldt Bay).

Historically, the width of the beach/dune system at the south end of the project area was constrained by maintaining the Western Drainage ditch and pasture lands immediately to the east. One important dune restoration objective should be to provide a wider area for the beach and dune front within the areas located at Profiles 1 and 2 (Figure 6). This would require abandoning the routine maintenance of the Western Drainage ditch and replacing the necessary drainage with an alternate system, setback further to the east out of the footprint of the designated dune restoration area. Alternatively, if a wider beach/dune system can't be accommodated, approaches to providing sand supply and sand trapping structures could be

DRAFT

pursued, but would require repeated applications and maintenance in response to periodic erosion from winter storms.

Under natural conditions, reestablishment of the historic foredune morphology (width and height) and desired vegetation assemblages can take up to 10 years (Nordstrom and Jackson, 2013). This restoration could be accelerated through some of the methods presented below, but ultimately, it is recommended that dune restoration is designed to be sustained by natural processes. Vestergaard (2013) reports on beach restoration projects in Denmark and noted that several foredunes formed by natural processes (sand movement and plant growth) on man-made beaches within 24 years. Dunes formed through movement and accumulation of initially placed beach nourishment sand, followed by sand sourced from the sea by natural coastal processes. Vestergaard also reported that the beach/dune zone widened by 25 m over the 24 period.

6.2.2 Mechanical Dune Construction

Dunes are frequently constructed through placement and contouring of fill material using earth-moving equipment (Nordstrom and Jackson, 2013). The intent of these types of dune projects are to accelerate dune formation to provide flood protection. However, the selection of fill material and implications on both physical and biological processes requires careful consideration. Typically, wind-blown sand is relatively fine grained. Placement of fill containing unnaturally coarse grained material can lead to armoring of the restored surface as the fine grained material is preferentially removed by aeolian processes leaving only a coarser grained surface (Nordstrom and Jackson, 2013). The suitability of fill material for planting is also an important consideration, especially when replanting with native species. Therefore, for purposes for EREP dune restoration, we recommend that only well-sorted sands resembling dune sediments be used to in dune construction. A suitable borrow area is the wave overwash deposits located adjacent to the restoration areas. Beach skimming may also provide the necessary material.

6.2.3 Sand Fence Installation

Sand fences are a simple and inexpensive way to trap windblown sand along beaches and dunes. Sand fences are porous barriers, typically constructed using spaced wooden slates woven together with wire in a manner to reduce wind speed such that sand being transported by the wind accumulates on the downwind (lee) side of the fence (Khalil, 2008). Sand fences are typically installed parallel to the shoreline, although other configurations to create desired configurations of foredune topography and vegetation (Nordstrom and Jackson, 2013). For example, side spurs perpendicular to a straight alongshore alignment can increase trapping efficiency in locations of strong longshore winds or multiple lifts of fences can create a higher dune with much greater volume than single lifts (Ibid). The National Park Service utilized sand fences in a large dune restoration project in Point Reyes National Seashore, focused on the removal of non-native vegetation. The site consists of very large dune fields and sand supply was abundant. The fences were utilized to act as temporary barriers to sand migration, but were quickly overwhelmed and buried, likely due to the scale of dune disturbance and associated dune mobility introduced by the project (Greg Kamman, personal communication).

DRAFT

Norstrom and Jackson (2013) provide the following guidelines with respect to fence placement applicable to use along the Eel River coastal plain.

- Fencing with a 50% porosity and gaps of less than 50mm can fill to capacity in about one year assuming appreciable aeolian sand supply.
- Fences should be placed at the seaward limit of natural vegetation or at the top of the existing foredune line (elevations above 15-feet NAVD88) to minimize exposure to routine wave attack.
- Where dune vegetation is lacking, dunes are likely to survive storms having a 1-year recurrence interval if they are built landward of the upper-most storm wrack line.
- Vegetation planting should be completed in association with dune fence installation in order to stabilize the new dunes and promote a natural long-term evolution.

6.2.4 Large Wood (Wrack) Placement

Given the likely loss of large wood wrack from human removal, another sand trapping and stabilization measure in dune creation and stabilization is the strategic placement of large wood along the upper beach-to-dune transition, a location this material would occupy naturally. Field observations of foredunes within the project area whose cores are exposed by winter erosion reveal the presence of abundant large wood buried within the base of dunes (Figure 26). The presence of this material may suggest the importance of large wood wrack in the formation and maintenance of dunes. Nordstrom and Jackson (2013) state that the highest storm rack line has the greatest amount of litter and if it survives long enough, it can provide the base for a new foredune. Thus, placement of large wood wrack at the seaward base of a restored project dune may be a desired design component. "*Finding a way to retain wrack is critical to conserving or restoring beach and dune habitats in developed areas* "(Nordstrom and Jackson, 2013). Beyond keying or burying large wood into the sand, other anchoring methods should be evaluated in the context of overall dune restoration planning and design.

6.2.5 Planting Native Vegetation

Without vegetation to trap and stabilize wind-blown sand, natural dunes would not persist and man-made dunes would need to be routinely replenished with imported sand. Vegetation reduces wind speed, traps sand, stabilizes the dune surface, and provides physical habitat (Nordstrom and Jackson, 2013). Dune habitats are an essential functional component of coastal ecosystems and their degradation is known to promote coastal erosion (Acosta et al., 2013). Thus, dune-stabilizing vegetation is an integral part of dune restoration. Highlights from the literature reviewed are as follows.

- Most dune restoration practitioners recommend the use of native species in restoration projects that are easy to propagate, harvest, store, transplant with high survival rates, and readily available at relatively low cost (Nordstrom and Jackson, 2013; Pickart, 1997 and 2013).
- Species that are most useful in foredune restoration are those that react positively to sand burial (Nordstrom and Jackson, 2013).
- Removal of non-native species such as *Ammophila arenaria* should only occur where the loss is coincident with replanting and colonization by similar or later native successional species.

6.3 Recommended Dune Restoration Approach, Design and Management

South of the Eel River inlet, the coastal dune field consists of a single, narrow foredune, which undergoes notable seasonal erosion. The southern end of this beach/dune system has undergone significant narrowing. These characteristics and trends suggest a dune system of limited sand supply. A similar dune system occurs on Oakura Beach, New Zealand, consisting of a single, low and narrow foredune, which Hesp and Hilton (2013) indicate either that sediment supply to this beach has been extremely small, or that significant erosion has taken place in the past. These conditions are in notable contrast to the prograding dune system north of the inlet, which has undergone significant foredune establishment and overall dune field widening, suggesting a more abundant sand supply. Review of historic aerial imagery and maps indicates that both the southern dune erosion and northern dune growth occurred in an episodic fashion and that prior and post beach/dune morphologies and overall widths remain relatively stable. Given the overall long-term stability of the majority of the dune fields along the Eel River coastal plain, which was only punctuated with episodic change, it is hypothesized that localized factors have led to the dune destabilization at the south end of the dune study area. The influences of climate change including SLR, changes in ocean circulation patterns, changes in wave climate, and any possible change in littoral sand transport are likely equally distributed throughout the Eel River delta coastline.

At the south end of the Project area, the current degraded state of the dunes is due to the effects of dune overwash lowering dune heights by waves pushing dune sand landward into a large oval overwash fan. The primary contributing factors for the dune destabilization in these areas likely include erosion due to the damage/loss of dune vegetation by vehicular and human trampling, and removal of large wood wrack material. Other unique factors that could be contributing to dune destabilization and overwash in this area include: 1) cattle grazing and/or trampling[6]; 2) higher subsidence rates along the south side of the Eel River alluvial basin relative to the middle; and 3) presence of the Ferndale fault, which could also be contributing to increased rates of vertical movement through this area.

The restoration approach recommended for the project dunes is to alter conditions from a degraded state to a targeted stable state. In this case, the desired morphology of the restored dune system is defined by the physical characteristics of the stable adjacent dunes. These adjacent reference sites provide a starting point for deign dimensions of slope, width, and height for the restoring foredunes in kind. The geometry and cross-sectional profile of the stable dunes in other Project areas are also relative constant.

Unfortunately, the Eel River coastal plain dune fields are dominated by non-native European beachgrass (*Ammophila arenaria*). Although it is desirable to revegetate the restored dune fields with native plants, sustaining native species may be futile if done as islands of native plantings surrounded by non-native species. Thus, any dune revegetation efforts completed on the Eel River delta are best dealt with on a local/regional level – an effective restoration planning and

[6] Hesp and Hilton (2013) report on widespread destruction of natural vegetation cover on dunes in New Zealand by cattle and sheep grazing in the 19th and 20th centuries. Rhind et al. (2013) report similar findings for the UK and San Miguel Island, California. It is not illogical to suspect dairy cows from pastures adjacent to Eel River coastal dunes have entered the dune system. The frequency and damage of such excursions is unknown.

design needs to consider for the whole scale removal of non-natives and replacement with native species along the entire Eel River delta coastline. Regardless of ability to undertake a regional native replanting effort, any dune restoration should incorporate revegetation of some kind (native or non-native) in order to promote dune stabilization and sediment trapping.

A summary of recommendations for construction and management elements in a dune restoration plan include the following.

- Integration/replacement of large wood wrack material into the base of any constructed dunes.
- Expanding the width of the beach/dune zone in restoration areas (i.e., allowing for dune establishment further inland than historic or adjacent conditions) to provide room for natural dune development and maintenance.
- Integration of sand fence to promote sand capture in the short- or long-term absence of dune vegetation.
- Reconstructing foredunes where material is sourced from existing overwash lobes or beach skimming to ensure a consistent grain size and seed bank.
- Restrict large-wood wrack removal
- Restrict driving on the vegetated portion of beaches and any part of dunes
- Restrict beach access to selected and managed locations to avoid the establishment of blowouts or trampling of vegetation. These restrictions should be incorporated into local and regional beach access plans.
- Control exotic species and replant with natives, which may need to be done on a regional scale to be long-lasting and effective. A specific objective of this revegetation program would be to promote natural succession and sea-to-land gradations in plant species as a mechanism to enhance the physical and biological character and function of the entire coastal dune system. The establishment of woody shrubs and trees in the backdune area would further stabilize the dune system.
- Consider fencing around restoration sites to prevent human and cattle access, to avoid excessive trampling and destruction of vegetation.
- Promote restoration actions throughout the entire Eel River delta coastline to promote an enhanced natural, self-sustaining dune system to buffer the adverse effects of climate change. The use of beaches and dunes for storm protection is not new and will probably play a more major role in the nation's response to accelerated sea level rise. The most realistic and successful approach for addressing SLR will be to provide the room for natural dune expansion and stability.
- Implement a monitoring and Adaptive Management Plan to ensure the success of the project, especially in a constrained/narrow corridor. As an example, the Oakura foredune restoration project in New Zealand reported by Hesp and Hilton (2013) experienced degradation (8 m loss in width) 8 years after construction due to wave erosion during several storms. They note that in a sand scarce project area undergoing erosion, many pioneer plant species that require sand deposition to grow could not get established in the middle and upper seaward slope of the foredune. In hindsight, with proper monitoring and adaptive management, they would have introduced secondary native plants to these areas to mimic the natural succession patterns that naturally occur in their area.

DRAFT

6.4 Special Foredune Restoration Design Considerations

The following sections touch on particular technical aspects that need to be considered in the engineering design of a foredune restoration effort on the Eel River coastal plain.

6.4.1 Wave Runup and Overwash

Knowledge of the limit of runup should be applied to the design and management of vegetated dunes (Douglas, 1990). For example, the minimum elevation at which dunes and beach/dune vegetation can be maintained on the beach is probably related to some recurrence interval of runup. Beach and dune vegetation can tolerate only a certain exposure to waves.

The engineering design of beach or dune should consider both the still water level (SWL) and the coincident runup heights. Adjusting the SWL for anticipated rates of SLR will provide guidance on how the project will perform under various SLR scenarios. One design approach to establish a dune height to prevent overtopping could be done by determining a design water level that considers storm surge plus maximum runup. The Federal Emergency Management Agency (FEMA) guidance for addressing runup was developed and applied to the East Coast and Great Lakes and likely does not fit or apply well to the more energetic and variable Pacific Coast (Broker et al., 2005). There does not appear to be FEMA guidance on runup and overtopping for the Pacific Coast.

6.4.2 Native vs. European Beach Grass

European beach grass *(Ammophila arenaria)* is commonly referred to as Marram and dominates the current dune vegetation along the Eel River coastal plain. Marram can establish from marine-dispersed rhizome and is capable of colonizing remote dune systems tens to hundreds of kilometers from its source (Hesp and Hilton, 2013). If not planted intentionally along the Eel River delta coastline, it could easily have migrated from Humboldt Bay where it was planted in the early part of the last century. Hesp and Hilton state, "*The introduction of Marram has led to the development of foredunes and dune types that were previously either poorly developed or non-existent, changes in the morphology of dunes, the development of mono-specific stands and exclusion of native plant species, various ecological effects including the decline of faunal habitats and fauna, and spread to the invasion of other coastal sites.*" Pickart (1997 and 2013) notes the following impacts associated with Marram: 1) it is a better sand collector than the native dunegrass and creates higher and steeper foredune faces; 2) it shortens the time for stabilization and drastically alters the natural plant succession; 3) it has the ability to displace entire native plant communities; and 4) suppresses the formation of blowouts.

In his study comparing restored (native) foredunes to "invaded" or Marram-dominated dunes, McDonald (2015) found that although the maximum elevations of the dunes did not differ, the restored dunes displayed shallower average upwind/seaward dune face[7] slopes (13.9% for restored vs. 16.5% for invaded). Based on their dune restoration work in New Zealand, Hesp and Hilton (2013) report that reshaped dune seaward slopes should lie within the slope range from 20% to 33% as these slopes approximate natural foredune slopes, slopes notably steeper than the Humboldt Bay slopes reported by McDonald. They also noted that the restored dune lee slope was constructed to around 36%. Although Hesp and Hilton desired a lower lee slope, they

[7] The seaward face of the dune commonly referred to as the "stoss" (Hesp and Hilton, 2013).

were constrained to narrow dune width and stabilized the lee slope with dense planting and fencing. Thus, restoration design of the Project foredunes will need to consider and evaluate the differences in vegetation-driven dune morphology, especially if the width of the restored dune field is narrow and a desired dune crest height is desired. The work by McDonald suggests that a wider zone foredune establishment is desirable if revegetated with native plants over Marram.

6.4.3 Soil Development

Soil development on a coastal dune requires a considerable amount of time and is heavily dependent on the establishment of vegetation. Rhind et al. (2013) studied the progress of soil development (measured by rate of organic matter content in sand) at two major dune systems in Wales and found similar soil development rates at both sites. They report that organic matter content was around 0.2% in the bare sand of the mobile dune, increasing to 1% when vegetation cover reached 100% and that this initial phase of soil development may take up to 40 years. By 60 years, soil reached an organic matter content of around 4%, comparable to much older soil. The key point of this research is that soils develop on dunes more quickly under full vegetation cover and revegetation efforts accelerate this process. Soil development will be retarded or reversed (eroded) in open areas.

6.4.4 Recommendation for Additional Data and Study

Additional data and information that could improve our understanding about the controls over dune stability in the Eel River coastal plain and inform the planning and design for foredunes includes the following.

- Converting a hardcopy of the Army Corp of Engineer's (Corp's) 1968 topographic map to a digitized electronic (GIS) version would allow preparing an associated DEM that would allow for more rapid and robust comparison to the 2010 DEM. This would allow for more precise comparison of changes in dune conditions, quantification of beach/dune erosion and aggradation volumes, and support other project analyses such as aggradation rates associated with the Wildcat tributaries on adjacent pasture lands.
- Project design will require site-specific surveys of the beaches and dunes. Beach profile surveys will allow for more precise and site-specific calculations of wave runup.
- Photo-documenting and/or completing seasonal beach profile surveys would provide a better understanding of the seasonal variability in beach morphodynamics, which would assist in foredune design.
- The episodic changes in dune conditions fall within a relatively broad periods (1993-2005) due to the lack of intervening aerial imagery. A more robust search and acquisition of aerial imagery within this period would allow for better identification of the date and conditions driving the changes.

These recommendations are intended to be adequate for compliance with CEQA and supporting documents for permitting processes such as the Adaptive Management Plan, Habitat Mitigation and Monitoring Plan and Biological Assessment. Additional design-level information will be necessary to advance the design prior to construction and initiating long-term adaptive management.

DRAFT

Chapter 7: References

Acosta, A.T.R., Jucker, T., Prisco, I., and Santoro, R. 2013. Chapter 12, Passive recovery of Mediterranean coastal dunes following limitation to human trampling. M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Arens, S.M., Slings, Q.L., Geelen, Luc H.W.T., and Van der Hagen, H.G.J.M. 2013. Chapter 7, Restoration of dune mobility in the Netherlands. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Broker, I., Coulton, K., Gangai, J., Hatheway, D., Lowe, J., Noble, R., and Srinivas, R. 2005. Wave runup and overtopping, FEMA Coastal Flood Hazard Analysis and Mapping Guidelines focused study report. February.

Brown, W.M. and J.R. Ritter. 1971. Sediment Transport and Turbidity in the Eel River Basin, California. Menlo Park, California: United States Dept. of the Interior, Geological Survey, Water Resources Division.

Buell, A. C. 1992. A history of the introduction and spread of Ammophila arenaria on the North Spit of Humboldt Bay, California. Thesis for Master of Science, Humboldt State University, December.

California Coastal Commission (CCC), 2015, The California Coastal Commission Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits, Adopted August 12, 2015. 293p.

Cherry, J. A. (1964). *Sand movement along a portion of the northern California coast*.

Clarke, S.H. 1990. Map Showing Geologic Structures of the Northern California Continental Margin. USGS Misc. Field Studies Map MF-2130.

Clarke, S.H. and White, M.E. 1980. Geology and Geologic Hazards of Offshore Eel River Basin, Northern California Continental Margin. USGS Open-File Report 80-1080.

Cooper, W.S. 1967. Coastal Sand Dunes of California. The Geological Society of America Memoir 104.

Costa, S.L. and Glatzel, K.A. 2002. Humboldt Bay, California, Entrance Channel, Report 1: Data Review. US Army Corps of Engineers, Coastal and Hydraulics Laboratory, ERDC/CHL CR-02-1, September.

Donnelly, C., Kraus, N.C., and Larson, M. 2004. Coastal Overwash: Part1: Overview of Processes. US Army Corps of Engineers, ERDC/CHL CHETN-XIV-13, September.

Douglass, S.L. 1990. Estimating Runup on Beaches: A Review of the State of the Art. US Army Corps of Engineers, Waterways Experiment Station, CERC-90-3, October.

Dronkers, J. 2005. Dynamics of Coastal Systems. Advanced Series on Ocean Engineering, World Scientific Publishing Co., New Jersey.

Everson, R.E. 1959. Geology and ground-water features of the Eureka Area, Humboldt County, California. U.S. Geological Survey Water-Supply Paper 1470.

Fan, S., Swift, D.J.P., Traykovski, P., Bentley, S., Borgeld, J.C., Reed, C.W., and Niedoroda, A.W., 2004, River flooding, storm resuspension, and event stratigraphy on the northern California shelf; observations compared with simulations: Marine Geology, v. 210, no. 1–4, p. 17–41.

Farnsworth, K.L. and Warrick, J.A. 2007. Sources, Dispersal, and Fate of Fine Sediment Supplied to Coastal California. USGS Scientific Investigations Report 2007-5254.

Field, M.E., Clarke, S.H., and White, M.E. 1980. Geology and geologic hazards of offshore Eel River Basin, Northern California Continental Margin. U.S. Geological Survey Open-File Report 80-1080.

Flint, L.E. and Flint, A.L. 2014. California Basin Characterization Model: A Dataset of Historical and Future Hydrologic Response to Climate Change, U.S. Geological Survey Data, Release, doi:10.5066/F76T0JPB

Flint, L.E. and Flint, A.L. 2012. Simulation of Climate Change in San Francisco Bay Basins, California: Case Studies in the Russian River Valley and Santa Cruz Mountains. U.S. Geological Survey, Scientific Investigations Report 2012-5132.

Geyer, W.R., Hill, P., Milligan, T., Traykovski, P., 2000. The structure of the Eel River plume during floods. Continental Shelf Research 20, 2067–2093.

Geyer, W.R. 1998. Sediment Transport in the Eel River Plume. Department of Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution.

Goff, J.A., Mayer, L.A., Hughes-Clarke, J., and Pratson, L.F. 1996, Swath Mapping on the Continental Shelf and Slope: The Eel River Basin, Northern California. Oceanography, Vol. 9, No. 3, 178-182.

Hapke, C.J., Reid, D., Richmond, B.M., Ruggiero, P., and List, J. 2006. National Assessment of Shoreline Change Part 3: Historical Shoreline Change and Associated Coastal Land Loss along Sandy Shorelines of the California Coast. USGS Open-File Report 2006-1219.

Hesp, P.A. and Hilton, M.J. 2013. Chapter 5, Restoration of foredunes and transgressive dune fields: case studies from New Zealand. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Hill, P.S., Fox, J.M., Crockett, J.S., Curran, K.J., Friedrichs, C.T., Rockwell Geyer, W., Milligan, T.G., Ogston, A.S., Puig, P., Scully, M.E., Traykovski, P.A., and Wheatcroft, R.A. 2007. Sediment delivery to the seabed on continental margins. In: Nittrouer, C.A. et al.

(eds.) Continental Margin Sedimentation, from sediment transport to sequence stratigraphy, Special Publication 37, International Association of Sedimentologists.

Hill, P.S. and Milligan, T.G. 1998. Evolution of Particle Size in Turbid Discharge Plumes. Dalhousie University, Department of Oceanography, Halifax, Nova Scotia, Canada.

IPCC. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (Eds.). Cambridge University Press.

Johnson, J. W., University of California, Berkeley, & United States. (1963). *Sand movement on coastal dunes*. Berkeley: University of California, Hydraulic Engineering Laboratory.

Khalil, S.M. 2008. The Use of Sand Fences in Barrier Island Restoration: Experience on the Louisiana Coast. ERDC TN-SWWRP-08-4. Vicksburg, MS: U.S. Army Engineer Research and Development Center, https://swwrp.usace.army.mil

Kelsey, H.M. and Carver, G.A. 1988. Late Neogene and Quaternary Tectonics Associated with Northward Growth of the San Andreas Transform Fault, Northern California. Journal of Geophysical Research, Vol. 93, No. B5, 4797-4819, May 10.

Kennedy, M.P., Greene, H.G., and Clarke, S.H. 1987. Geology of the California Continental Margin: Explanation of the California Continental Margin Geologic Map Series – interpretive methods, symbology, stratigraphic units, and bibliography. Bulletin 207, California Department of Conservation, Division of Mine and Geology.

Kniskern, T.A., Warrick, J.A., Farnsworth, K.L., Wheatcroft, R.A., and Goni, M.A. 2011. Coherence of River and Ocean Conditions along the US West Coast during Storms. Continental Shelf Research 31, 789-805.

Kraus, N.C. and Galgano, F.A. 2001. Beach Erosional Hot Spots: Types, Causes, and Solutions. US Army Corps of Engineers, ERDC/CHL CHETN-II-44, September.

Laird, A. 2015. Humboldt Bay Sea Level Rise Adaptation Planning Project: Phase II Report. Prepared for: California Coastal Conservancy, February.

Larson, M., Rosati, J.D., and Kraus, N.C., 2003, Overview of Regional Coastal Sediment Processes and Controls. U.S. Army Corps of Engineers, ERDC/CHL CHETN-XIV-4, June, 23p.

Leithold, E. L. (1987). The relative roles of fluvial-sediment supply and marine processes in continental shelf sedimentation: A study of the modern Eel River and Pleistocene Rio Dell shelves

Li, W.H. and Carver, G.A. 1992. The Late Holocene Stratigraphy of the Eel River Delta. Dept. of Geology, Humboldt State University, Report prepared for Soil Conservation Service, February 17.

Limber, P.W., Patsch, K.B., and Griggs, G.B. 2008. Coastal Sediment Budgets and the Littoral Cutoff Diameter: A Grain Size Threshold for Quantifying Active Sediment Inputs. Journal of Coastal Research 24, 2B 122-133, March.

Lin, L., Hoghai, L., Brown, M.E., and Wu, F. 2013. Pilot Study Evaluation Nearshore Sediment Placement Sites, Noyo Harbor, CA. US Army Corps of Engineers, Coastal Inlets Research Program, ERDC/CHL TR-1-3-2, February.

Lynch, J.F. and Irish, J.D. 1998. STRATFORM Plume Study. Woods Hole Oceanographic Institution, Woods Hole, MA.

Madalon, L.J. and Kendall, T.R. 1993. Dependence on Shoreline Change on Channel Dredge Material Disposal Practices, Humboldt Bay, CA, A Case Study. S.A. Hughes and O.T. Magoon (eds.), Coastal Engineering Considerations in Coastal Zone Management, American Society of Civil Engineers.

Martinez, M.L.M., Hesp, P.A., and Gallego-Fernandez, J.B. 2013b. Chapter 20, Coastal dune restoration: trends and perspectives. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Martinez, M.L.M., Hesp, P.A., and Gallego-Fernandez, J.B. 2013b. Chapter 1, Coastal Dunes: Human Impact and Need for Restoration. M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

McDonald, K. 2015. Differences in the morphology of restored and invaded foredunes, Humboldt Bay, CA. U.S. Fish and Wildlife Service, Humboldt Bay National Wildlife Refuge, Arcata, CA, January.

McLaughlin, R.J., Ellen, S.D., Blake, Jr., M.C., Jayko, A.S., Irwin, W.P., Aalto, K.R., Carver, G.A., and Clarke, Jr., S.H. 2000. Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30x60 Minute Quadrangles and Adjacent Offshore Area, Northern California. USGS Misc. Field Studies MF-2236, v. 1.0.

Meisburger, E.P. 1993. Review of Geologic Data Sources for Coastal Sediment Budgets. US Army Corp of Engineers, Waterways Experiment Station, Instruction Report CERC-93-1, February.

Moffatt & Nichol. 2013. Coastal Regional Sediment Management Plan, Eureka Littoral Cell, California. Prepared for: CA Coastal Sediment Management Workgroup, December.

Morehead, M.D. and Syvitski, J.P., 1999. River Plume Sedimentation Modeling for Sequence Stratigraphy: Application to the Eel River Margin, Northern California. Marine Geology 154, issues 1-4, pp. 29-41, February.

DRAFT

Mossa, J. and Meisburger, A.M., 1992, Geomorphic Variability in the Coastal Zone. U.S. Army Corps of Engineers, Coastal Geology and Geotechnical Program, Technical Report CERC-92-4, May, 123p.

Mullenbach, B.L., Nittrouer, C.A., Puig, P., Orange, D.L., 2004. Sediment deposition in a modern submarine canyon: Eel Canyon, northern California. Marine Geology 211, 101–119.

National Research Council. 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press.

Nittrouer, C.A., Austin Jr., J.A., Field, M.E., Kravitz, J.H., Syvitski, J.P.M, and Wiberg, P.L. 2007. Writing a Rosetta stone: insights into continental-margin sedimentary processes and strata. In: Nittrouer, C.A. et al. (eds.) Continental Margin Sedimentation, from sediment transport to sequence stratigraphy, Special Publication 37, International Association of Sedimentologists.

Nittrouer, C.A. 1999. STRATFORM: overview of its design and synthesis of its results. Marine Geology 154, issues 1-4, pp. 3-12, February.

Nordstrom, K.F. and Jackson, N.L. 2013. Chapter 2, Foredune restoration in urban settings. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Nordstrom, K. F. (2008). Beach and dune restoration. Cambridge, UK: Cambridge University Press.

Northern Hydrology & Engineering (NHE). 2015. Humboldt Bay: sea level rise, hydrodynamic modeling, and inundation vulnerability mapping. Prepared for: State Coastal Conservancy and Coastal Ecosystems Institute of Northern California. April.

Ogle, B.A. 1953. Geology of the Eel River Valley Area, Humboldt County, California. California Division of Mines Bulletin 164, November.

Ogston, A.S., Cacchione, D.A., Sternberg, R.W., and Kineke, G.C., 2000, Observations of storm and river flood-driven sediment transport on the northern California continental shelf: Continental Shelf Research, v. 20, no. 16, p. 2141–2162.

Patsch, K. and Griggs, G. 2007. Development of Sand Budgets for California's Major Littoral Cells. Institute of Marine Sciences, University of Santa Cruz. Prepared for: California Department of Boating and Waterways and California Coastal Sediment Management Workgroup, January.

Patsch, K. and Griggs, G. 2006. Littoral Cells, Sand Budgets, and Beaches: Understanding California's Shoreline. Institute of Marine Sciences, University of Santa Cruz. Prepared for: California Department of Boating and Waterways and California Coastal Sediment Management Workgroup, October.

Pickart, A.J. 2013. Chapter 10, Dune restoration over two decades at the Lanphere and Ma-le'l Dunes in Northern California. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Pickart, A.J. 1997. Control of European Beachgrass (Ammophila arenaria) on the West Coast of the United States. California Exotic Pest Plant Council, 1997 Symposium Proceedings.

Psuty, N.P. and Silveira, T.M. 2013. Chapter 4, Restoration of coastal foredunes, a geomorphological perspective: examples from New York and New Jersey, USA. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Puig, P., Ogston, A.S., Mullenbach, B.L., Nittrourer, C.A., and Sternberg, R.W. 2003. Shelf-to-Canyon Sediment-Transport Processes on the Eel Continental Margin (Northern California). Marine Geology, 193, Issues 1-2, 129-149, January.

Pullen, J.D., and Allen, J.S., 2000, Modeling studies of the coastal circulation off Northern California; shelf response to a major Eel River flood event: Continental Shelf Research, v. 20, no. 16, p. 2213–2238.

Rhind, P., Jones, R. and Jones, L. 2013. Chapter 8, The impact of dune stabilization on the conservation status of sand dune systems in Wales. . M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Ritter, J.R. 1972. Sand Transport by the Eel River and Its Effect on Nearby Beaches. USGS and California Department of Water Resources. Report #2001-07 pg. 17.

Roberts, J.A, Bleistein, D.M., and Dolan, R. 1967. Investigations of Marine Processes and Coastal Landforms near Crescent City, California, Volume I: Technical Discussion. Atmospheric Research Group, Altadena, CA, report prepared for: Earth Science Division, Department of Army, July.

Rosati, J.D. and Kraus, N.C. 1999. Formulation of Sediment Budgets at Inlets. US Army Corps of Engineers, Coastal Engineering Technical Note IV-15, Rev. September.

Scheffner, N.W. 1992. Dispersion Analysis of Humboldt Bay, California, Interim Offshore Disposal Site. US Army Corps of Engineers Waterways Experiment Station, Miscellaneous Paper DRP-92-1, June.

Sloan, J., Miller, J.R., Lancaster, N., 2001. Response and recovery of the Eel River, California, and its tributaries to floods in 1955, 1964, and 1997. Geomorphology 36, 129–154.

Smith, J.B. 1995. Literature Review on the Geologic Aspects of Inner Shelf Cross-Shore Sediment Transport. US Army Corps of Engineers, Waterways Experiment Station, Miscellaneous Paper CERC-95-3, February.

DRAFT

Smith, L.M. and Patrick, D.M. 1979. Engineering Geology and Geomorphology of Streambank Erosion, Report I, Eel River Basin, California. Geotechnical Laboratory, U.S. Army Engineer Waterways Experiment Station, Technical Report GL-79-7, September.

Sommerfield, C.K. and Nittrouer, C.A. 2014. Comment on "Eel River margin source-to-sink sediment budgets: Revisited" by J.A. Warrick [Marine Geology 351 (2014) 25-37]. Marine Geology 357, pp. 401-403.

Sommerfield, C.K., Ogston, A.S., Mullenbach, B.L., Drake, D.E., Alexander, C.R., Nittrouer, C.A., Borgeld, J.C., Wheatcroft, R.A., and Leithold, E.L. 2007. Oceanic dispersal and accumulation of river sediment. In: Nittrouer, C.A. et al. (eds.) Continental Margin Sedimentation, from sediment transport to sequence stratigraphy, Special Publication 37, International Association of Sedimentologists.

Sommerfield, C.K., Nittrouer, C.A., 1999. Modern accumulation rates and a sediment budget for the Eel shelf: a flood-dominated depositional environment. Marine Geology 154, 227–241.

Sommerfield, C.K., Nittrouer, C.A., Alexander, C.R., 1999. 7Be as a tracer of flood sedimentation on the northern California continental margin. Continental Shelf Research 19, 335–361.

Sommerfield, C.K., Drake, D.E., Wheatcroft, R.A., 2002. Shelf record of climatic changes in flood magnitude and frequency, north-coastal California. Geology 30, 395–398.

Sternberg, R.W. and Ogston, A.S. 1998. Field Measurements of Sediment Transport Processes in STRATFORM: Extended Duration Observations. University of Washington, School of Oceanography, Seattle, WA.

Syvitski, J.P. and Morehead, M.D. 1977. Numerical Coupling of River Discharge to Shelf/Slope Sedimentation Models. Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO.

Thorne, J.H., Boynton, R., Flint, L., Flint, A., and N'goc Le, T. 2012. Development and application of downscaled hydroclimatic predictor variables for use in climate vulnerability and assessment studies, a white paper from the California Energy Commission's California Climate Change Center. CEC-500-2012-010, prepared for: California Energy Commission, prepared by: University of California, Davis, July.

Traykovski, P., Geyer, W.R., Irish, J.D., Lynch, J.F., 2000. The role of wave-induced density-driven fluid mud flows for cross-shelf transport on the Eel River continental shelf. Continental Shelf Research 20, 2113–2140.

U.S. Army Corps of Engineers. 2002. Coastal Engineering Manual Part II, Coastal Hydrodynamics. EM110-2-1100.

U.S. Army Corps of Engineers. 2002b. Coastal Engineering Manual Part III, Chapter 4, Wind-Blown Sediment Transport. EM110-2-1100, April 30, 84p.

U.S. Army Corps of Engineers. 1985. Coastal Engineering Technical Note, direct methods for calculating wavelength. CETN-1-17.

U.S. Army Corps of Engineers. 1984. Shore Protection Manual, Volume 1 and 2. Department of the Army, Waterways Experiment Station, Coastal Engineering Research Center.

Vestergaard, P. 2013. Chapter 4: Natural plant diversity development on a man-made dune system. M.L. Martinez et al. (eds.), Restoration of Coastal Dunes, Springer Series on Environmental Management, Springer, Verlag.

Warrick, J.A. 2014. Eel River margin source-to-sink sediment budgets: Revisited. Marine Geology 351, pp. 25-37.

Warrick, J.A., Madej, M.A., Goni, M.A. and Wheatcroft, R.A. 2013. Trends in the Suspended-Sediment Yields of Coastal Rivers of Northern California, 1955-2010. Journal of Hydrology, 489, 108-123.

Wiberg, P.L. and Sherwood, C.R. 2006. Calculating wave-generated bottom orbital velocities from surface-wave parameters. Computers & Geosciences, 34, 1243-1262.

Wheatcroft, R.A., Wiberg, P.L., Alexander, C.R., Bentley, S.J., Drake, D.E., Harris, C.K. and Ogston, A.S. 2007. Post-depositional alteration and preservation of sedimentary strata. In: Nittrouer, C.A. et al. (eds.) Continental Margin Sedimentation, from sediment transport to sequence stratigraphy, Special Publication 37, International Association of Sedimentologists.

Willis, C.M. and Griggs, G.B. 2003. Reductions in Fluvial Sediment Discharge by Coastal Dams in California and Implications for Beach Sustainability. Journal of Geology, v. 111, p. 167-182.

Willis, C. M., D. Sherman, et al. 2002. Chapter 7: Impediments to Fluvial Delivery of Sediment to the Shoreline. California Beach Restoration Study. M. Coyne and K. Sterrett. Sacramento, California, California Boating and Waterways and State Coastal Conservancy

Young, L.E. 1963. Floods near Fortuna, California. U.G. Geological Survey, Hydrologic Investigations, Atlas HA-78.

PERSONS CONTACTED

Greg Kamman, Kamman Hydrology & Engineering, Inc. (KHE) Personal Communications, June 1, 2015.

DRAFT

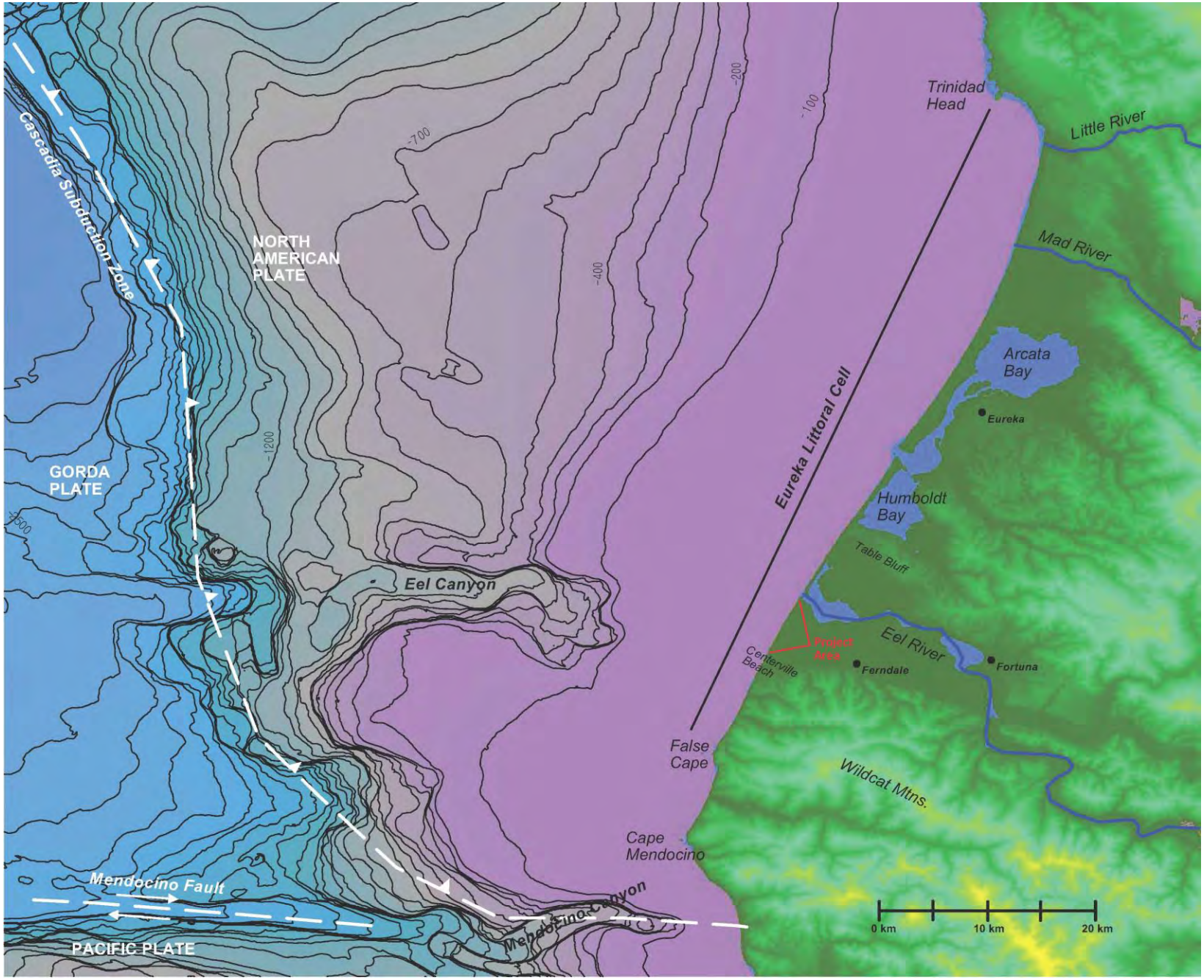


FIGURE 1: Study Area with key geographic, bathymetric and plate-tectonic features. Wave buoy locations are also provided. Bathymetry contours in meters (100 m interval) below sea level. Off-shore fault locations are approximate per McLaughlin et al., 2000 and Clarke and White, 1980.

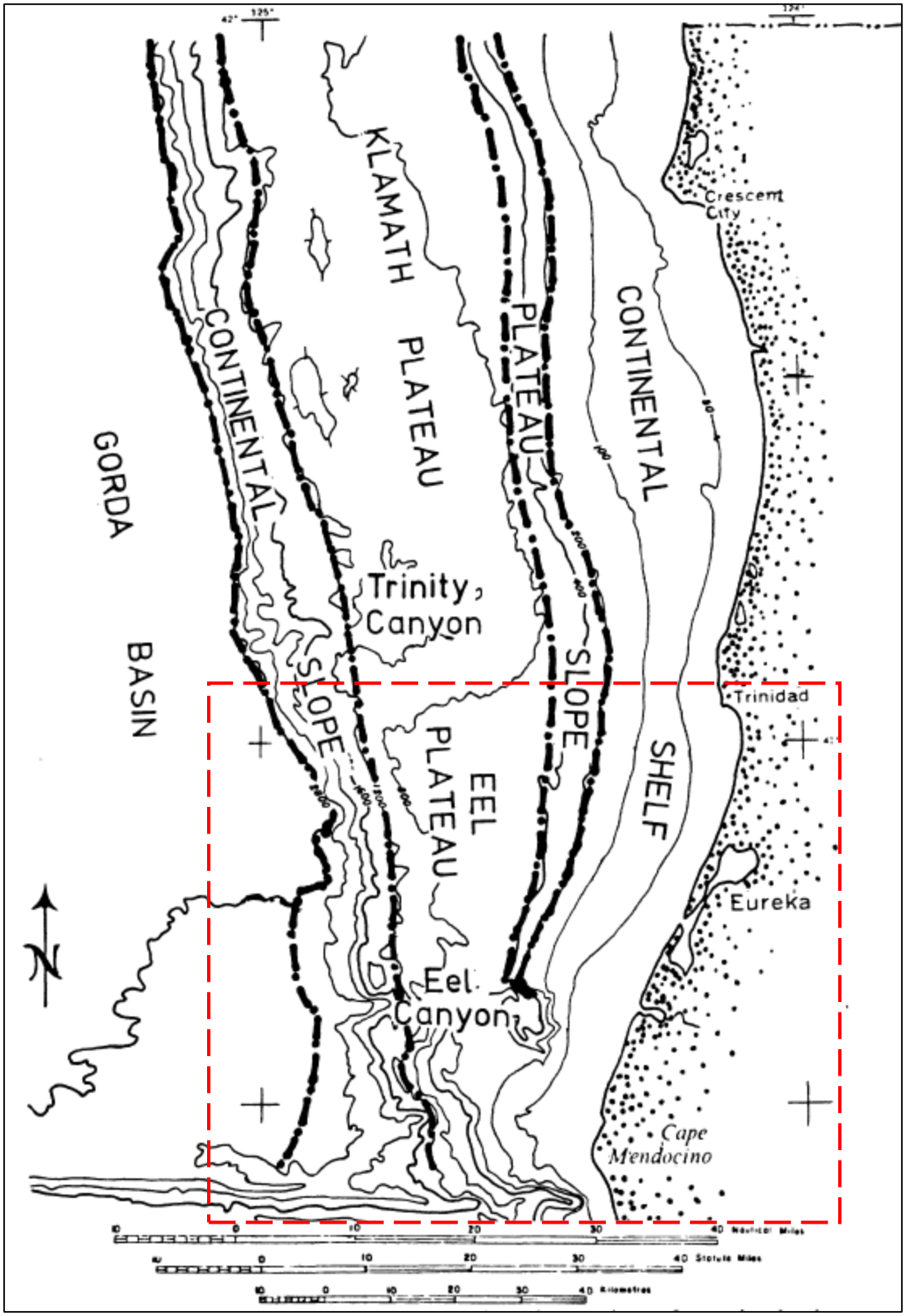


FIGURE 2a: Bathymetry of the northern California continental margin and physiographic feature terminology. Source: Field et al., 1980. Dashed red box outlines approximate area depicted in Figure 1.

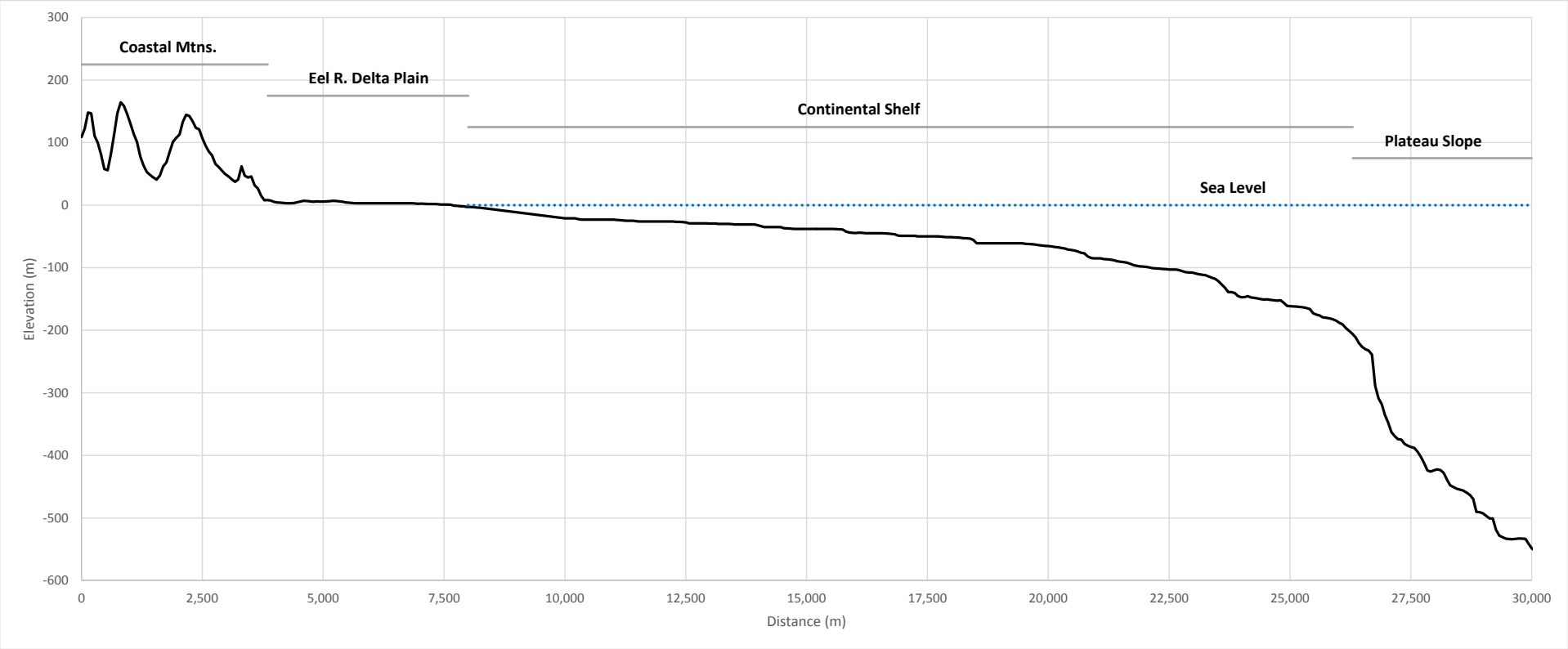


FIGURE 2b: Morphology of continental-margin off the Eel River mouth. Alignment of profile perpendicular to shoreline on north side of Eel Canyon. Continental-margin morphology terminology per Nittrouer et al., 2007; Smith, 1995; and Field et al., 1980.

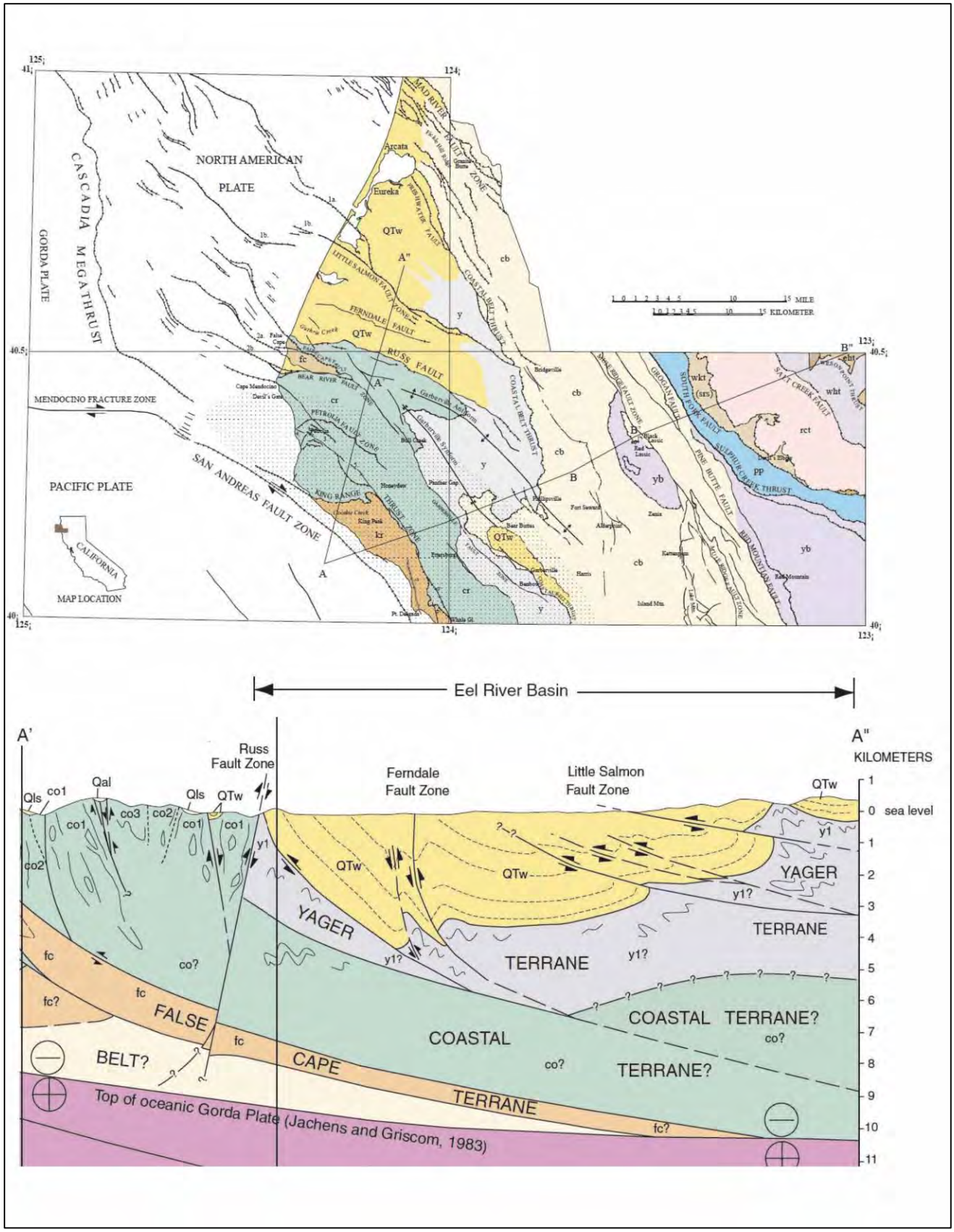


FIGURE 3a: Regional Geology of Eel River coastal plain. Alignment of cross-sectional profile A'-A" (lower graphic) is indicated in upper graphic. Formation abbreviations: QTw – marine and non-marine siltsone, sandstone, and mudstone; y1 - sheared and highly folded mudstone of the Yager terrane; co – highly folded and sheared sandstone, mudtone (mélange) of the Coastal terrane; and fc – thin-bedded sandstone and limestone of the False Cape terrane. Modified from McLaughlin et al., 2000.

FIGURE 3b: Local Geology of Eel River coastal plain. Formation abbreviations: QTw – marine and non-marine siltsone, sandstone, and mudstone; y1 - sheared and highly folded mudstone of the Yager terrane; Qm – Holocene and late Pleistocene marine shoreline and aeolian beach and dune sands ; Qt – Holocene and Pleistocene non-marine terrace deposits of river-born sediments; and Qal – Holocene clay, silt, sand, gravel and boulders deposited in modern stream channels and flood plains. Source: McLaughlin et al., 2000.

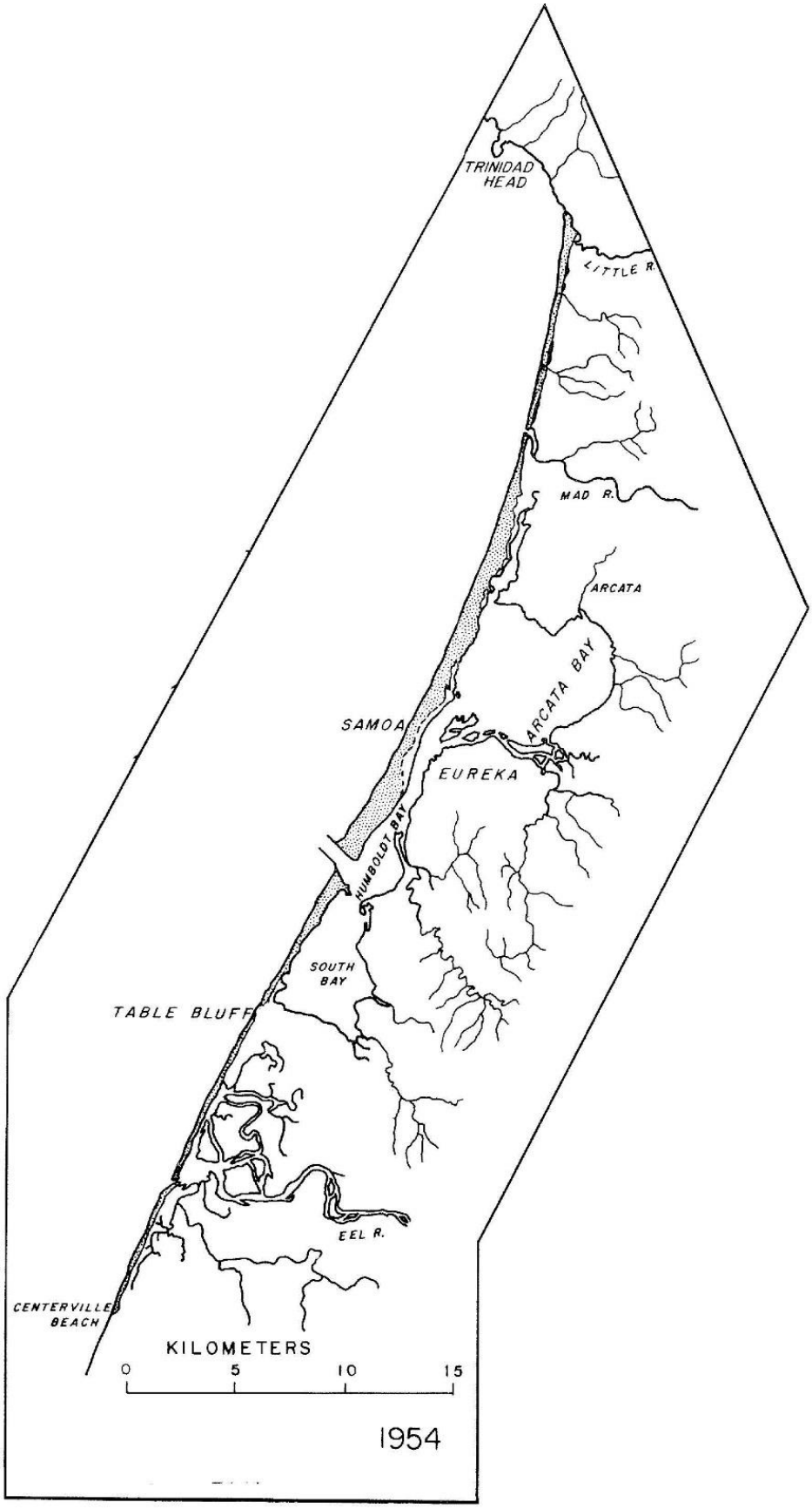


FIGURE 4: Coastal dunes (stippled area) found between Centerville Beach and the Little River (circa 1954), Humboldt County, California. Modified from Cooper, 1967.

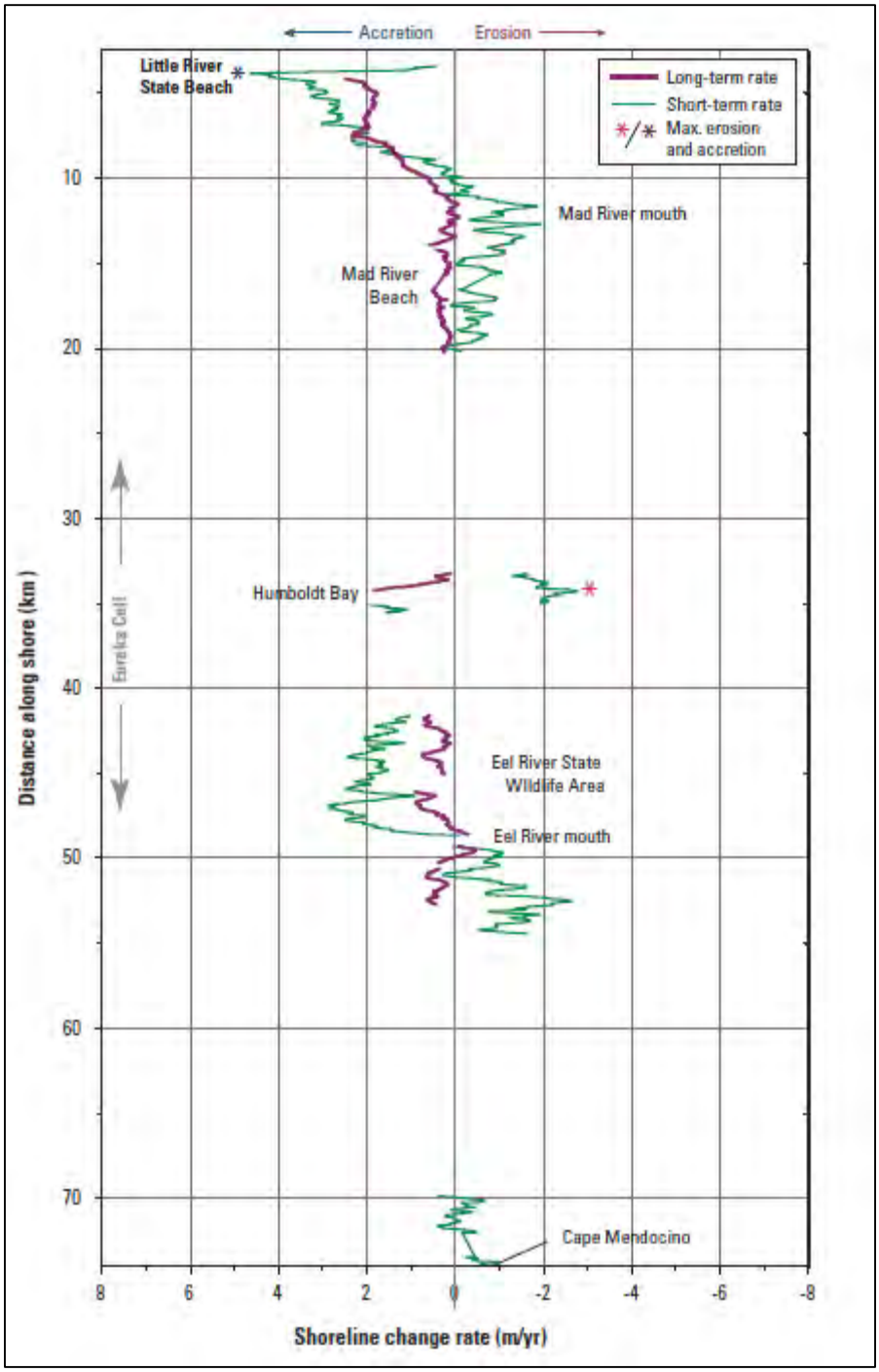


FIGURE 5: USGS estimated long- and short-term shoreline change rates for the Eureka region. Source: Hapke et al., 2006.

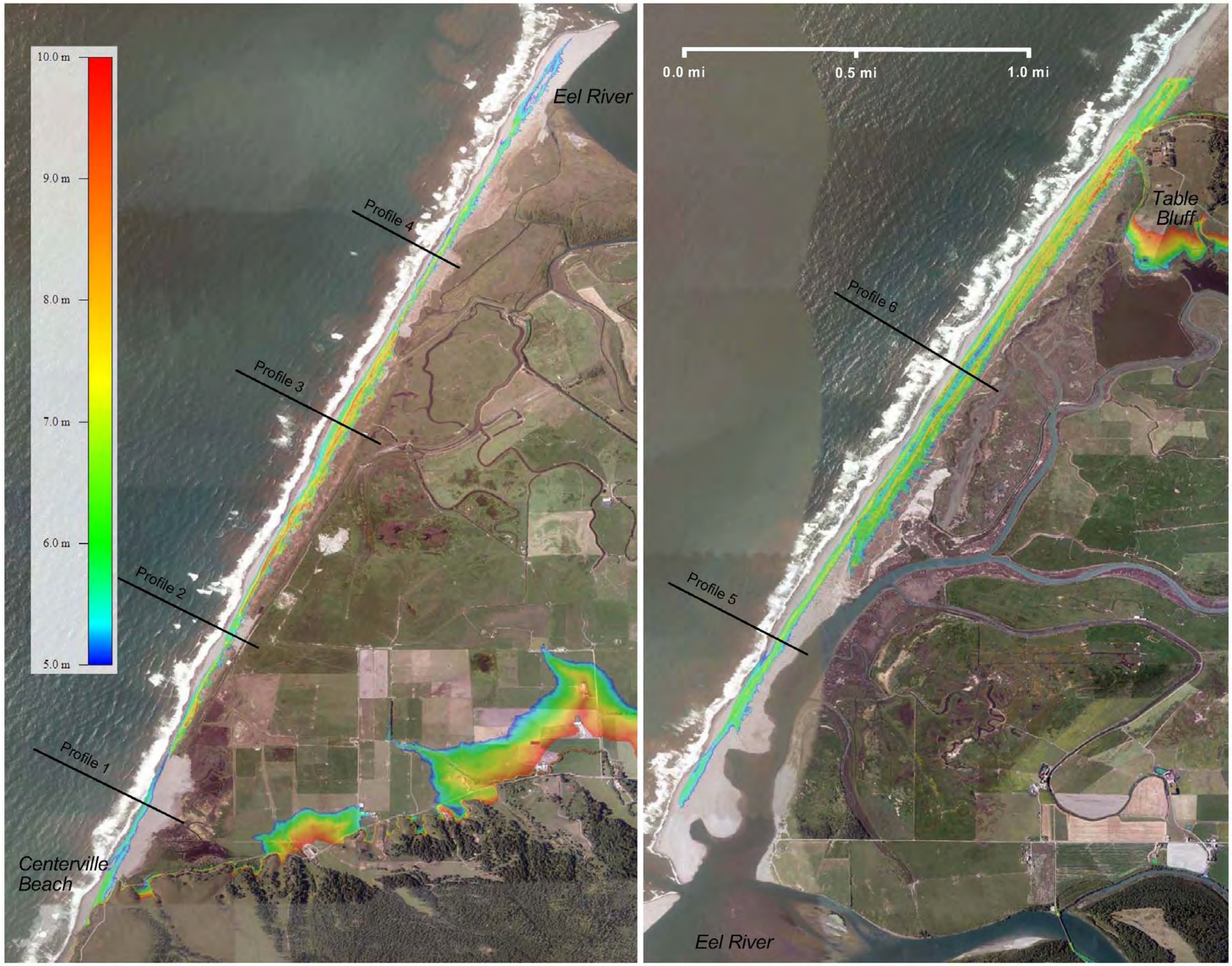


FIGURE 6: Shaded relief map of Eel River coastal plain dune fields. Shading between 5- and 10-meter elevations.

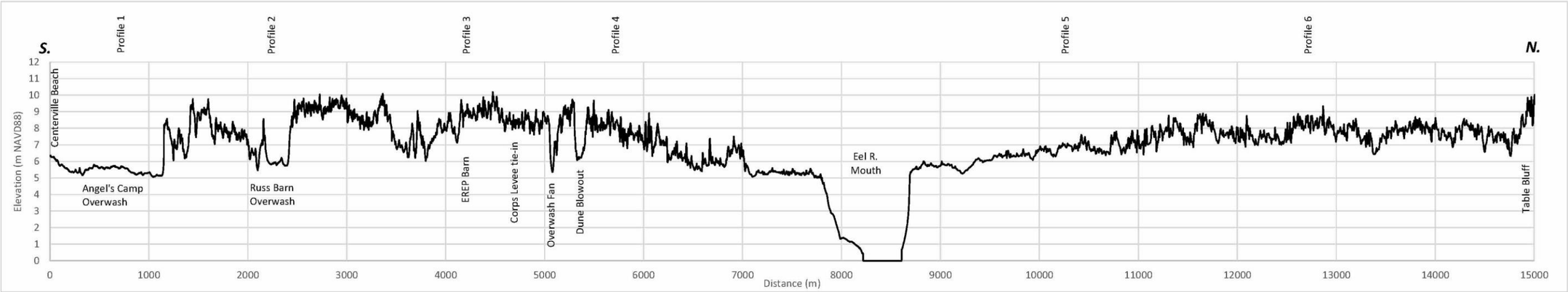


FIGURE 7: Long profile along of Eel River coastal plain foredunes, Centerville Beach to Table Bluff.

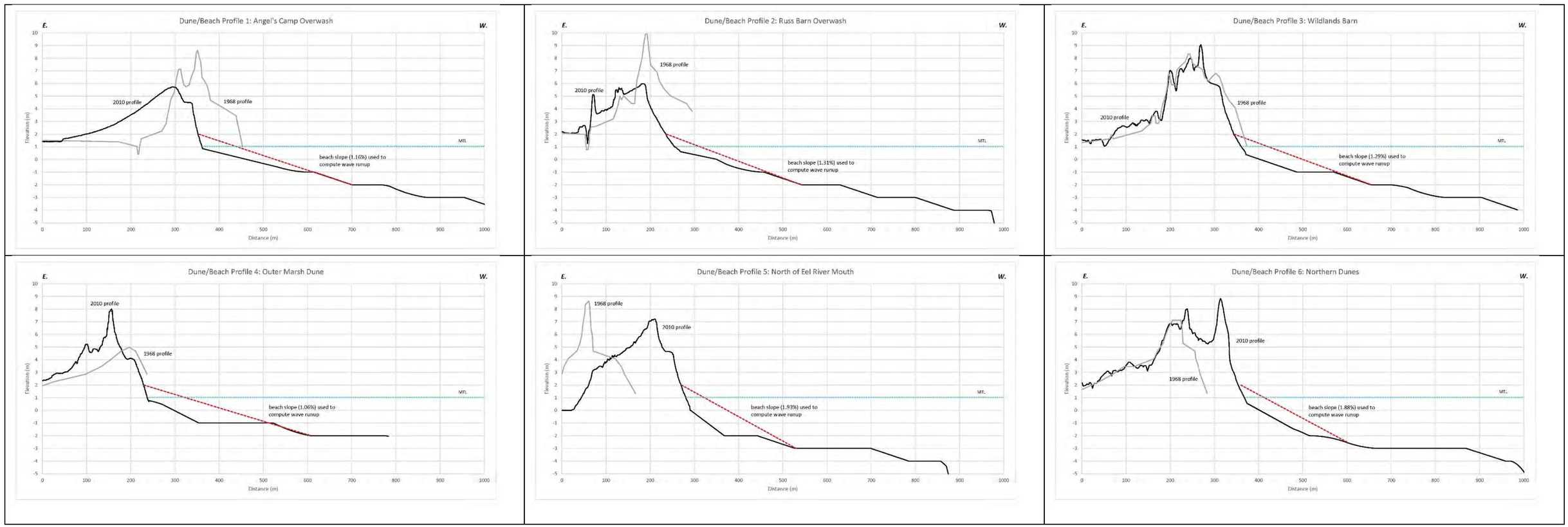


FIGURE 8: Dune/beach profiles along Eel River coastal plain, Centerville Beach to Table Bluff (see Figure 6 for profile locations).

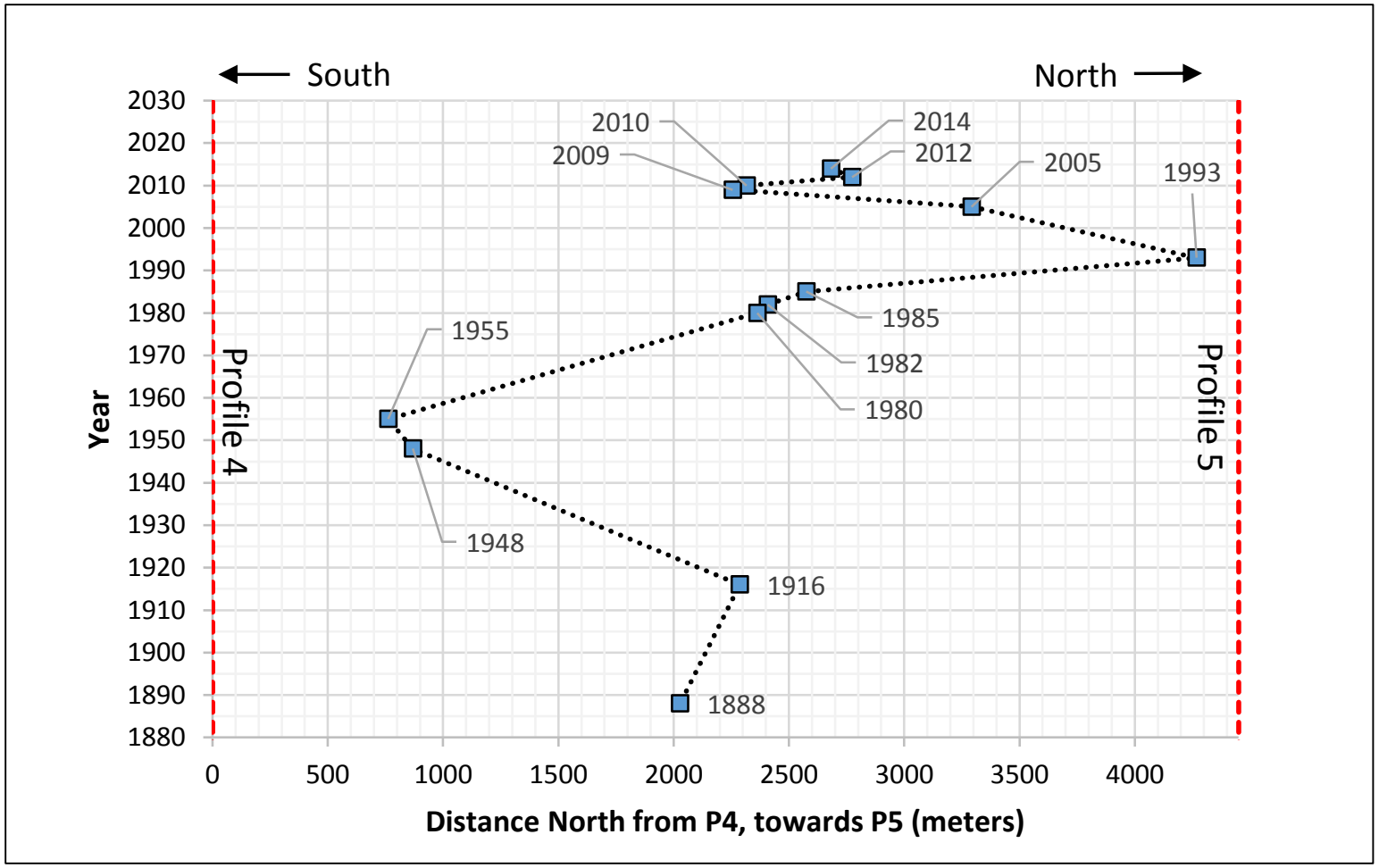


FIGURE 9: Chronology of Eel River inlet location relative to Profiles 4 and 5 (see Figure 6 for location of profiles).

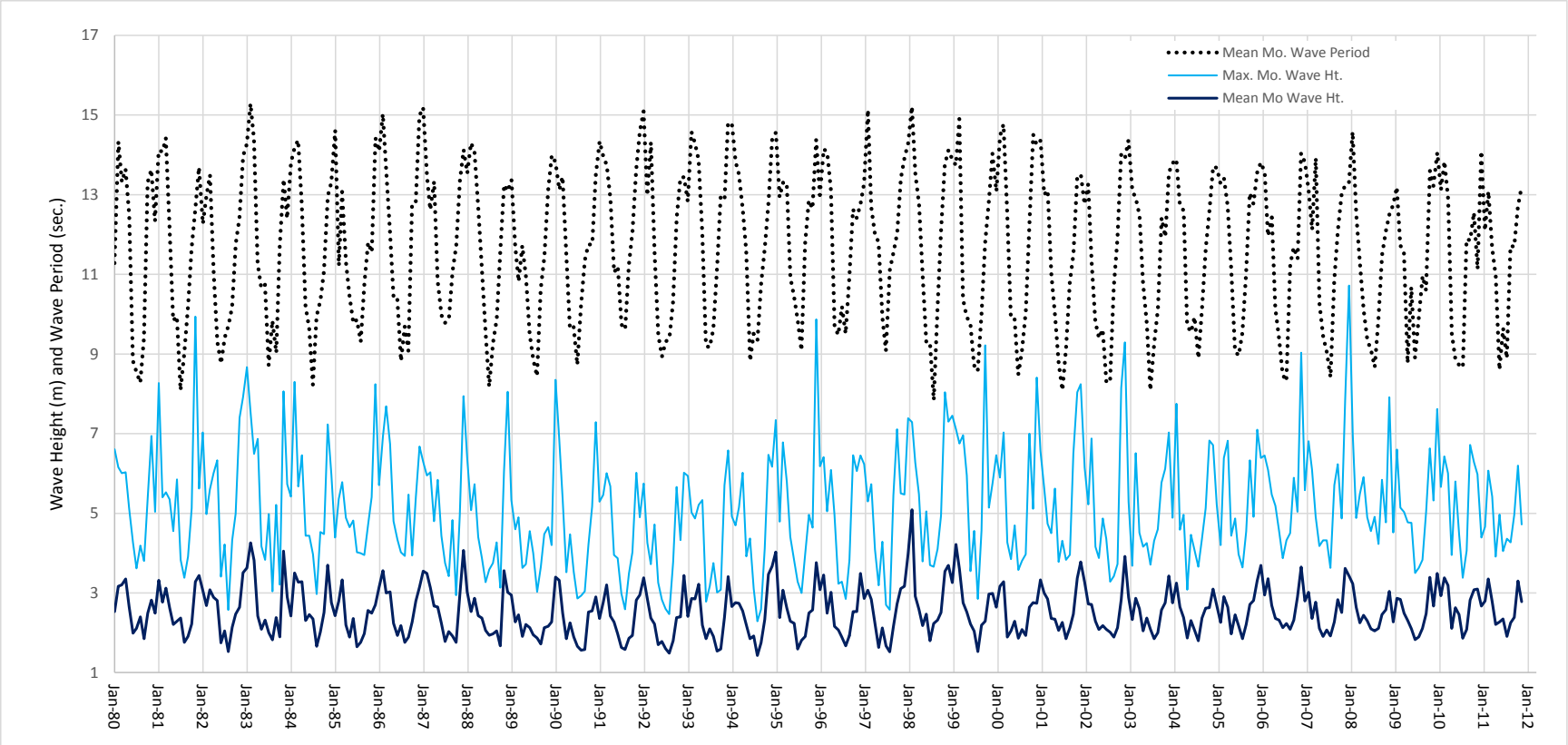


FIGURE 10: Monthly wave height and wave period information for WIS buoy 83048 (1980-2011; see Figure 1 for buoy location).

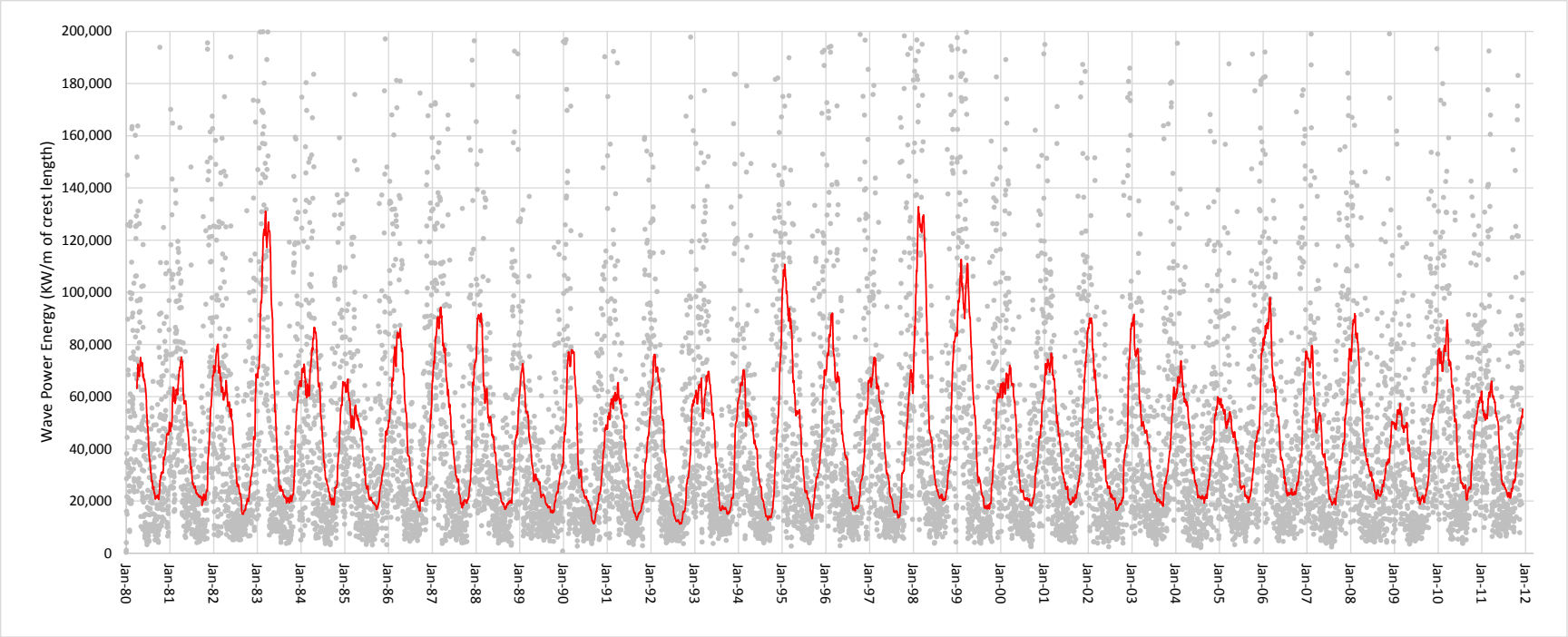


FIGURE 11: Calculated daily wave power energy for period 1980 through 2011. Red line is 90-day running average of daily values. See Figure 1 for buoy location.

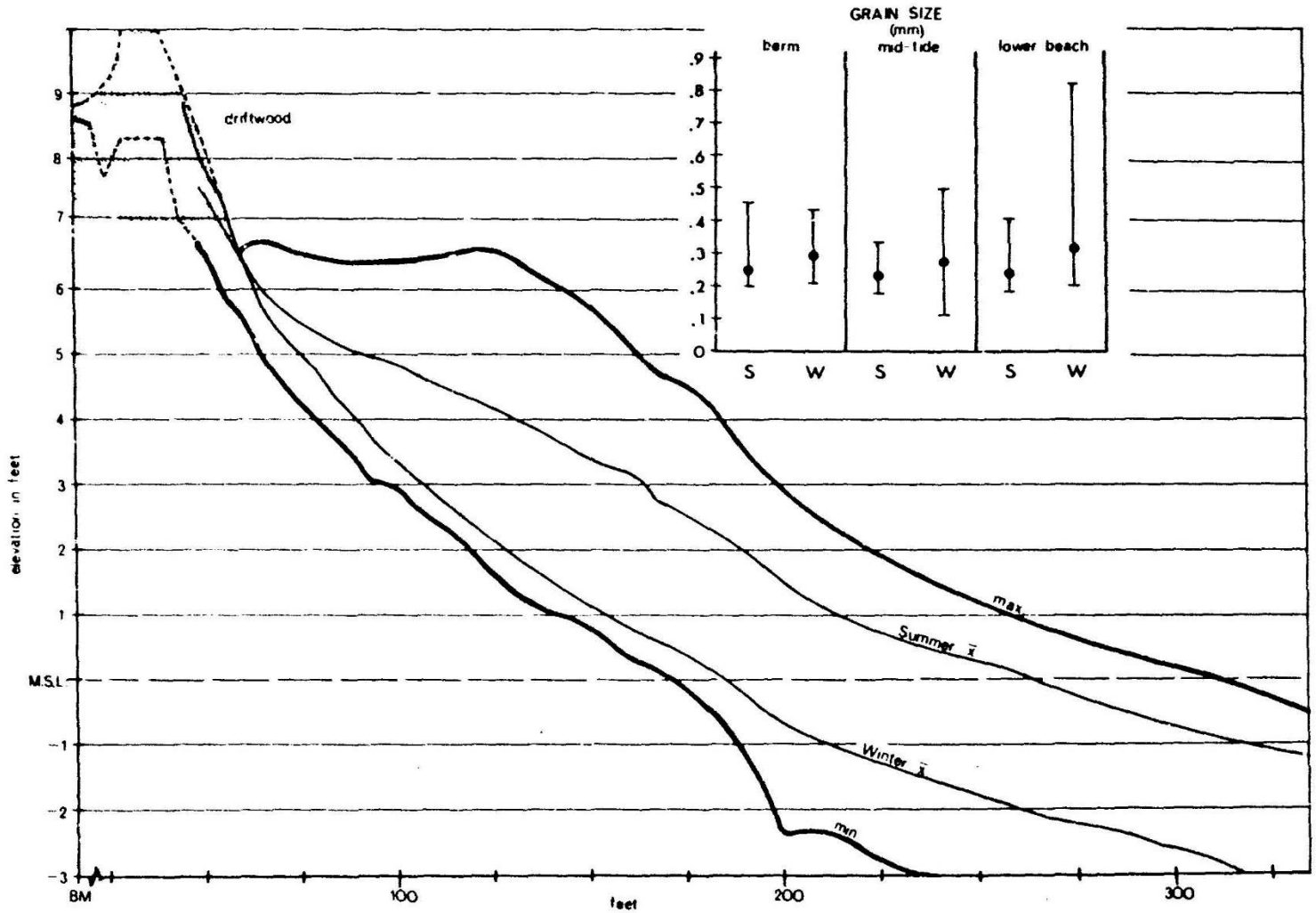


FIGURE 12: Seasonal cycle of beach change at South Beach, Crescent City. This cycle and magnitude of beach erosion and subsequent reconstruction is typical along the California coast and is representative of a similar process along the Eel River coastal plain beaches. Source: Roberts et al., 1967.

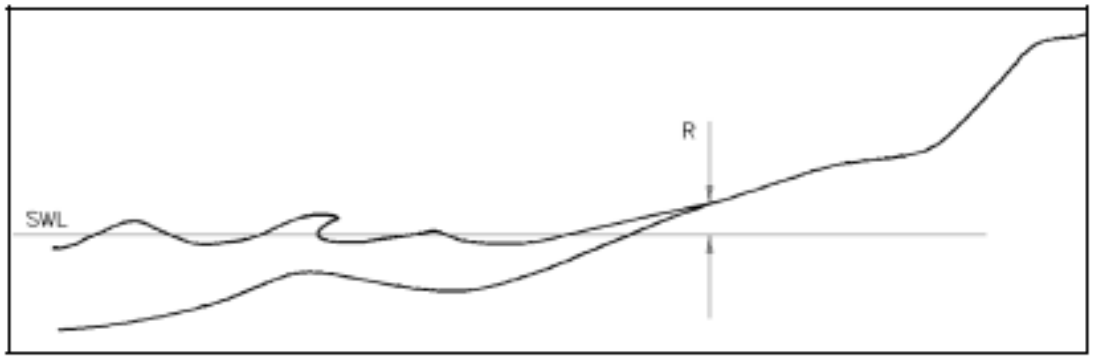


FIGURE 13: Definition sketch of wave runup. Source: U.S. Army Corps, 2002.

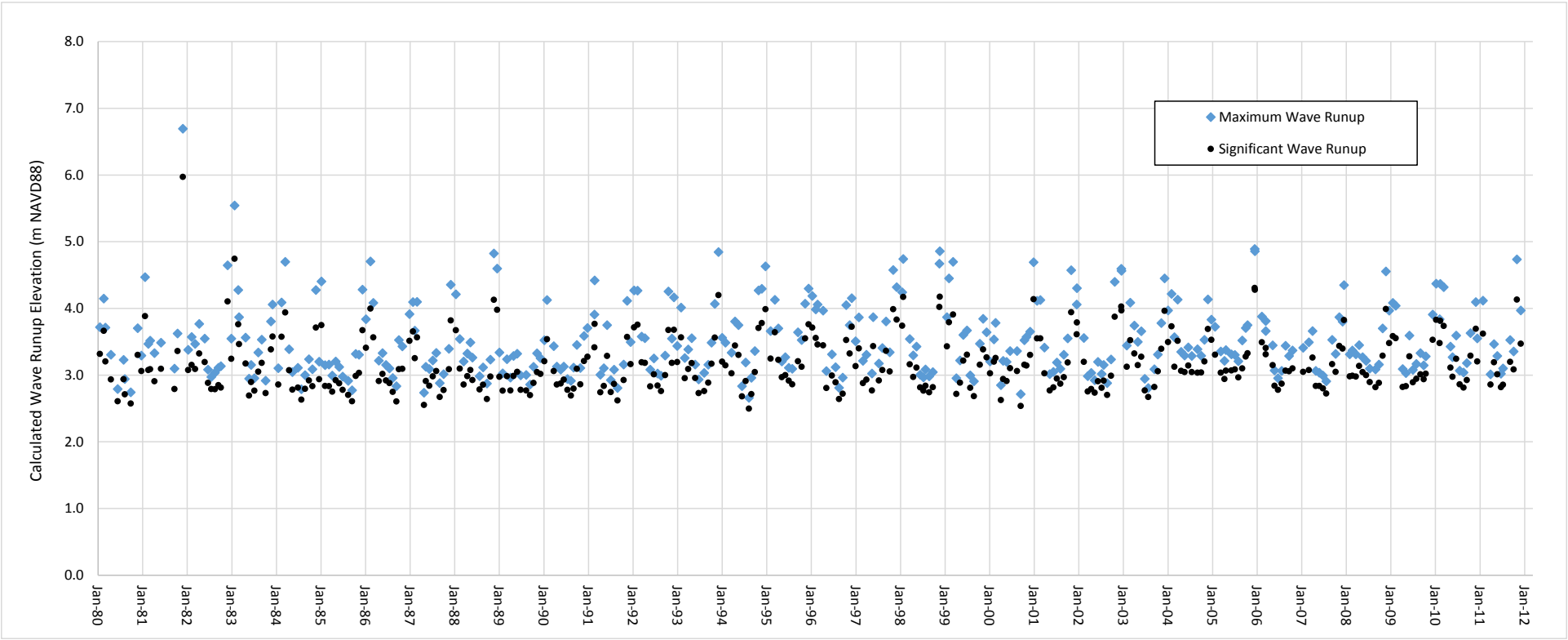


FIGURE 14: Calculated maximum and significant wave runup for period 1980 through 2011.

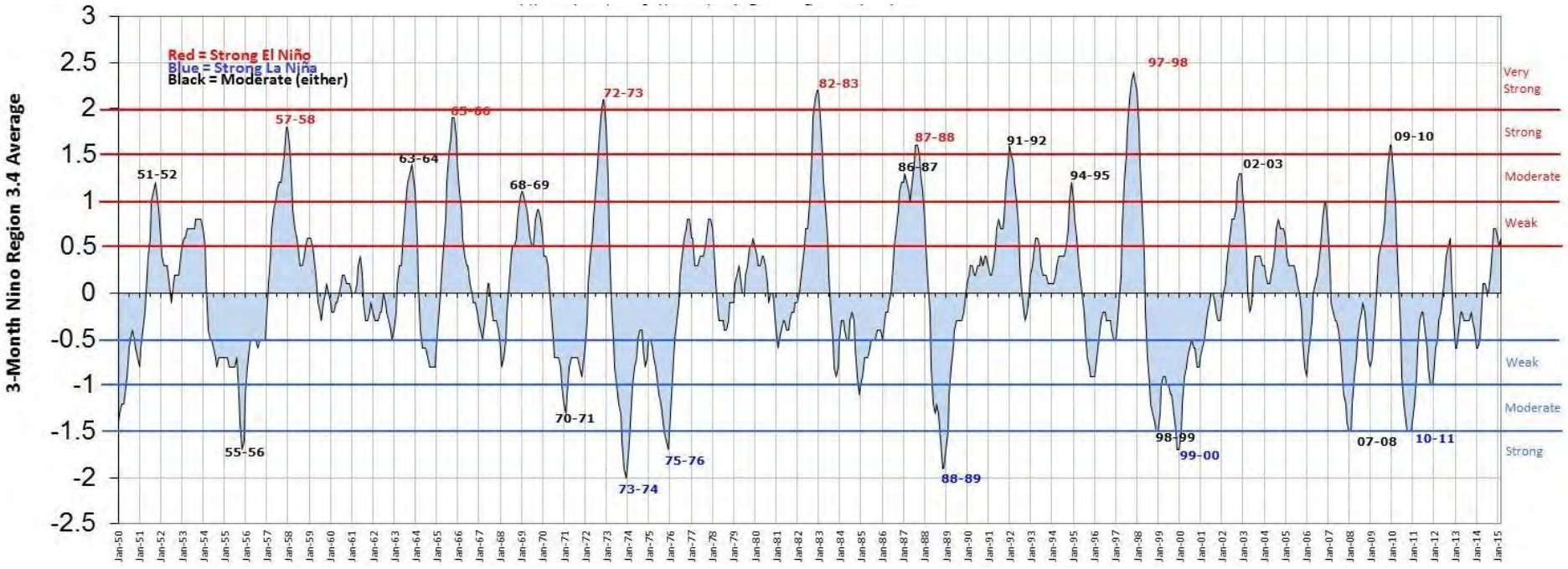


FIGURE 15: Oceanic Nino Index (ONI) rating the relative strength of El Nino and La Nina events from 1950-2015. Source: National Weather Service, Climate Prediction Center (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml).

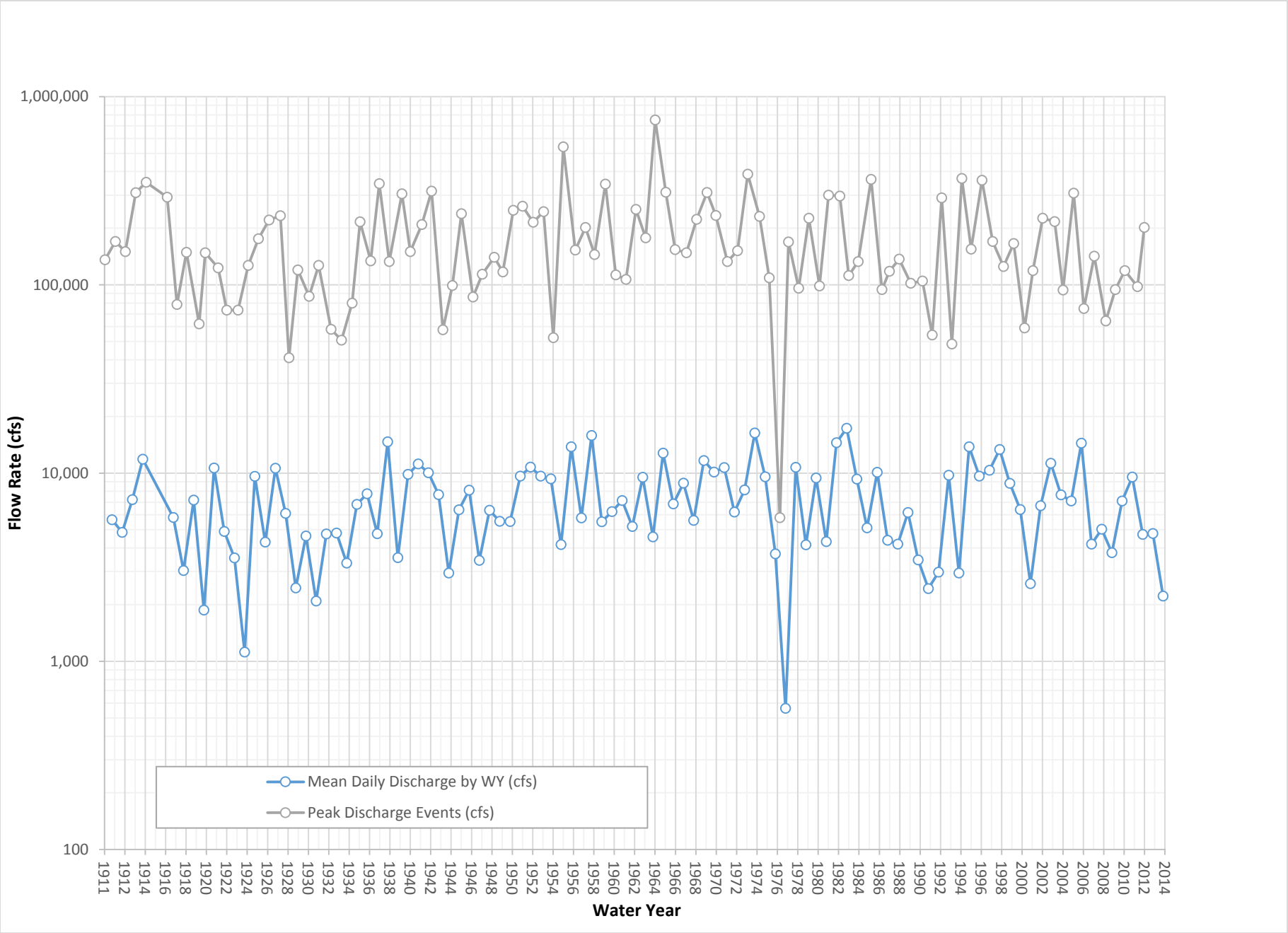


FIGURE 16: Mean annual flow and annual peak discharges for Eel River at Scotia, CA (USGS gauge 11477000), WY 1912-2014.

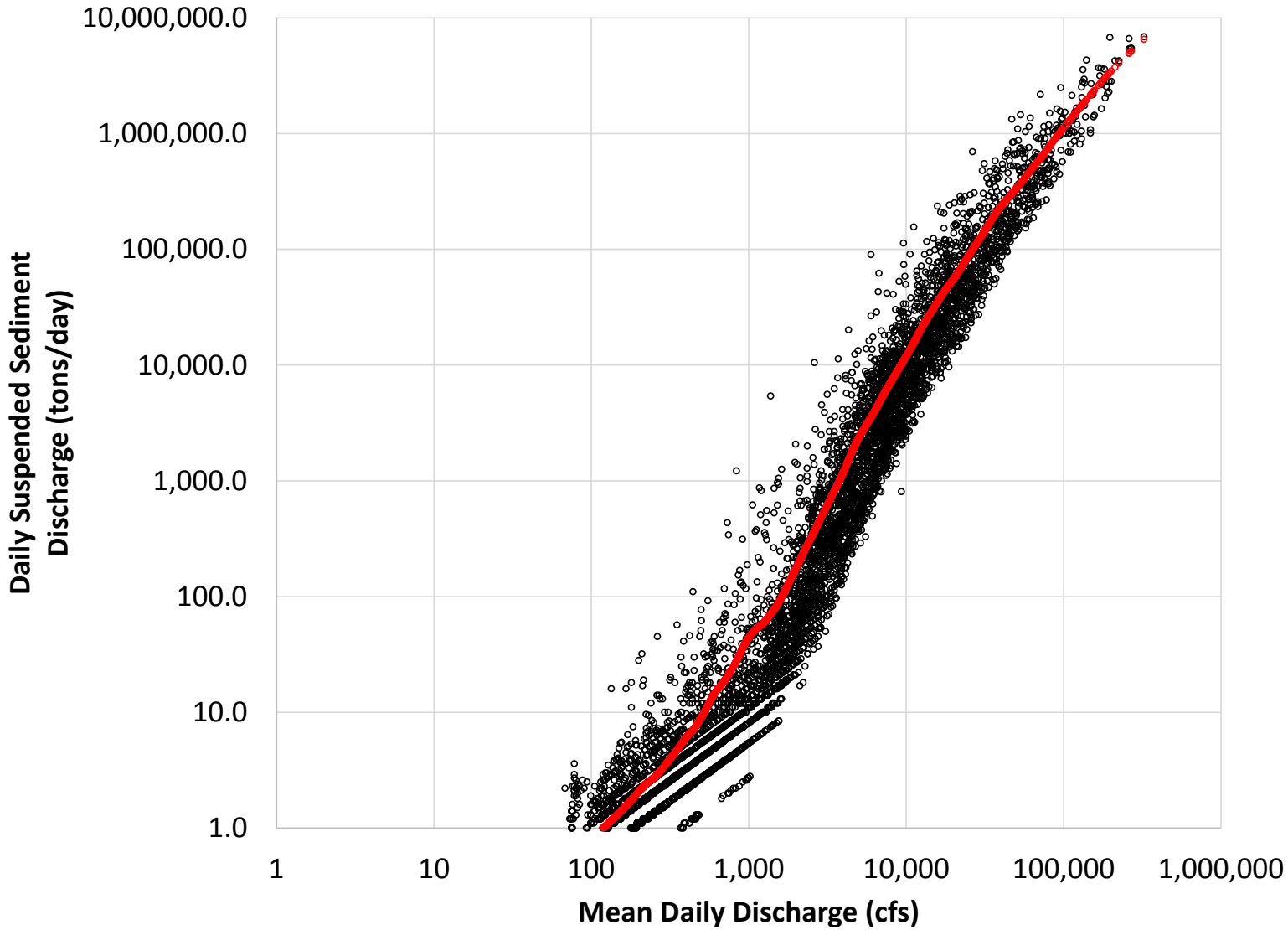


FIGURE 17: Mean daily flow versus suspended sediment discharge rating curve for the period 1960-1980. Measured at USGS gauge 11477000 on the Eel River at Scotia. A best trend (red line) was fit to the data using the LOESS local regression algorithm with a LOESS smoothing parameter of 0.25.

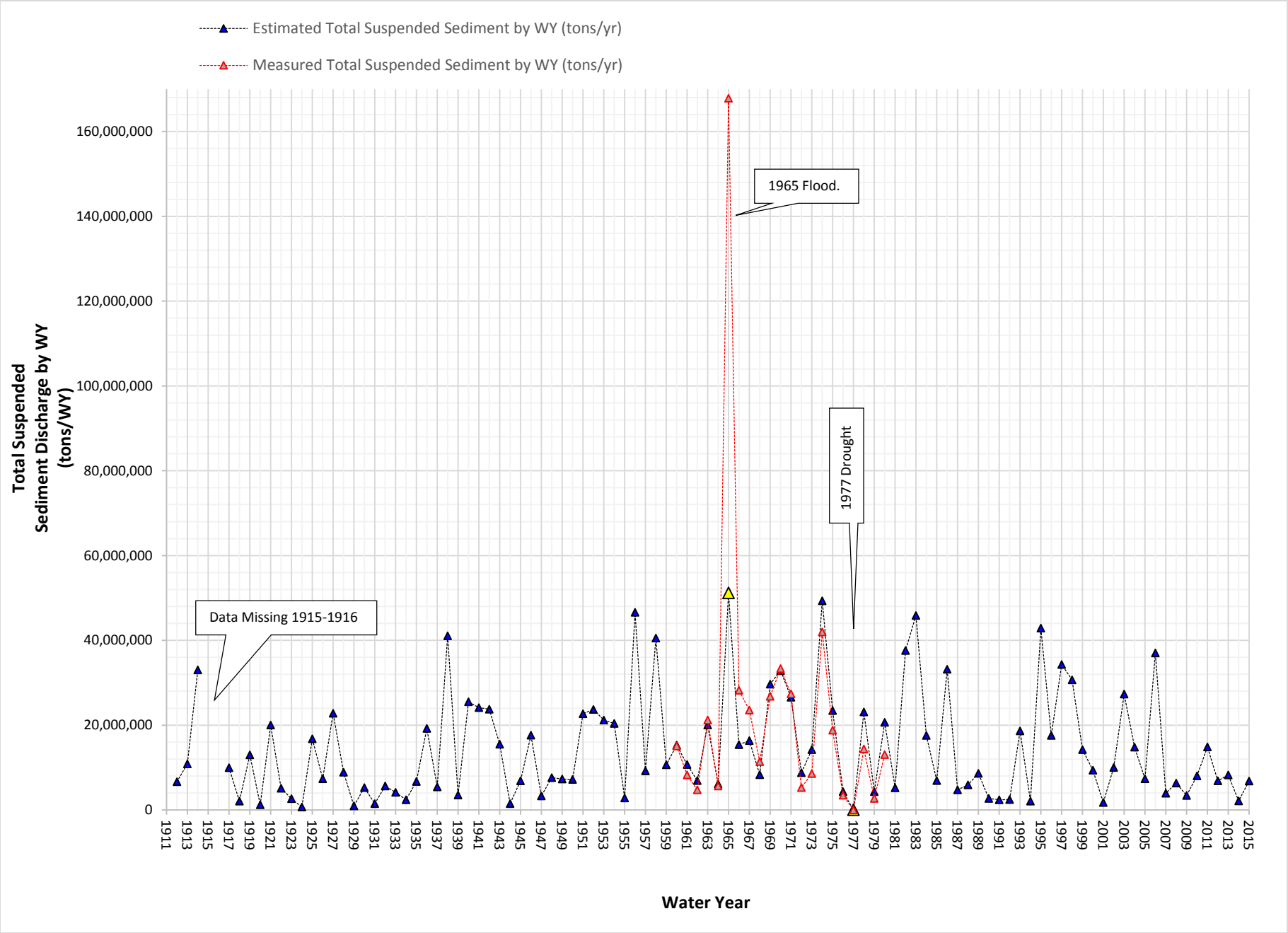


FIGURE 18: Estimated and measured total annual suspended sediment discharge (tons/yr) from Eel River to Eureka littoral cell.

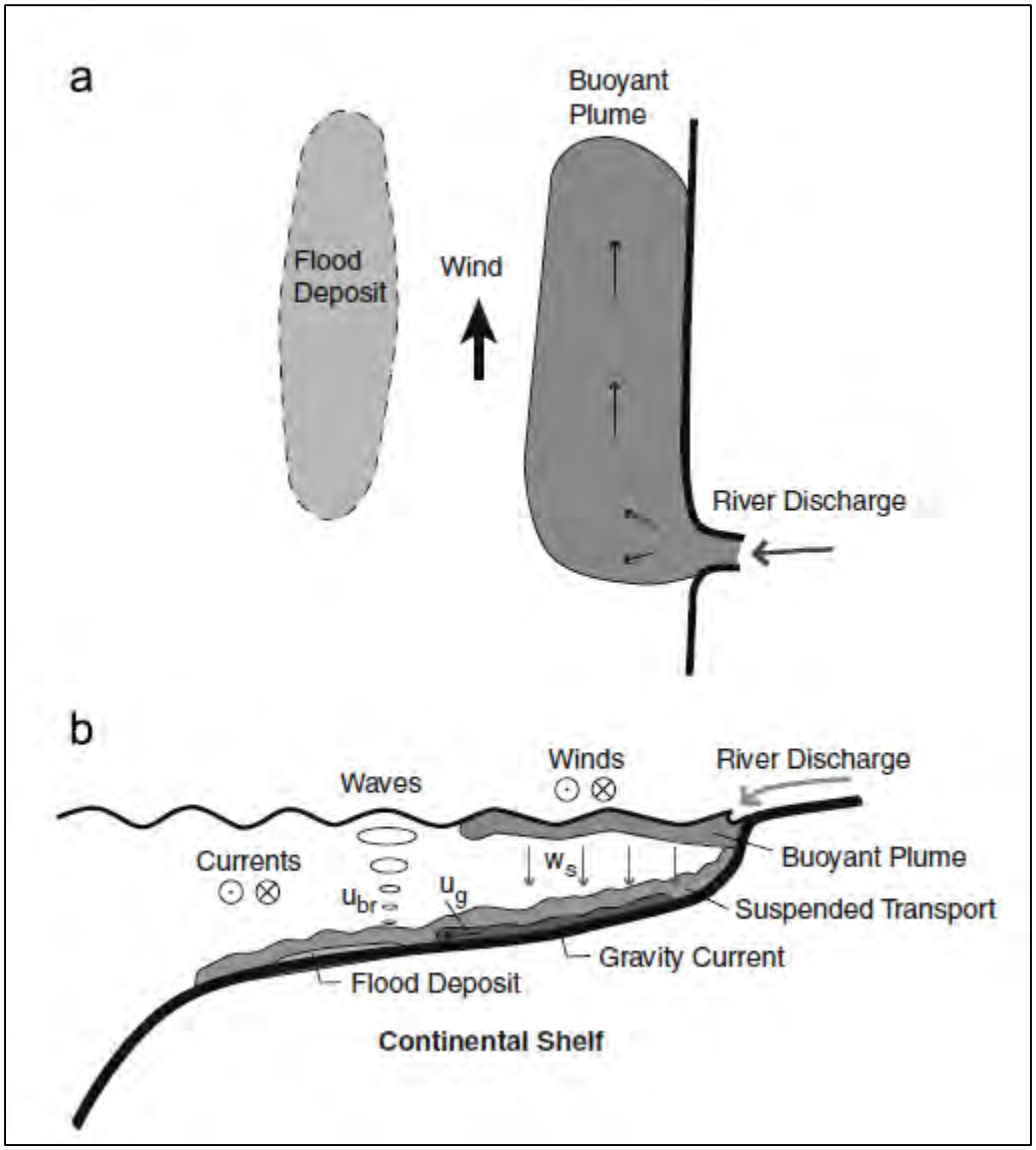


FIGURE 19: Conceptual model of typical storm plume dispersal and deposition at the Eel River mouth; in plan view (a) and cross-section view (b). W_s = sediment settling, U_g = sediment transport by gravity flows, and U_{br} = resuspension by waves and currents (Source: Kniskern et al., 2011).

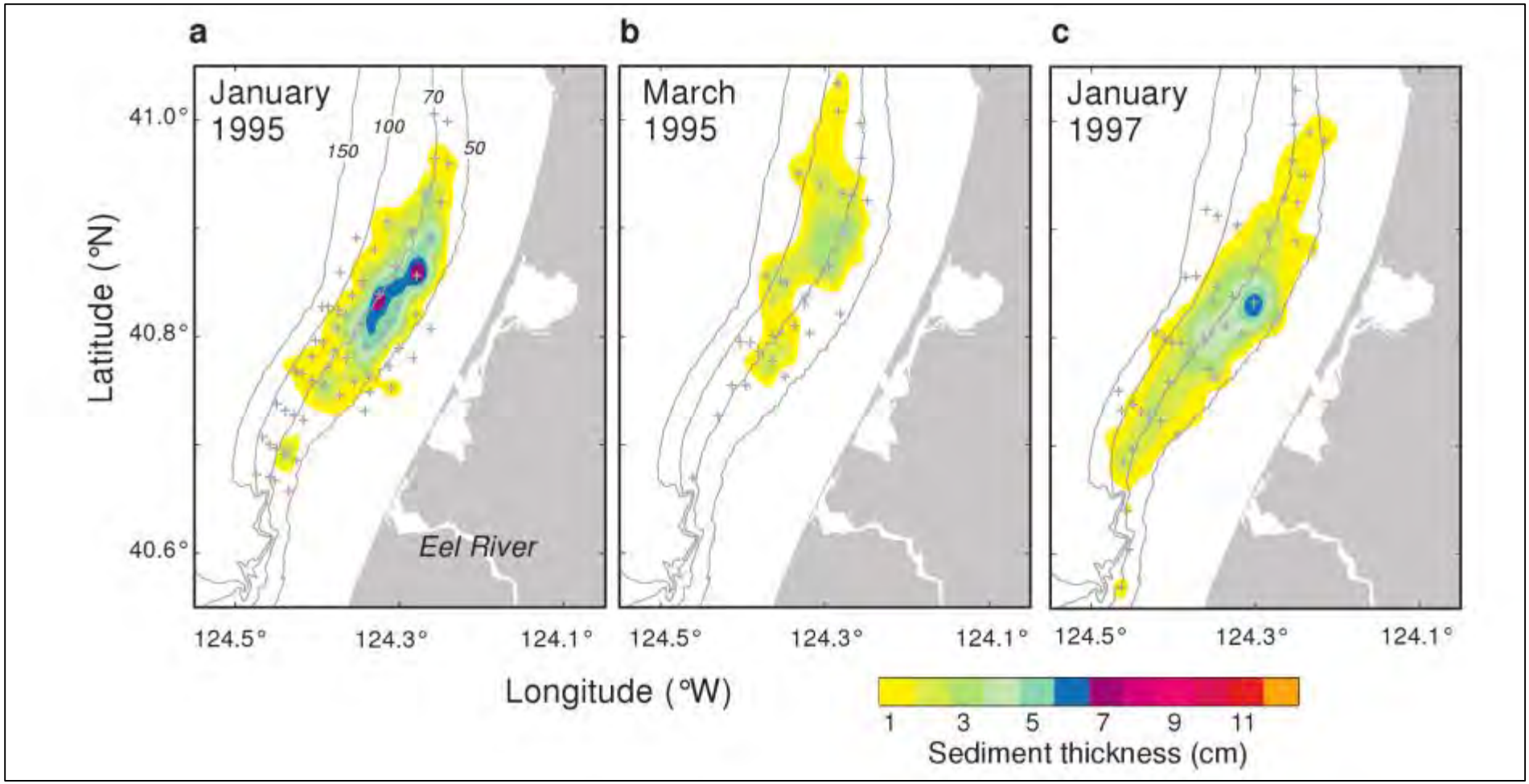


FIGURE 20: Maps indicating monitored flood deposit thickness for storms on a) January 1995, b) March 1995 and c) January 1997 (source: Hill et al., 2007).

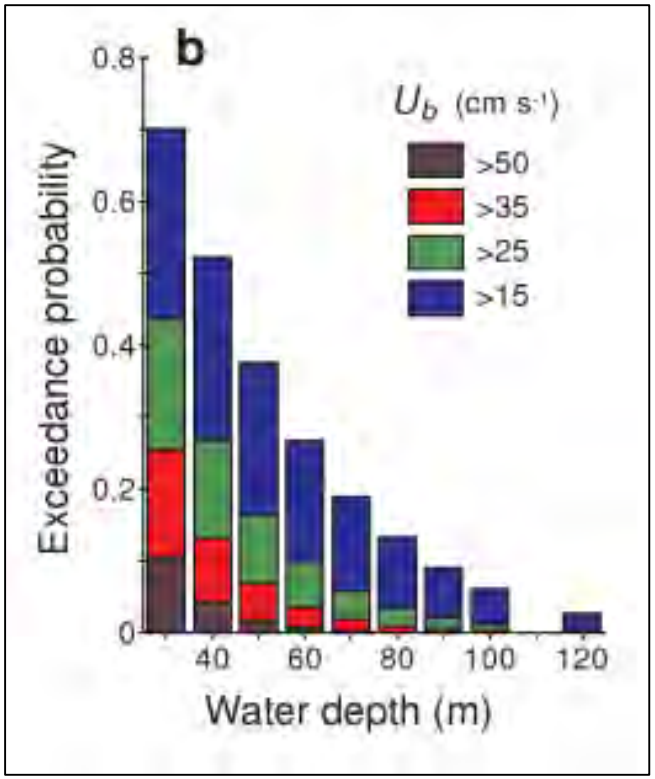


FIGURE 21: Water depth-dependent variations in exceedance probabilities for values of near-bed orbital velocity (Ub) ranging from 0.15 to 0.50 m/s.

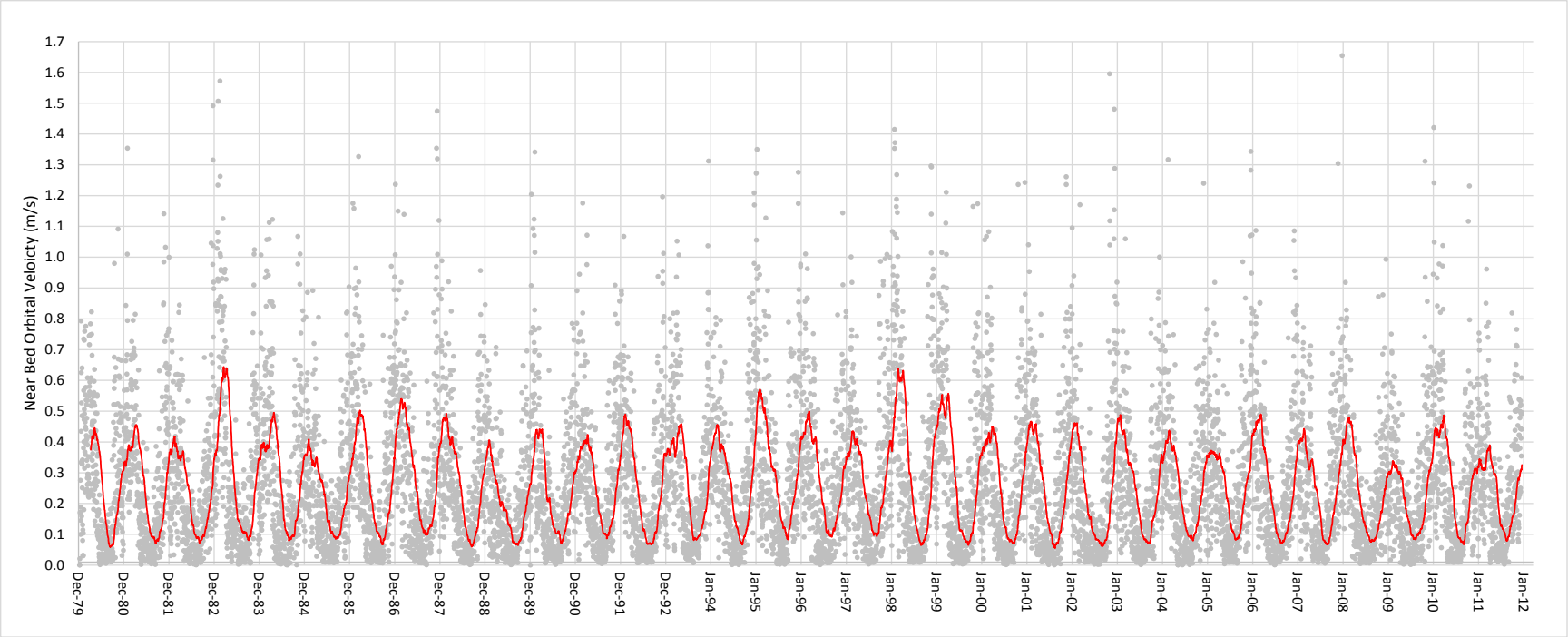


FIGURE 22: Calculated daily near bottom wave orbital velocity at water depth of 60 meters for period 1980 – 2011. Red line is 90-day running average of daily values.

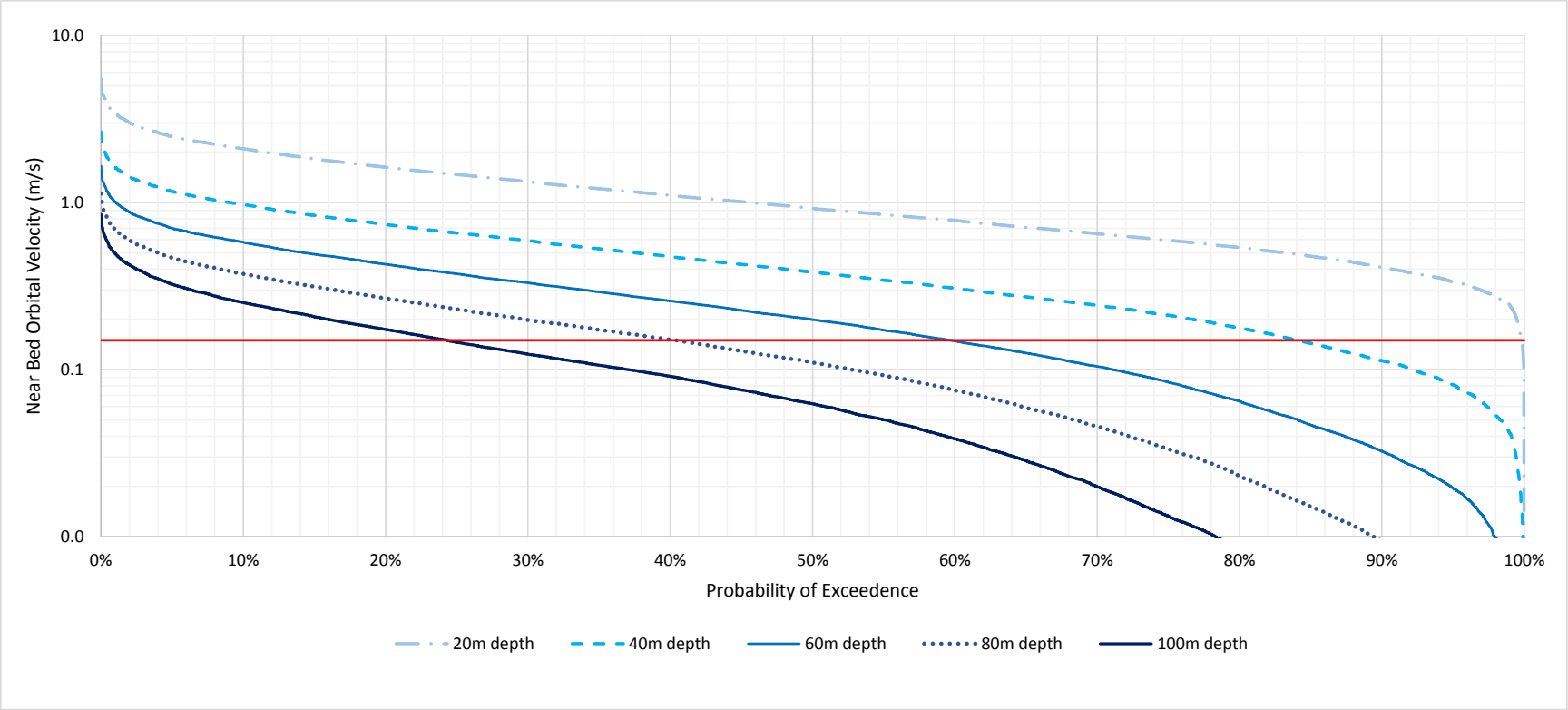


FIGURE 23: Exceedance probability for near bottom wave orbital velocity at various water depths for the period 1980 – 2011.

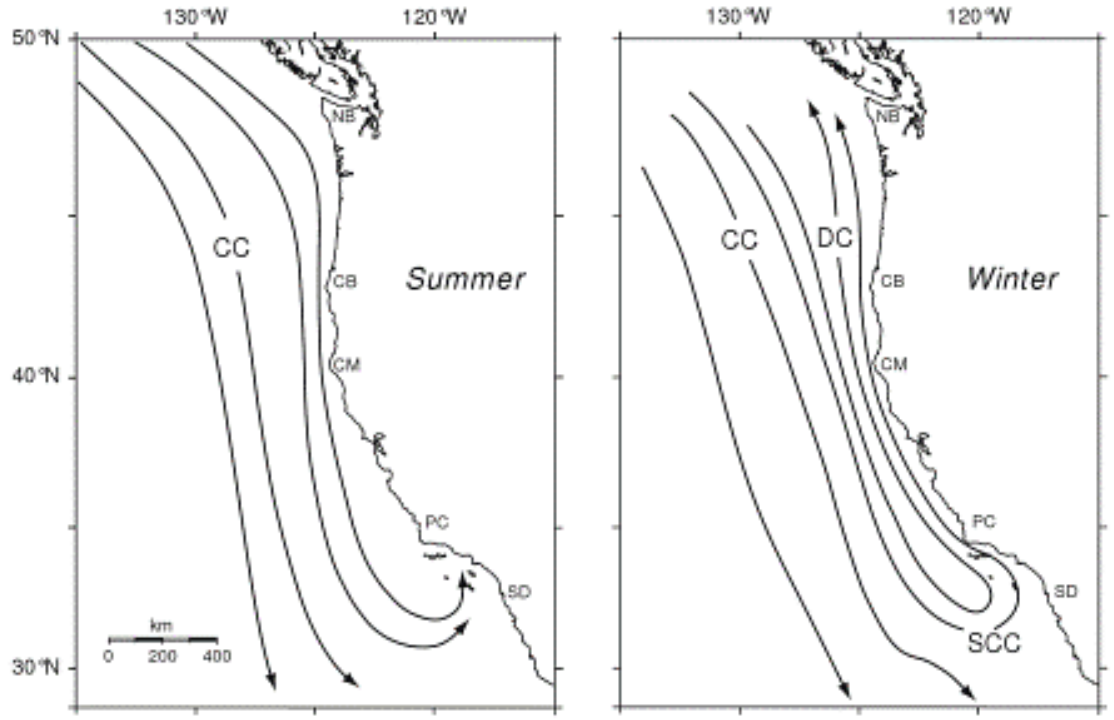
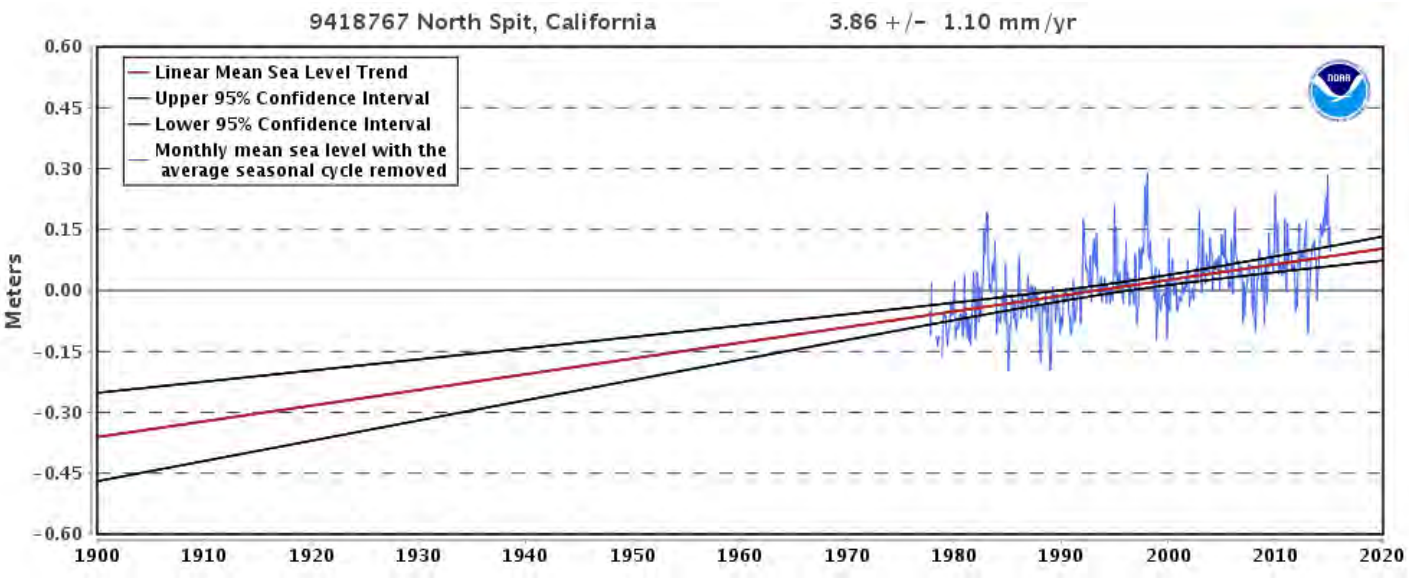


FIGURE 24: Major seasonal ocean current patterns off California: California Current (CC); Southern California Current (SCC); and Davidson Current (DC). Shoreline references: Neah Bay (NB); Cape Blanco (CB); Cape Mendocino (CM); Point Conception (PC); and San Diego (SD). Source: Sommerfield et al., 2007.

a)



b)

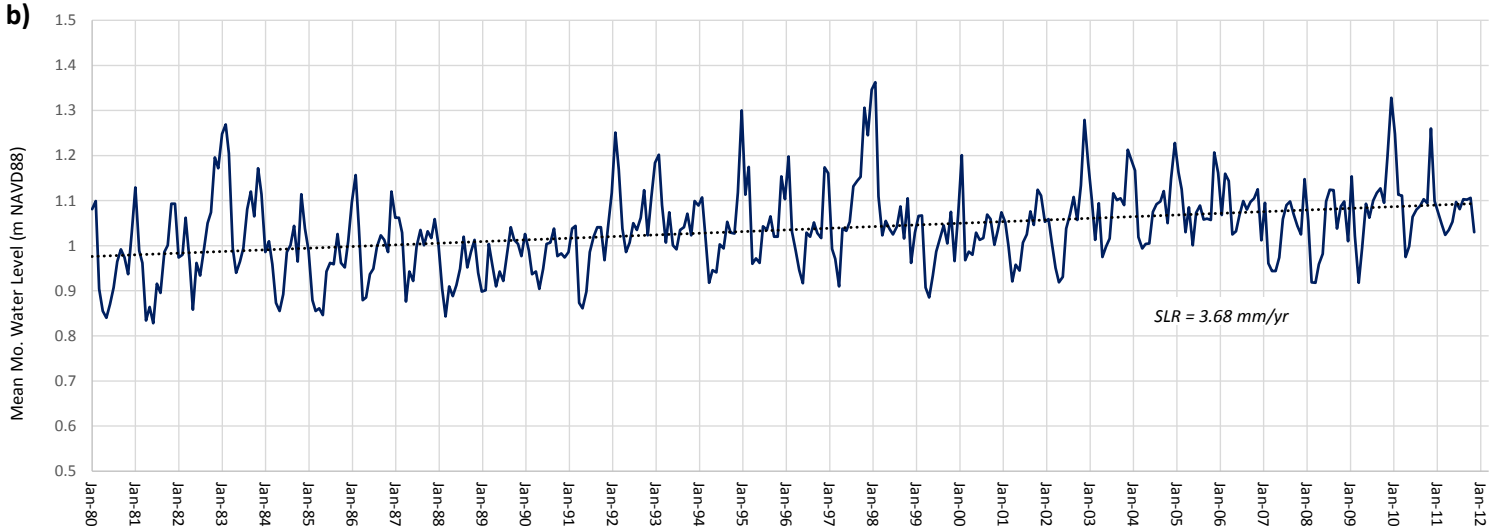
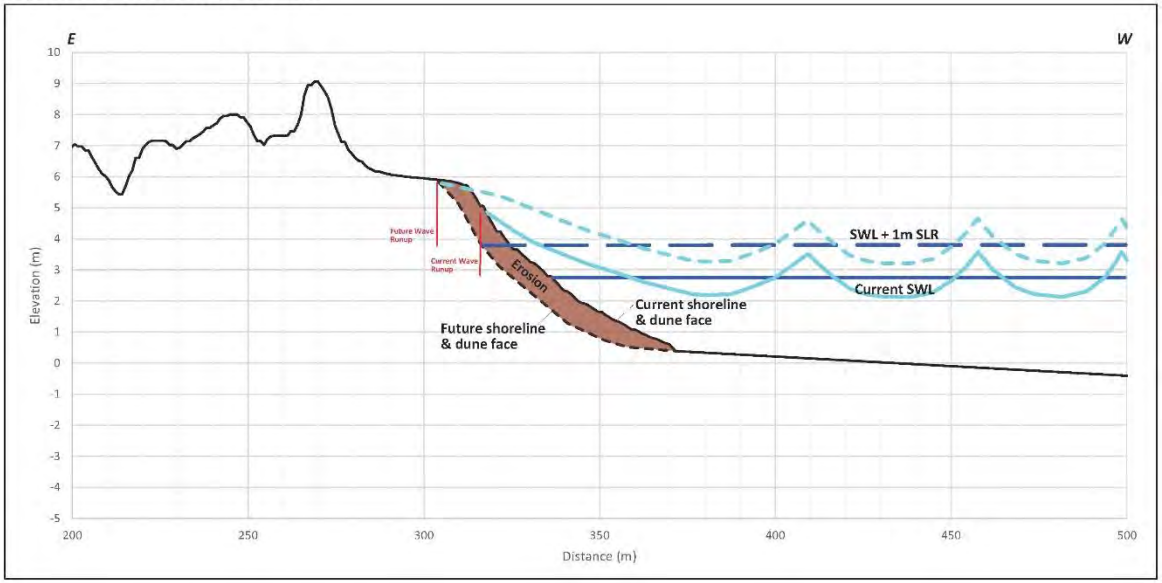


FIGURE 25: Estimated rates of Sea Level Rise: a) NOAA plot based on water level monitoring data for Mean monthly water levels at NOAA Tide Gauge 9418767; b) Mean monthly water levels at NOAA Tide Gauge 9418767: North Spit Humboldt Bay (1980-2011).

a) Dune at Profile 3: Wildlands Barn



b) Dune at Profile 1: Angels Camp Overwash

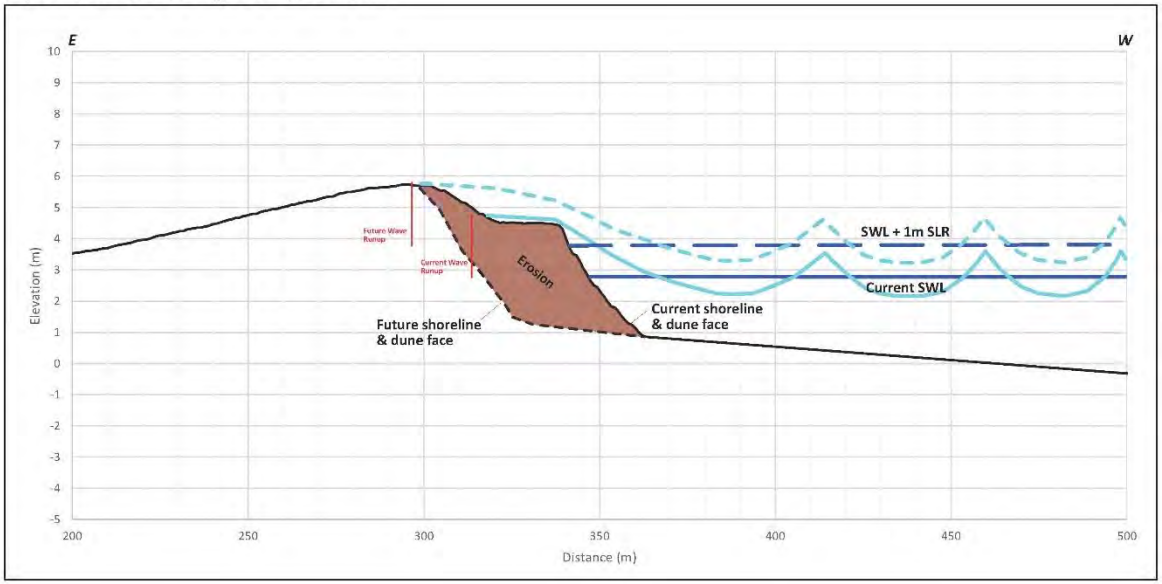
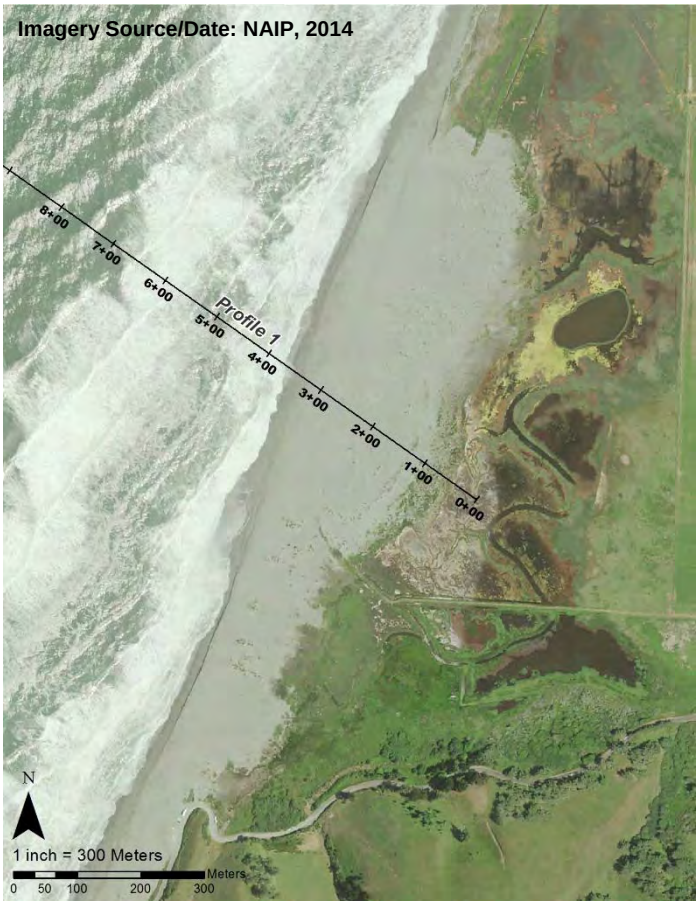


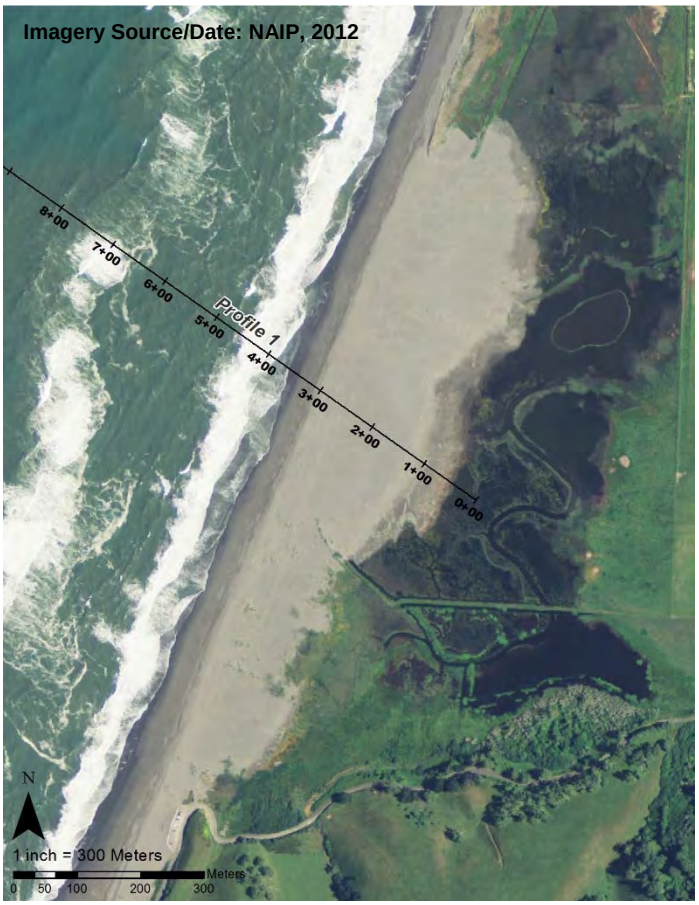
FIGURE 26: Schematic depicting anticipated increase in shoreline static water level (SWL) and associated runup heights associated with 1-meter of sea level rise (SLR) at dune Profile 3 (upper figure) and Profile 1 (lower figure). Also depicted are areas of likely erosion associated with these increases. See Figure 6 for profile locations.

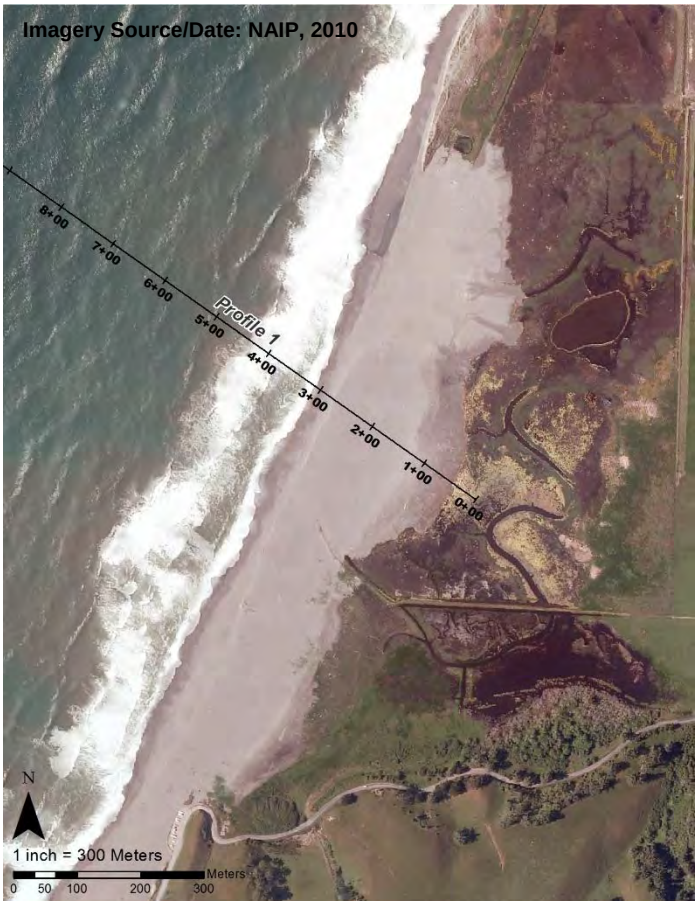
FIGURE 27: Photographs of large wood along beach and dunes of Eel River coastal plain near Profile 3: a) large wood wrack along upper beach; and b) through d) large wood exposed in base of foredunes.

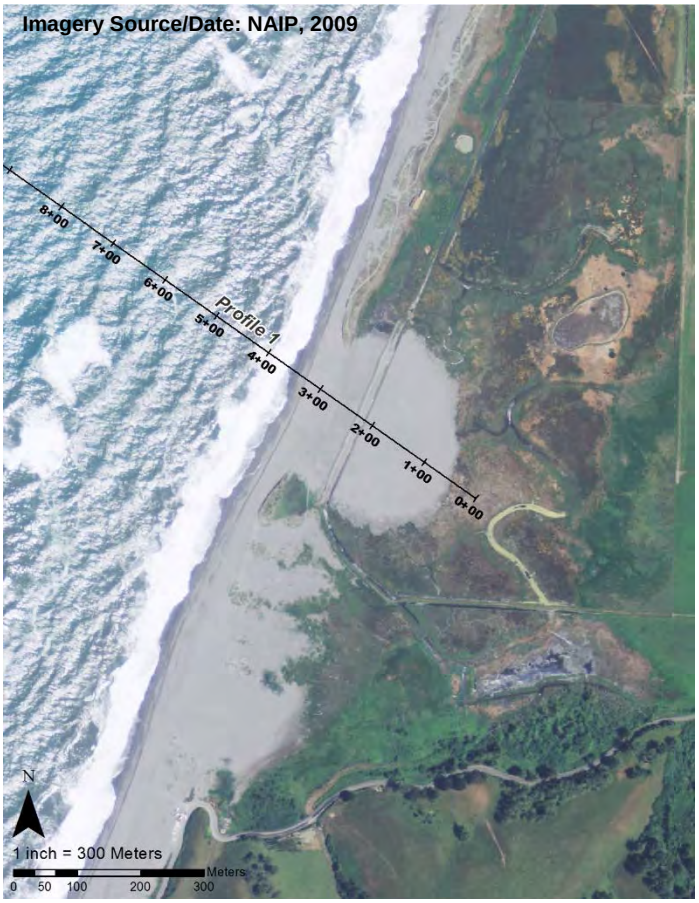
Appendix A – Profile Imagery

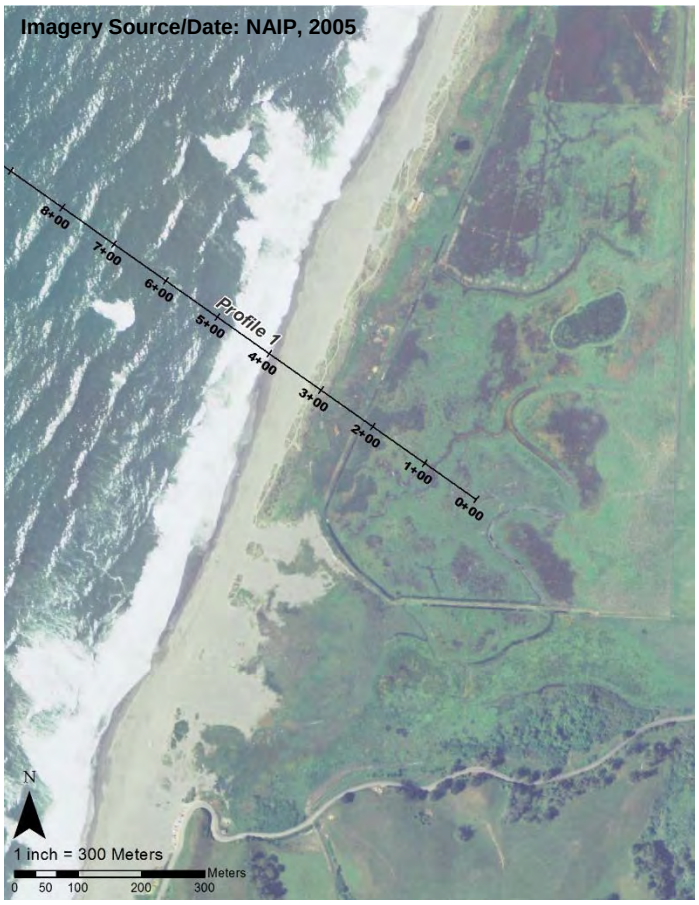
Profile 1 Imagery

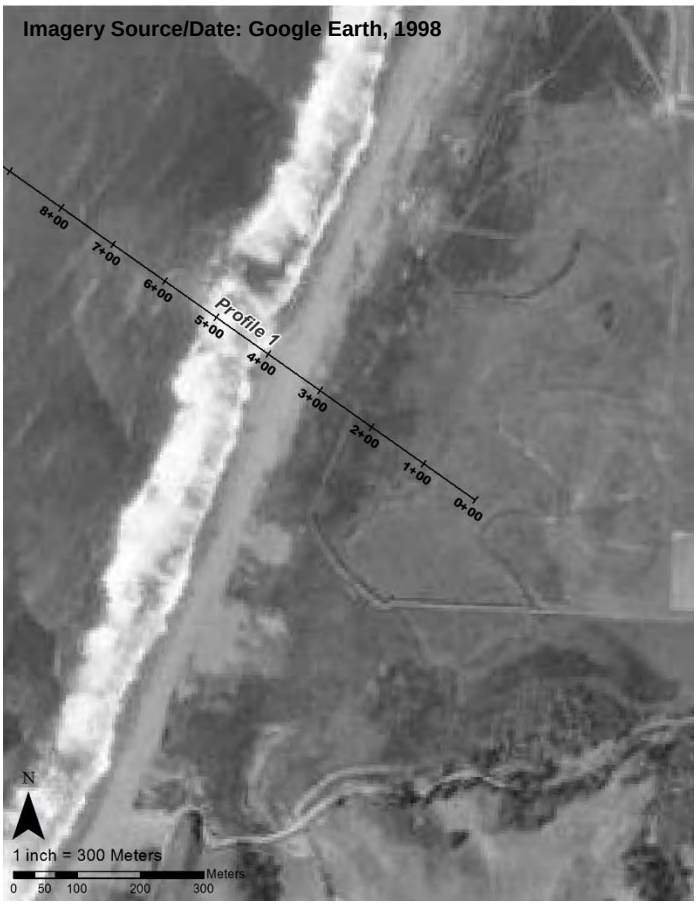

Imagery Source/Date: NAIP, 2014
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters

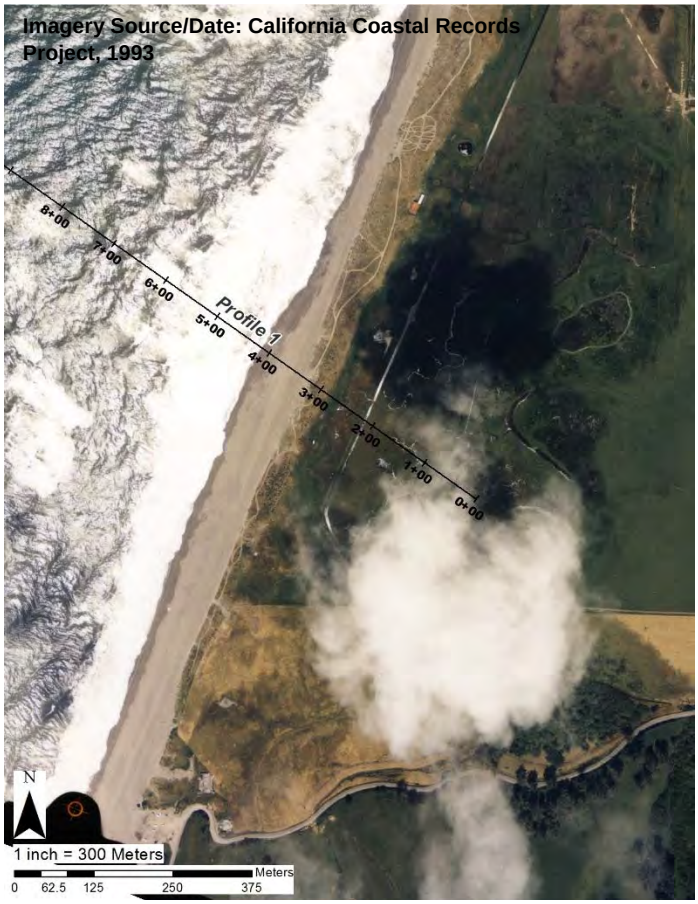

Imagery Source/Date: NAIP, 2012
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters


Imagery Source/Date: NAIP, 2010
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters

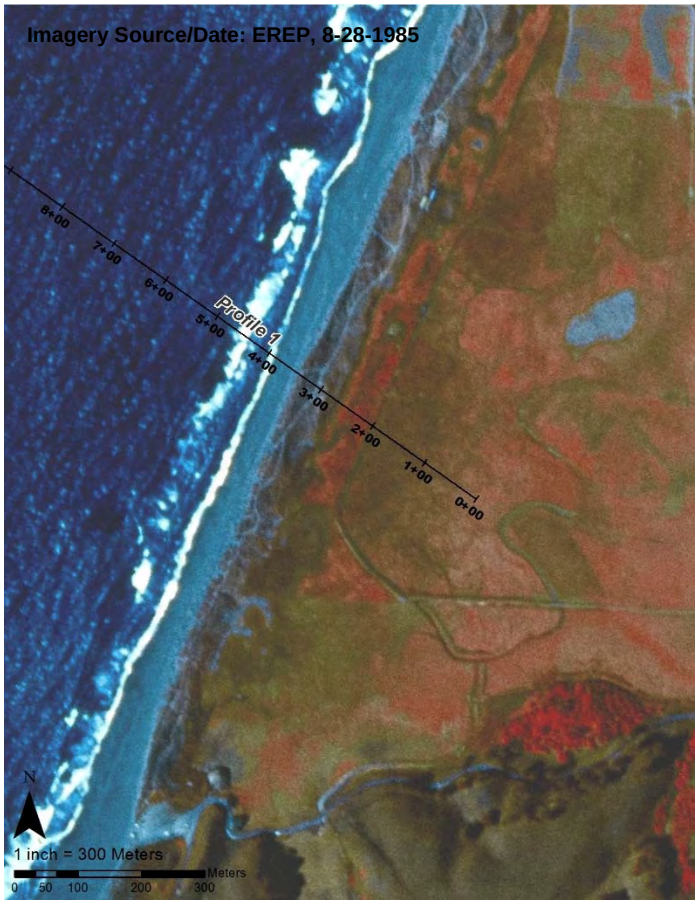

Imagery Source/Date: NAIP, 2009
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters

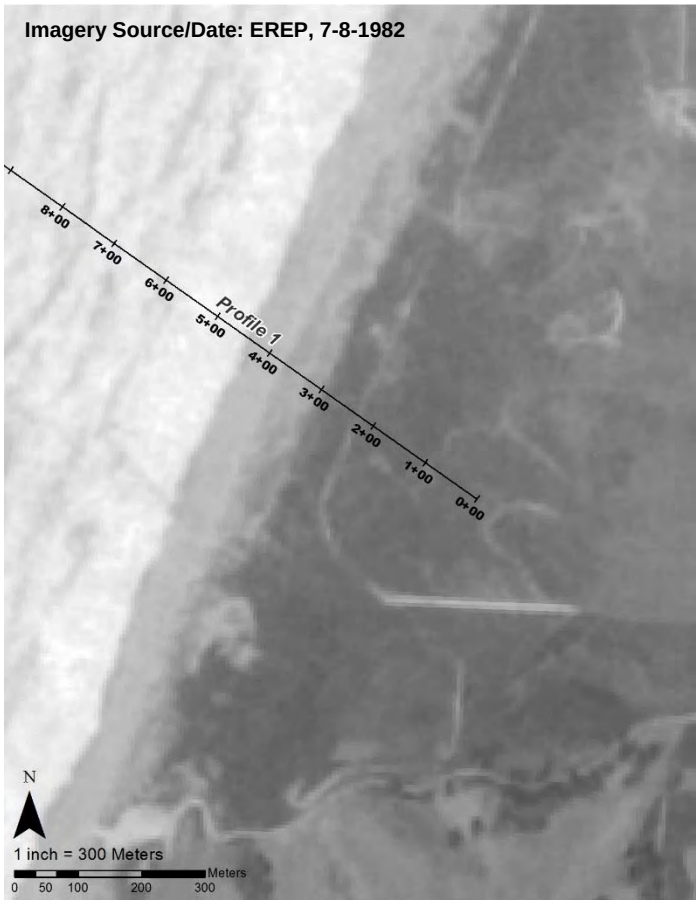

Imagery Source/Date: NAIP, 2005
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 50 100 200 300

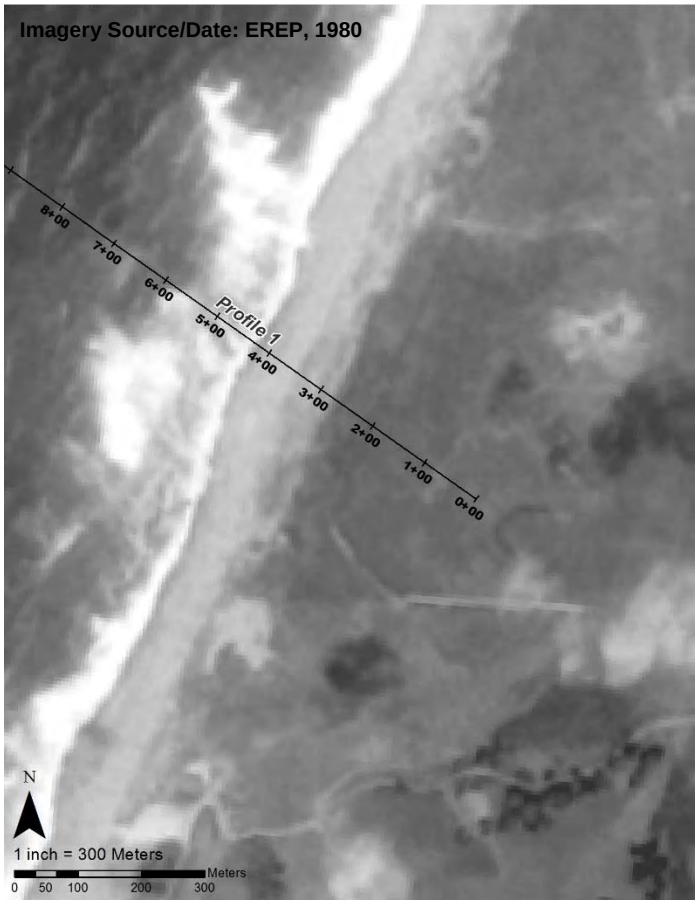

Imagery Source/Date: Google Earth, 1998
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 50 100 200 300

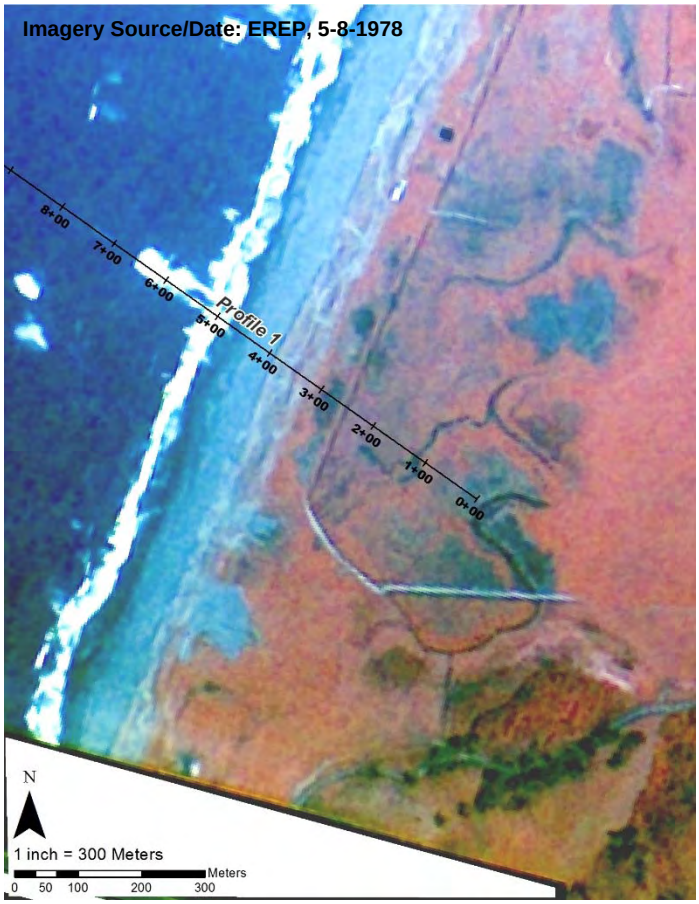

Imagery Source/Date: California Coastal Records Project, 1993
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 62.5 125 250 375

Imagery Source/Date: Humboldt County, 1988
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 50 100 200 300

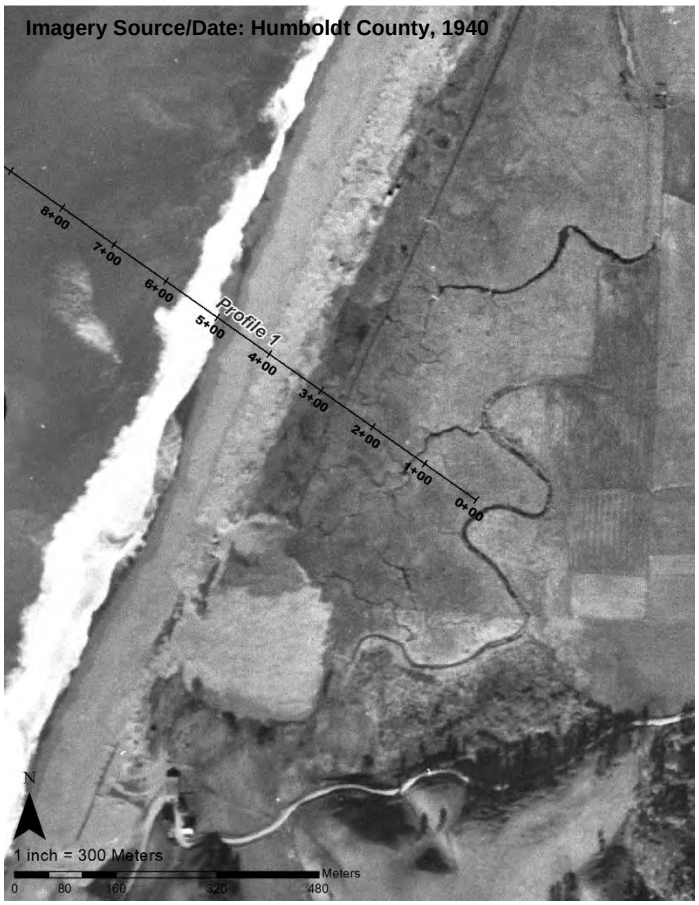

Imagery Source/Date: EREP, 8-28-1985
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 7-8-1982
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters

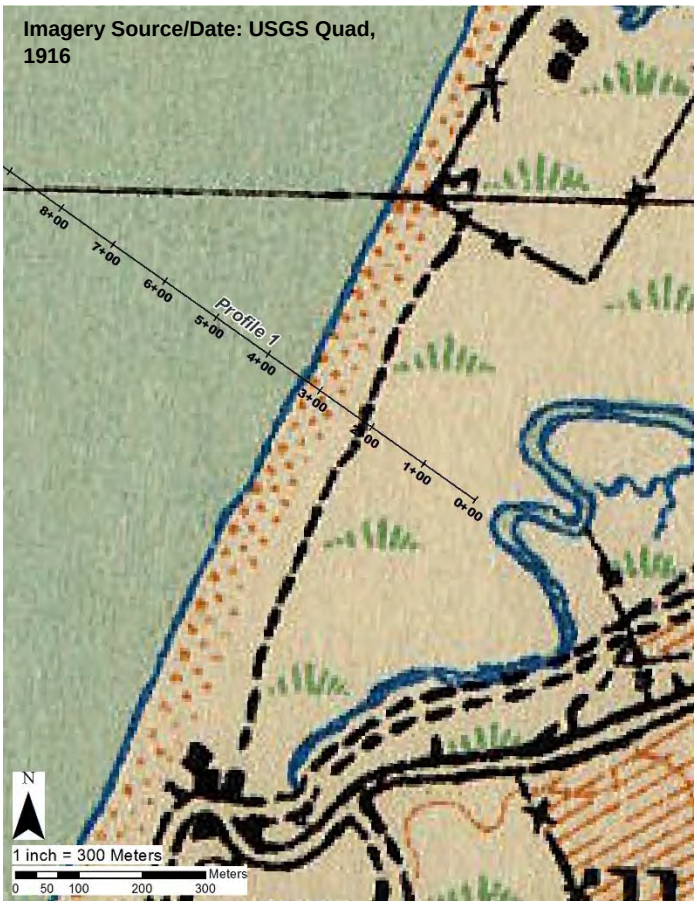

Imagery Source/Date: EREP, 1980
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 5-8-1978
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
0 50 100 200 300
Meters

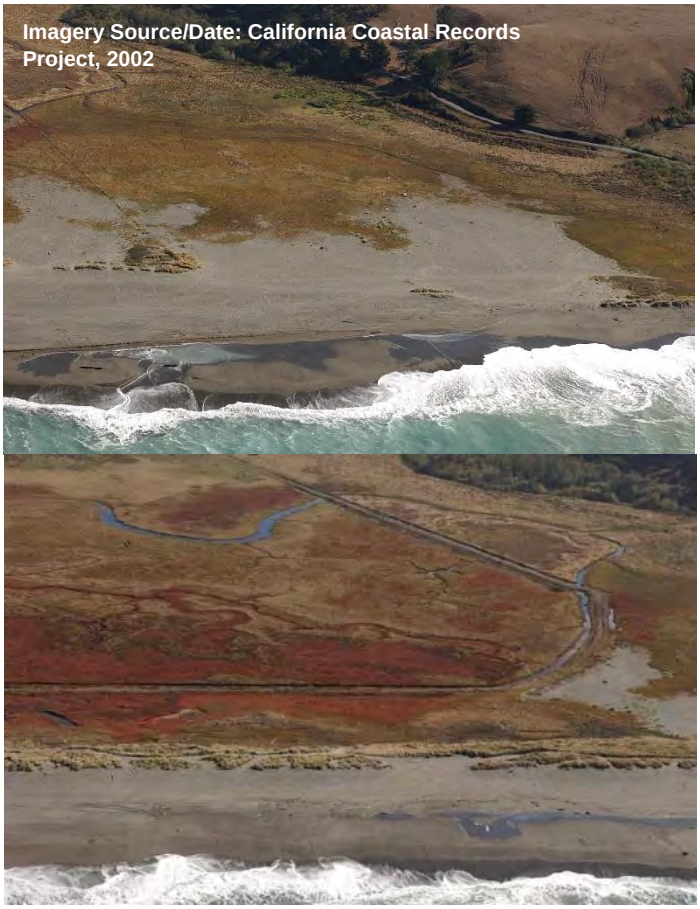
Imagery Source/Date: Humboldt County, 1963
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 50 100 200 300


Imagery Source/Date: Humboldt County, 1940
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 80 160 320 480

Imagery Source/Date: USGS Flood Map, 1955
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Well
N
1 inch = 300 Meters
Meters
0 50 100 200 300


Imagery Source/Date: USGS Quad, 1916
Profile 1
8+00
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 300 Meters
Meters
0 50 100 200 300

Imagery Source/Date: California Coastal Records Project, 2013


Imagery Source/Date: California Coastal Records Project, 2002

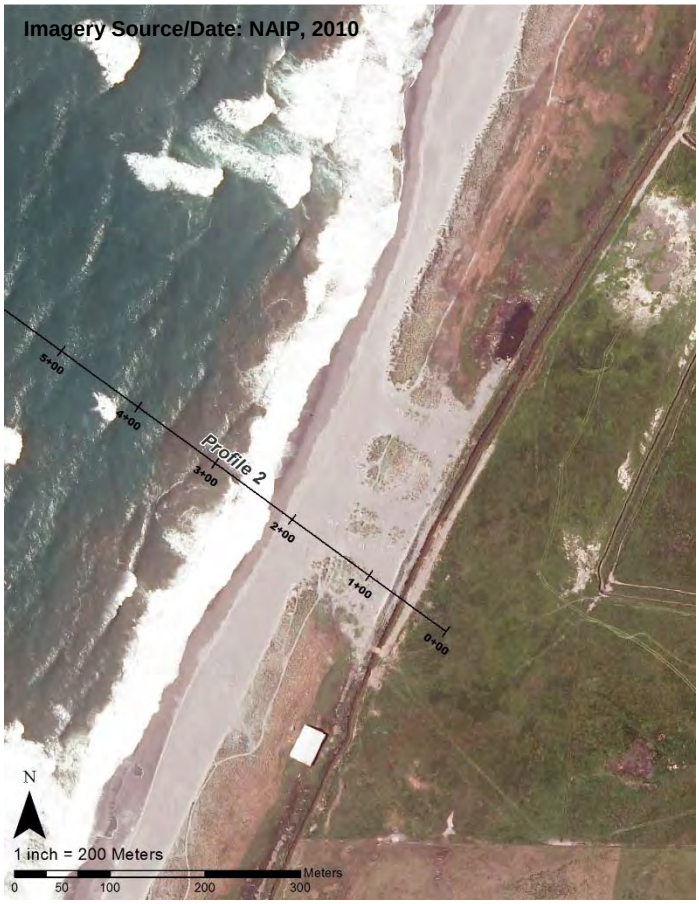
Imagery Source/Date: California Coastal Records Project, 1987

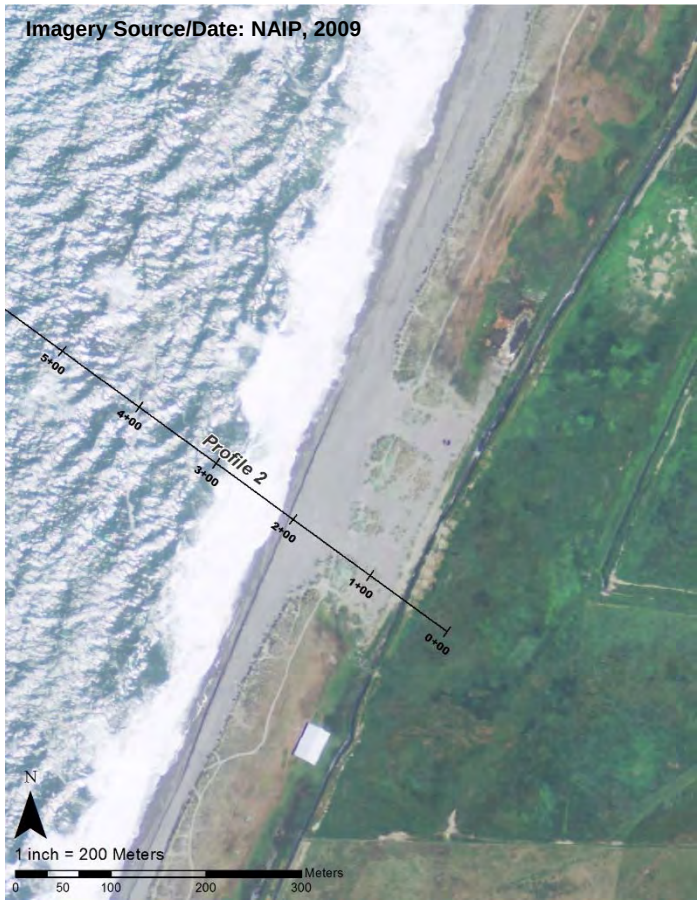
Imagery Source/Date: California Coastal Records Project, 1972

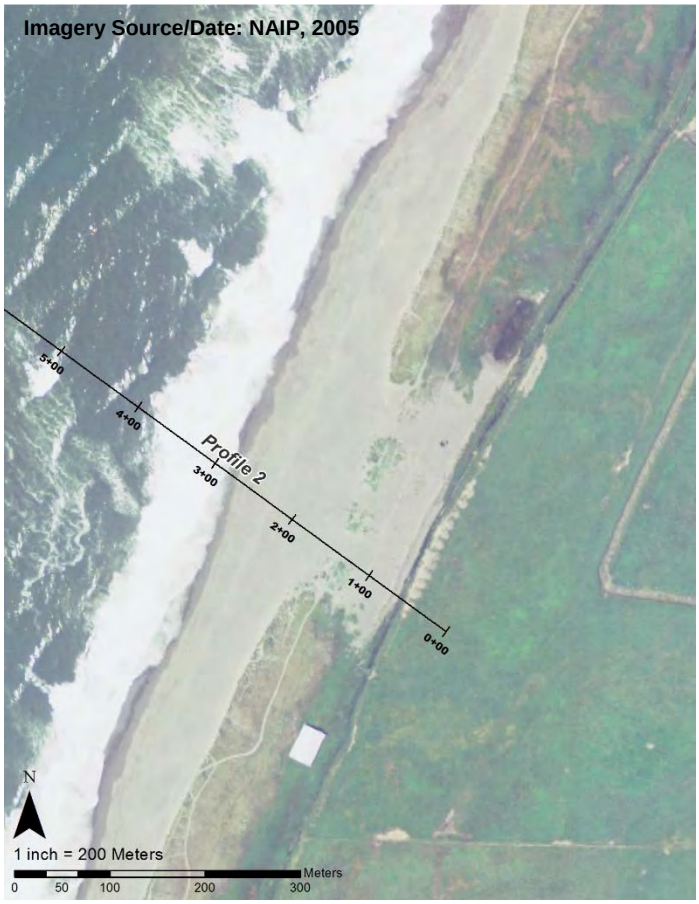
Profile 2 Imagery

Imagery Source/Date: NAIP, 2014
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

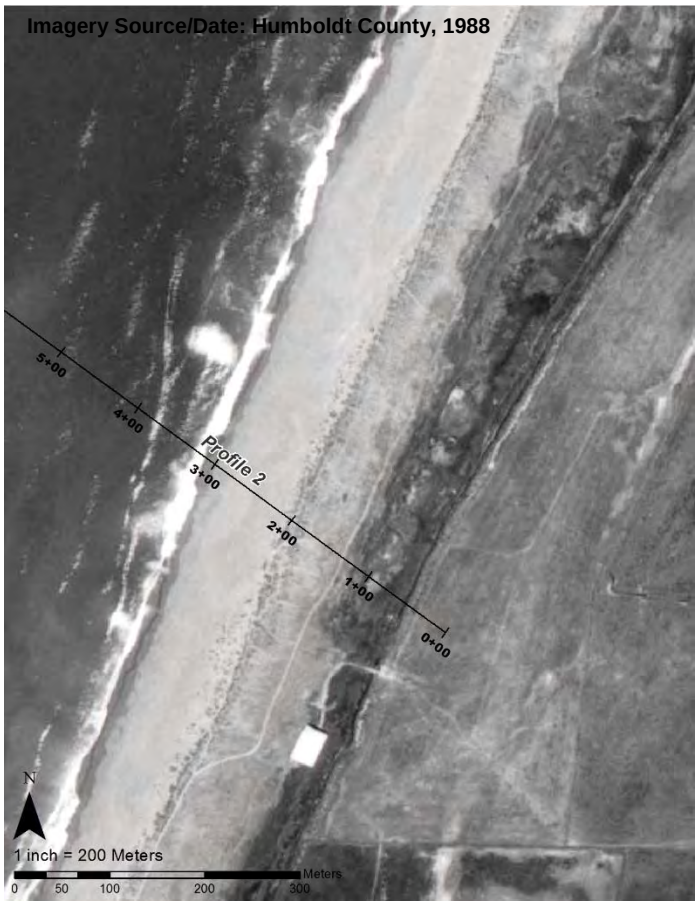
Imagery Source/Date: NAIP, 2012
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

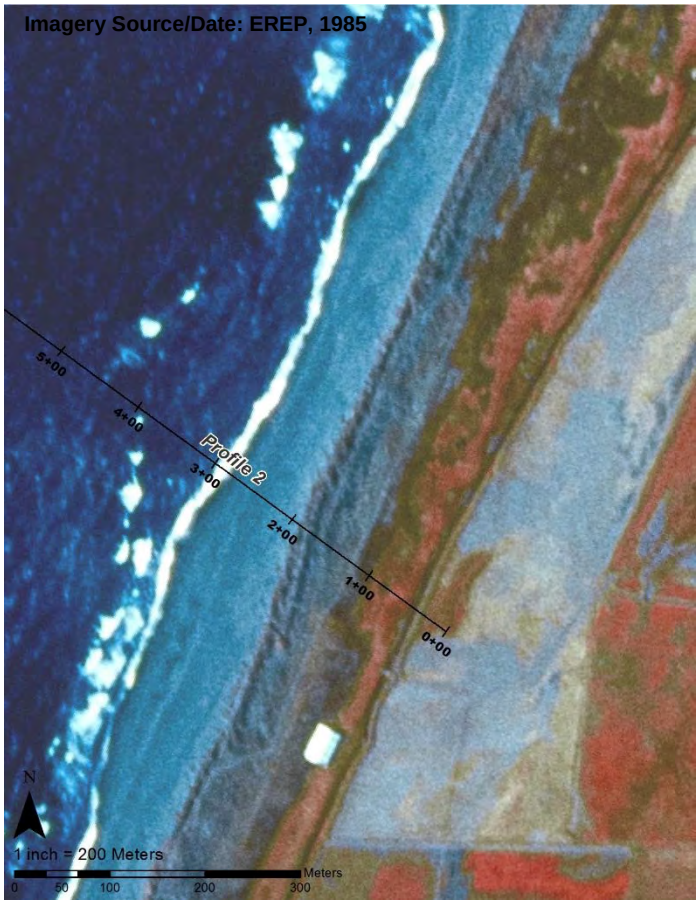

Imagery Source/Date: NAIP, 2010
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

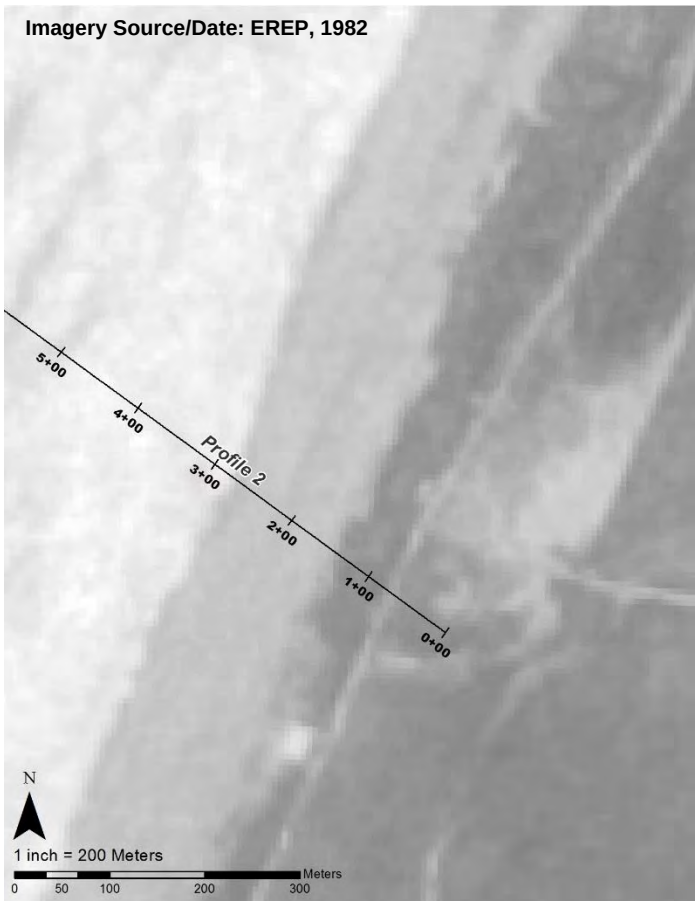

Imagery Source/Date: NAIP, 2009
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

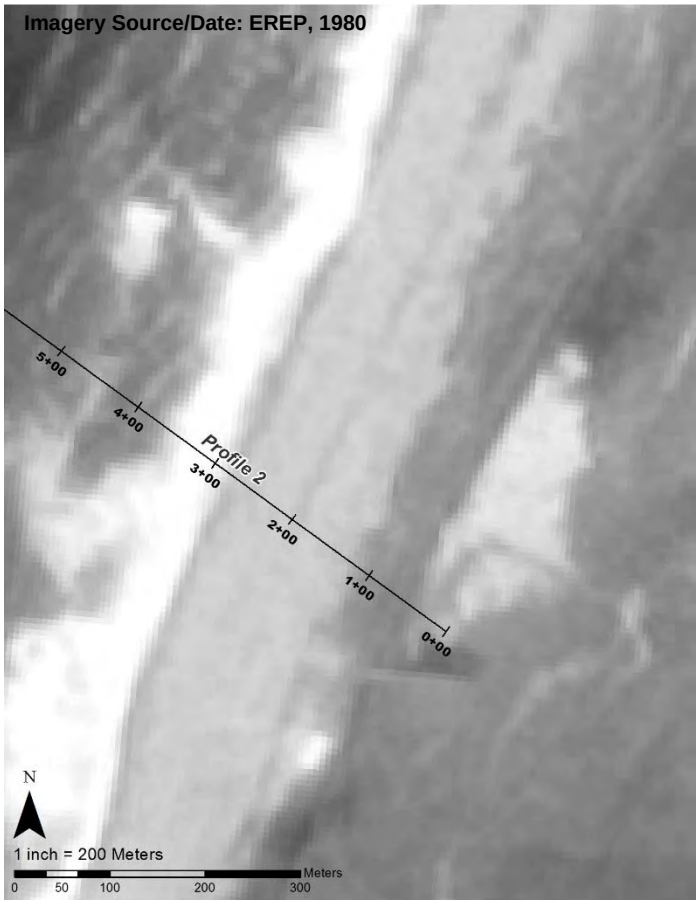

Imagery Source/Date: NAIP, 2005
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

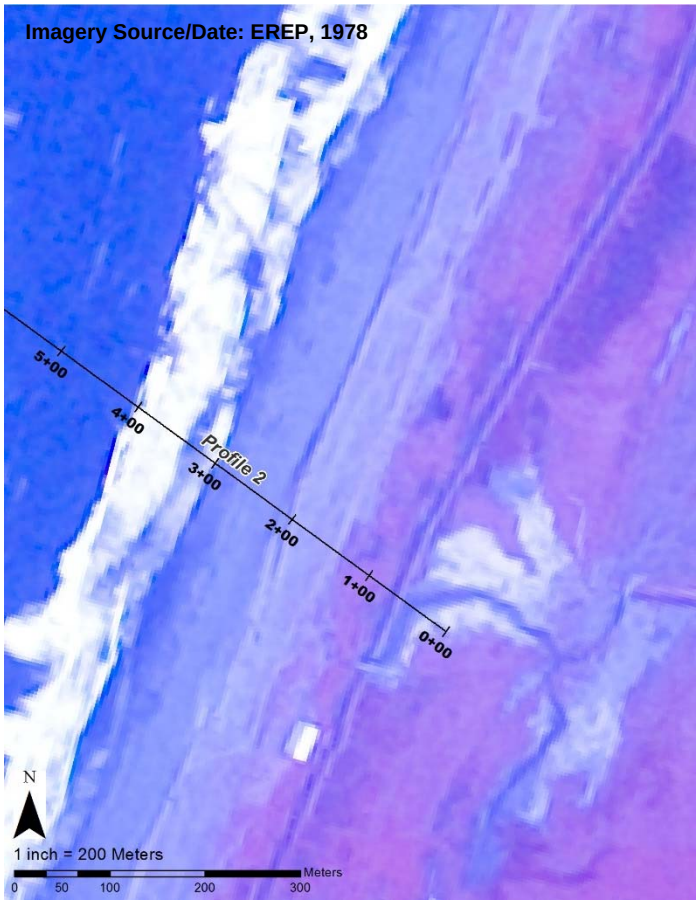
Imagery Source/Date: California Coastal Records Project, 1993
CDBV
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 40 80 160 240
Meters

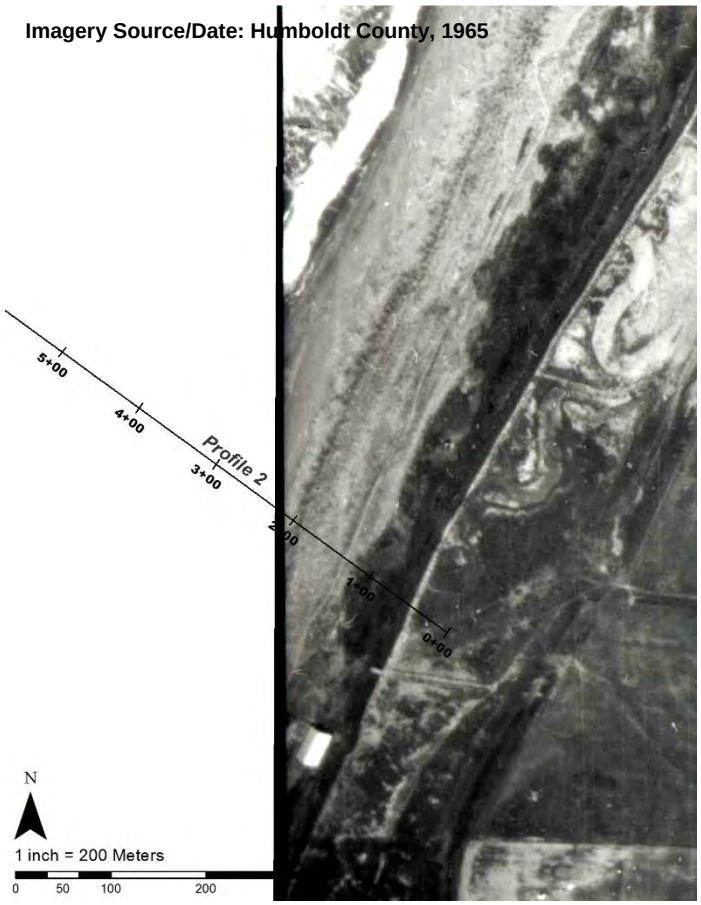

Imagery Source/Date: Humboldt County, 1988
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1985
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

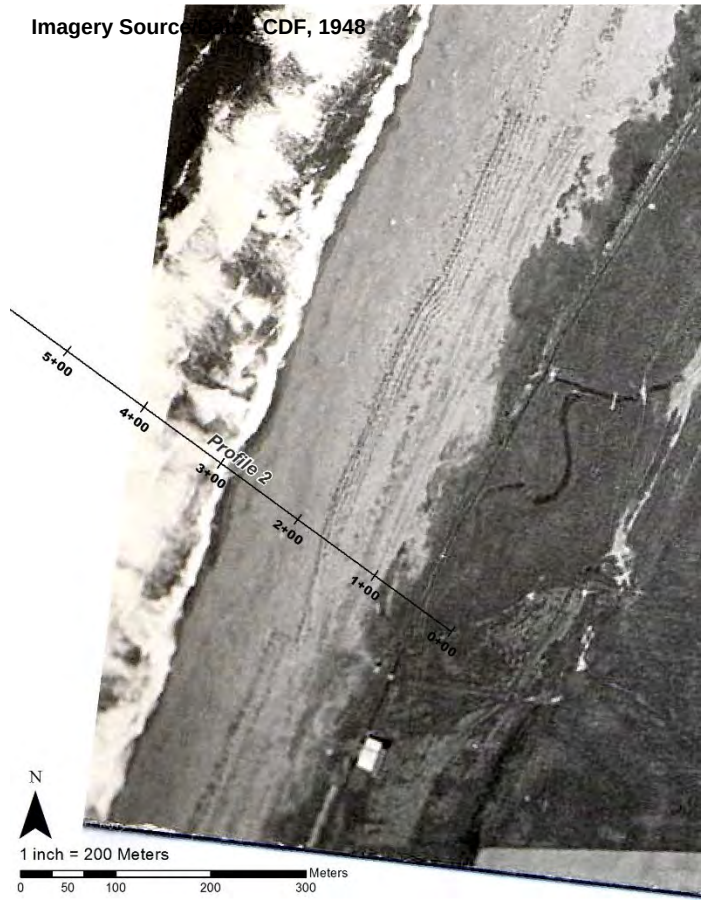

Imagery Source/Date: EREP, 1982
5+00
4+00
Profile 2
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

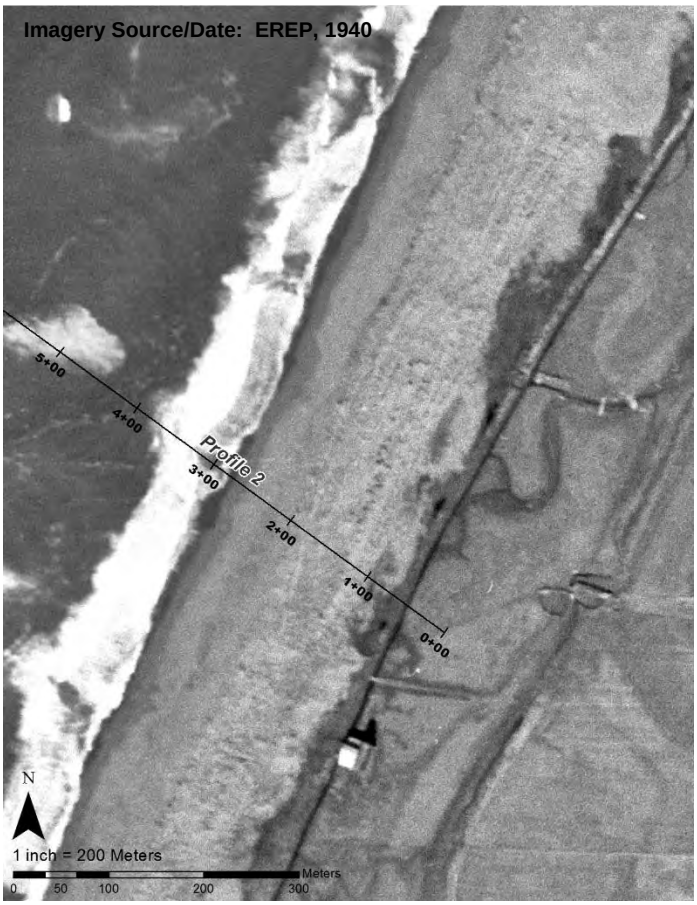

Imagery Source/Date: EREP, 1980
5+00
4+00
Profile 2
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

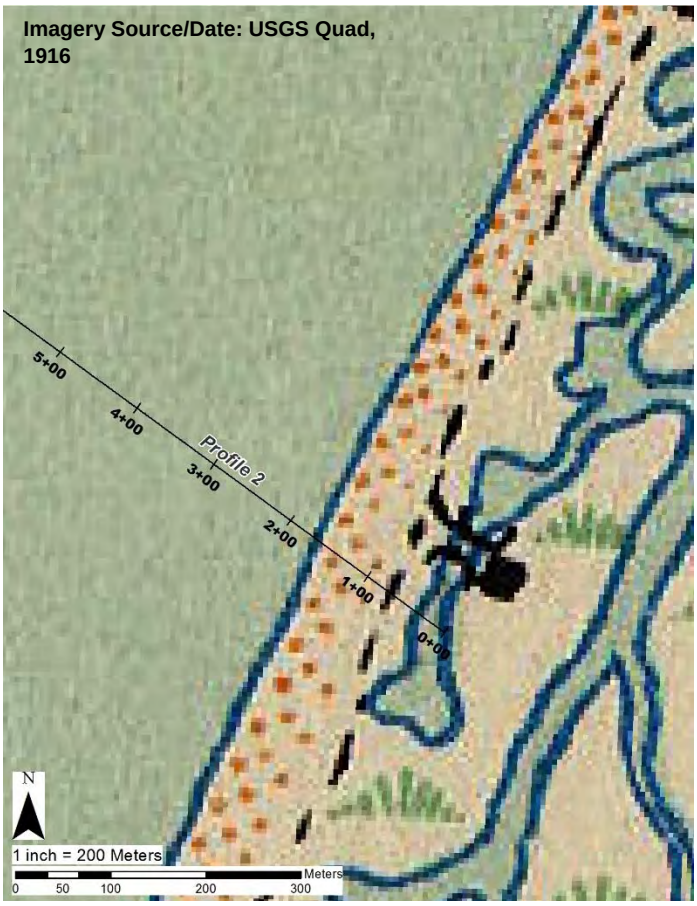

Imagery Source/Date: EREP, 1978
5+00
4+00
Profile 2
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: Humboldt County, 1965
5+00
4+00
Profile 2
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200

Imagery Source/Date: Humboldt County, 1963
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: CDF, 1948
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1940
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: USGS Quad, 1916
Profile 2
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

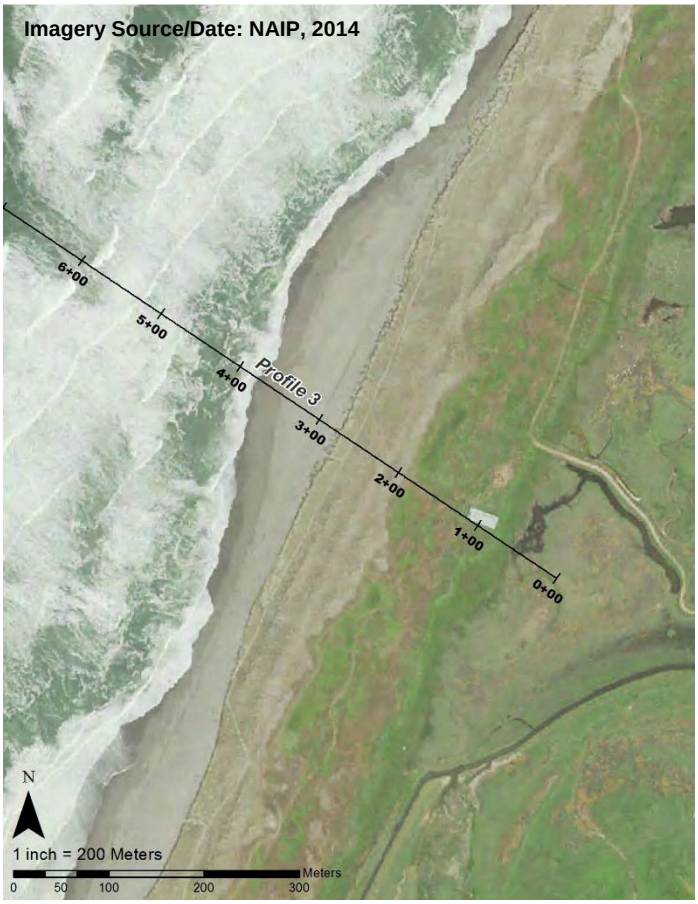
Imagery Source/Date: California Coastal Records Project, 2013

Imagery Source/Date: California Coastal Records Project, 2002

Imagery Source/Date: California Coastal Records Project, 1987

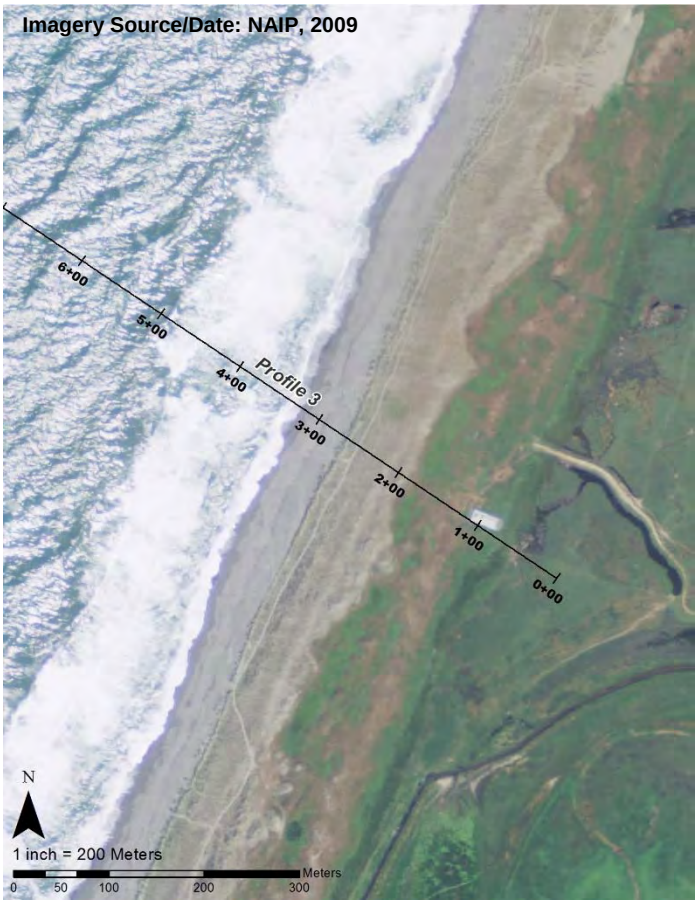
Imagery Source/Date: California Coastal Records Project, 1972

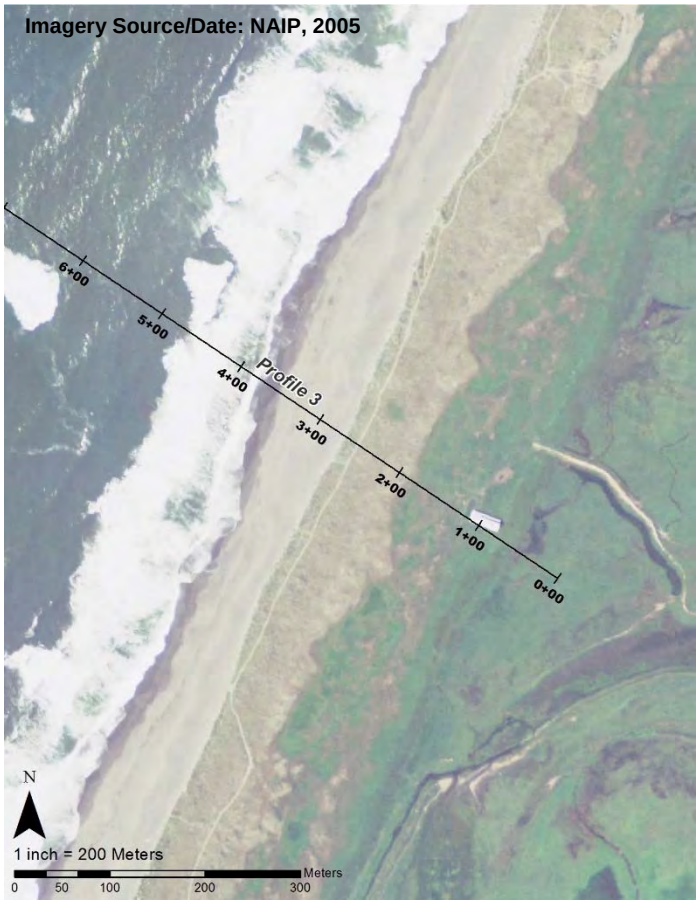
Profile 3 Imagery

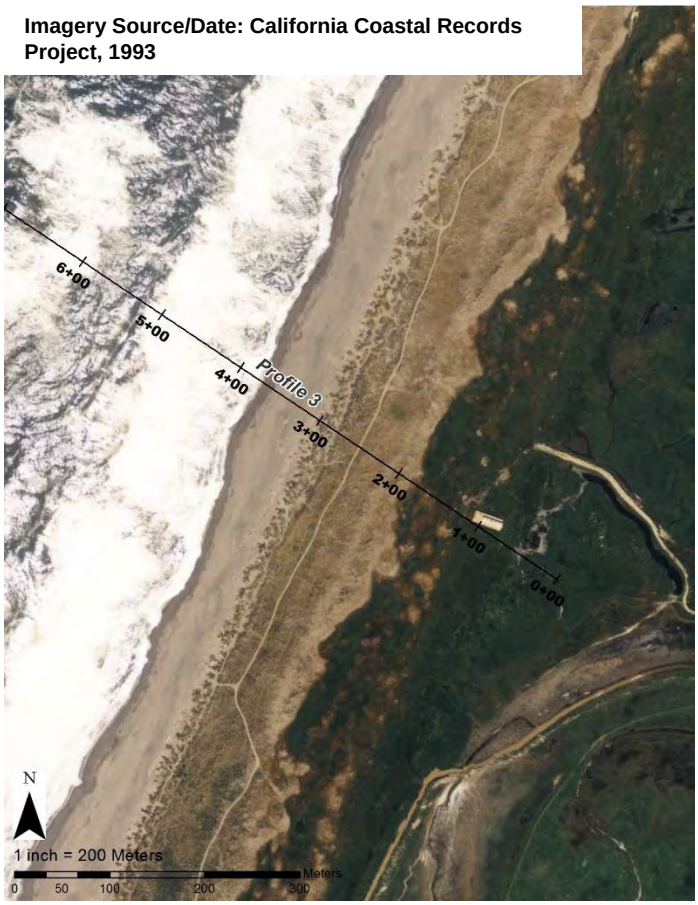

Imagery Source/Date: NAIP, 2014
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

Imagery Source/Date: NAIP, 2012
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

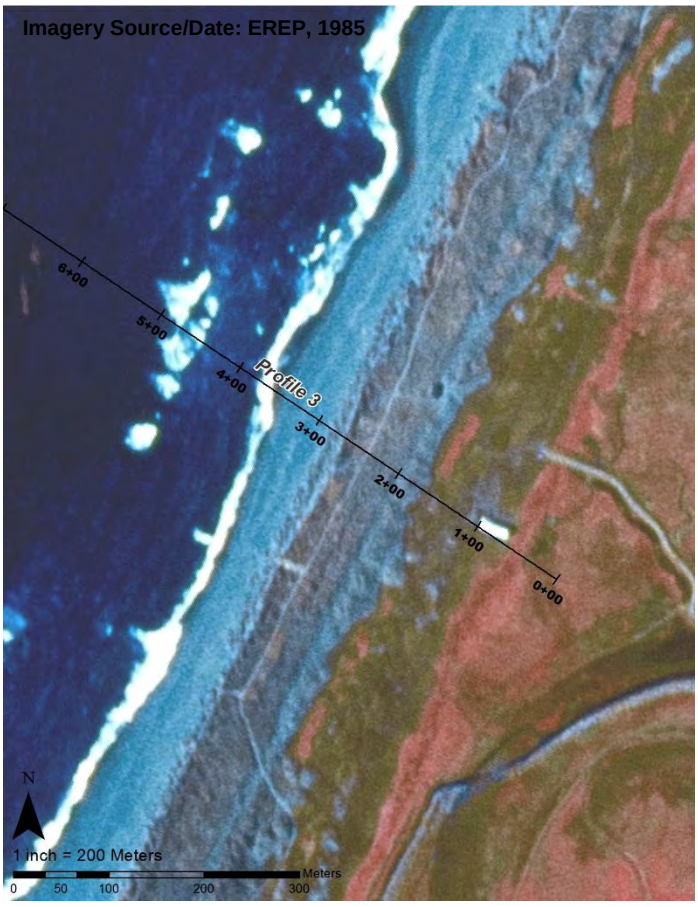
Imagery Source/Date: NAIP, 2010
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

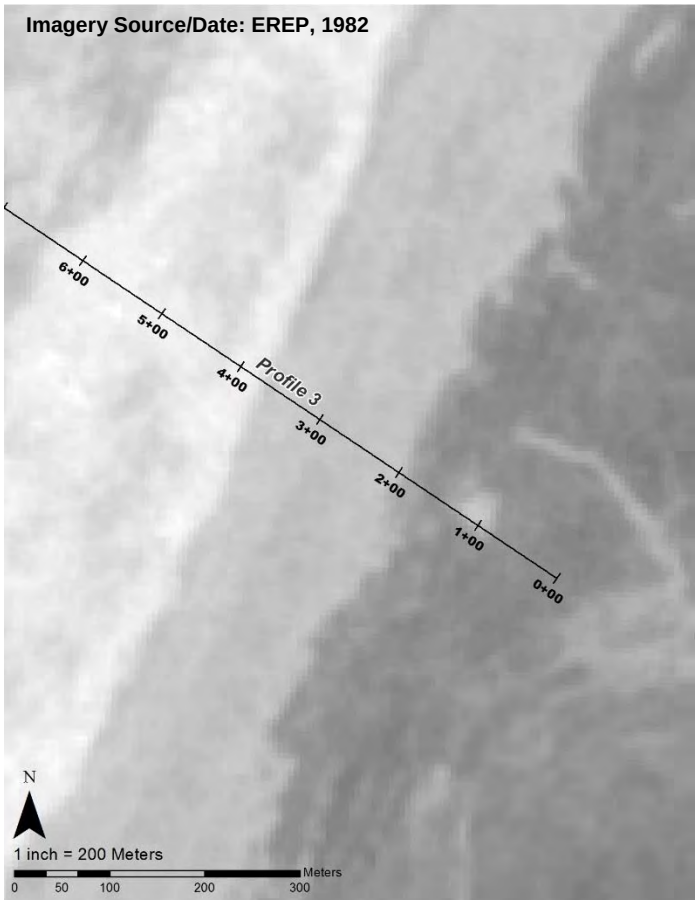

Imagery Source/Date: NAIP, 2009
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

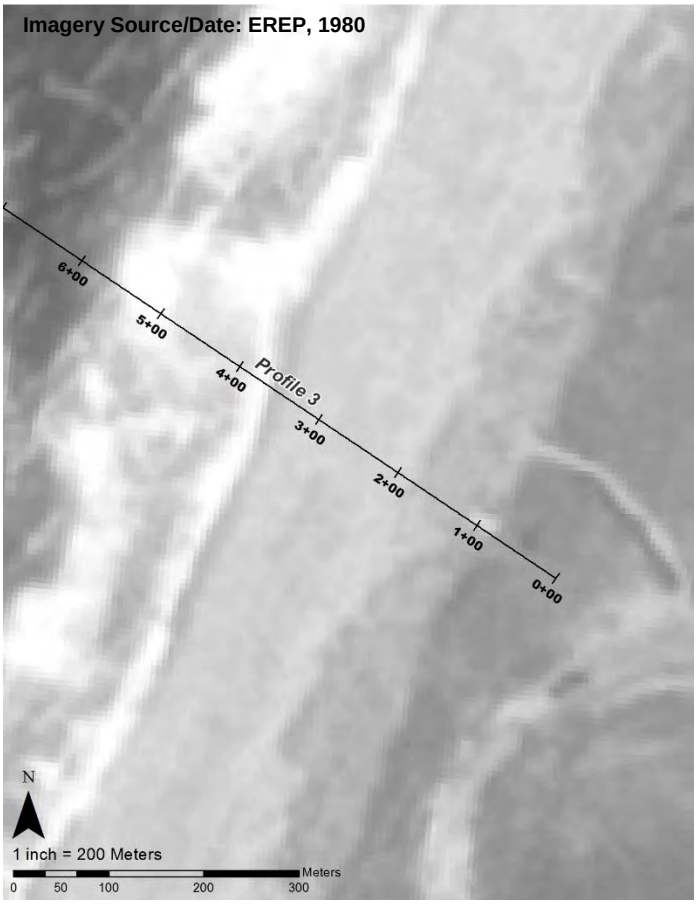

Imagery Source/Date: NAIP, 2005
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

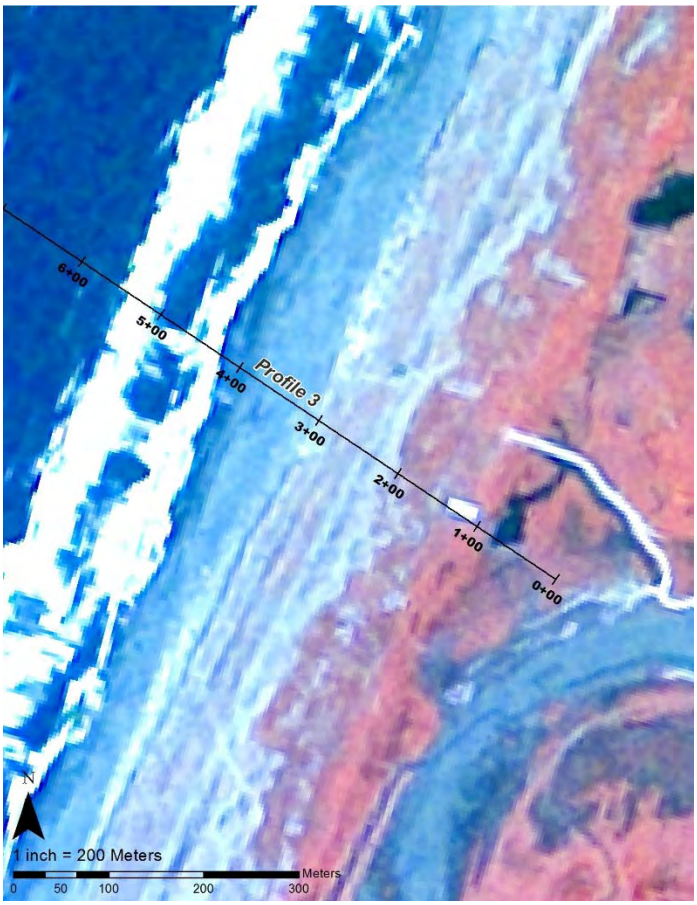

Imagery Source/Date: California Coastal Records Project, 1993
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

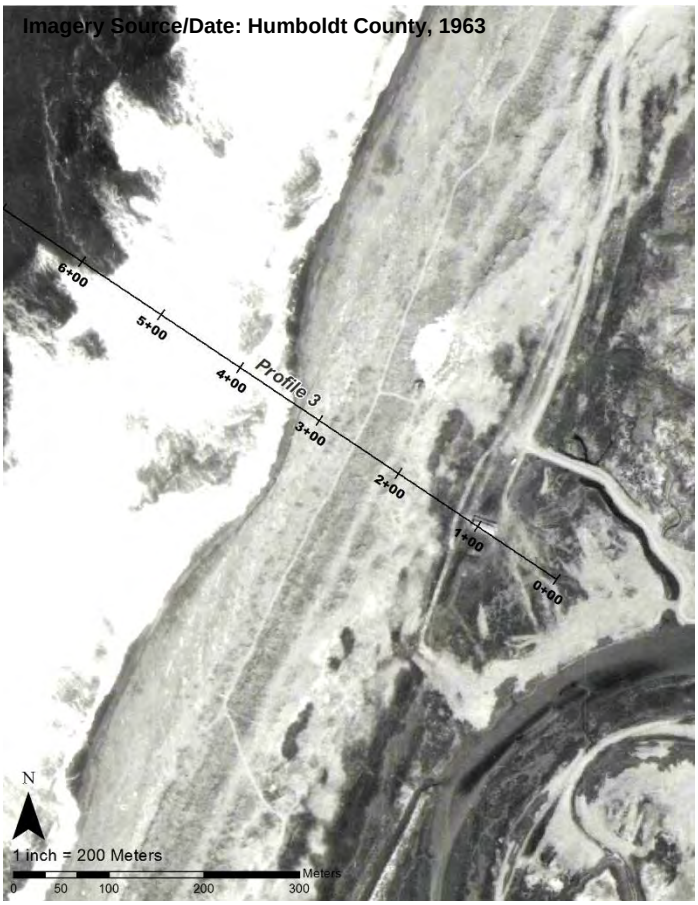
Imagery Source/Date: Humboldt County, 1988
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1985
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1982
6+00
5+00
4+00
Profile 3
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

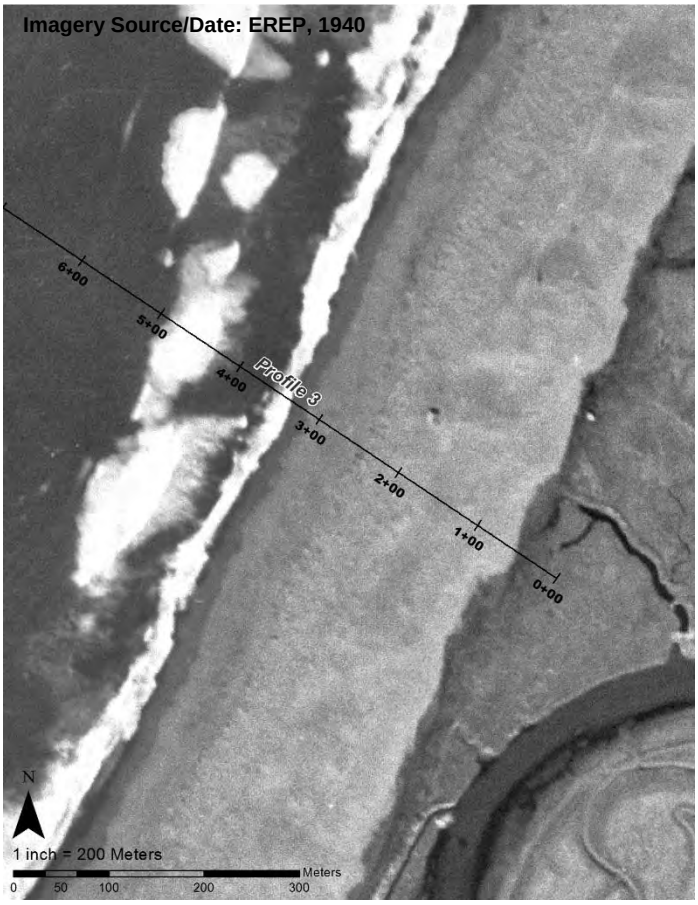

Imagery Source/Date: EREP, 1980
6+00
5+00
4+00
Profile 3
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

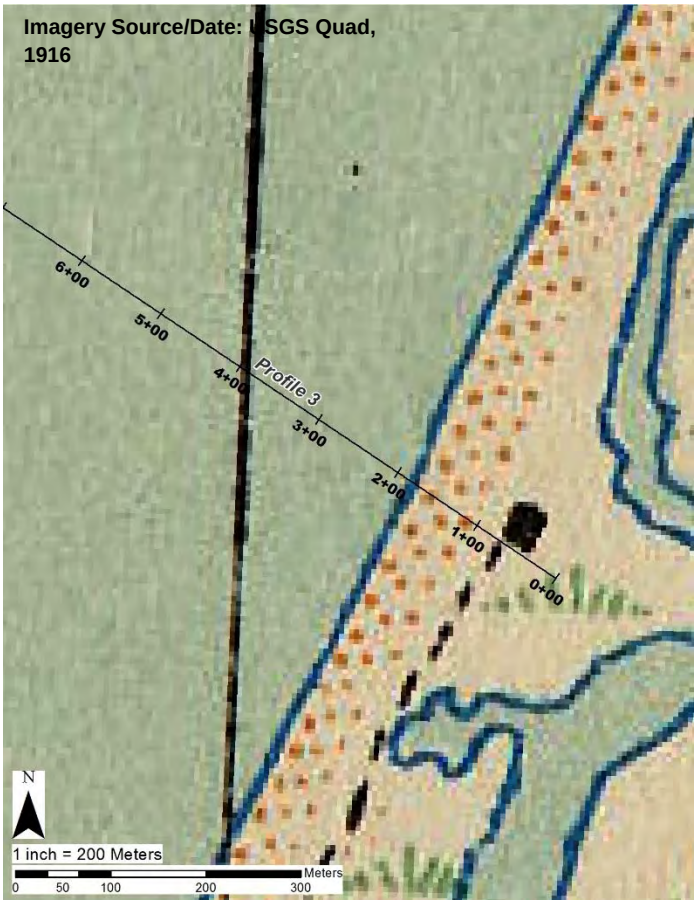

6+00
5+00
4+00
Profile 3
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: Humboldt County, 1963
6+00
5+00
4+00
Profile 3
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

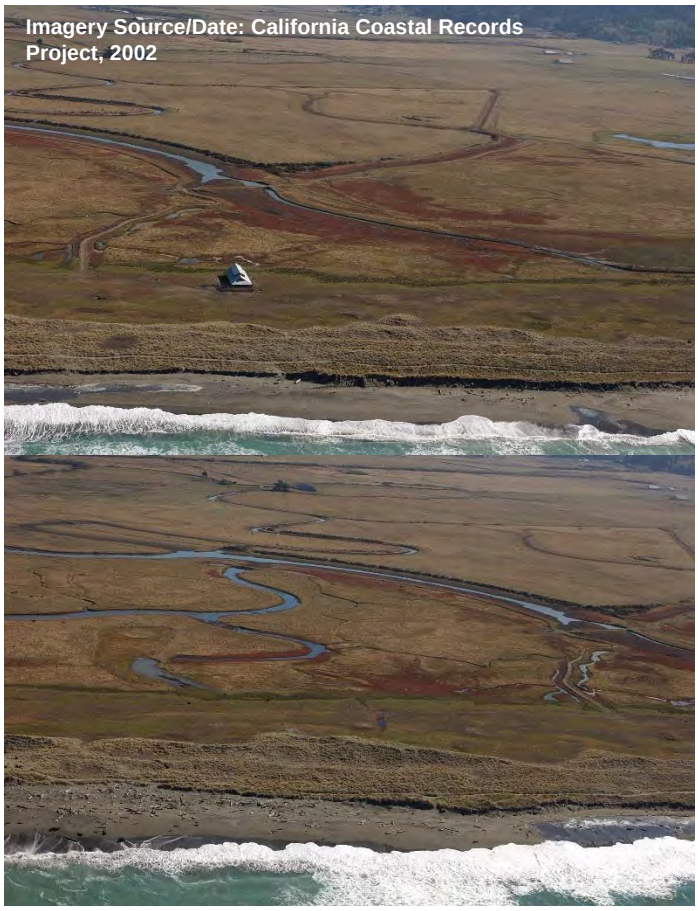
Imagery Source/Date: Humboldt County, 1963
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300

Imagery Source/Date: CDF, 1948
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300


Imagery Source/Date: EREP, 1940
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300


Imagery Source/Date: USGS Quad, 1916
Profile 3
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300

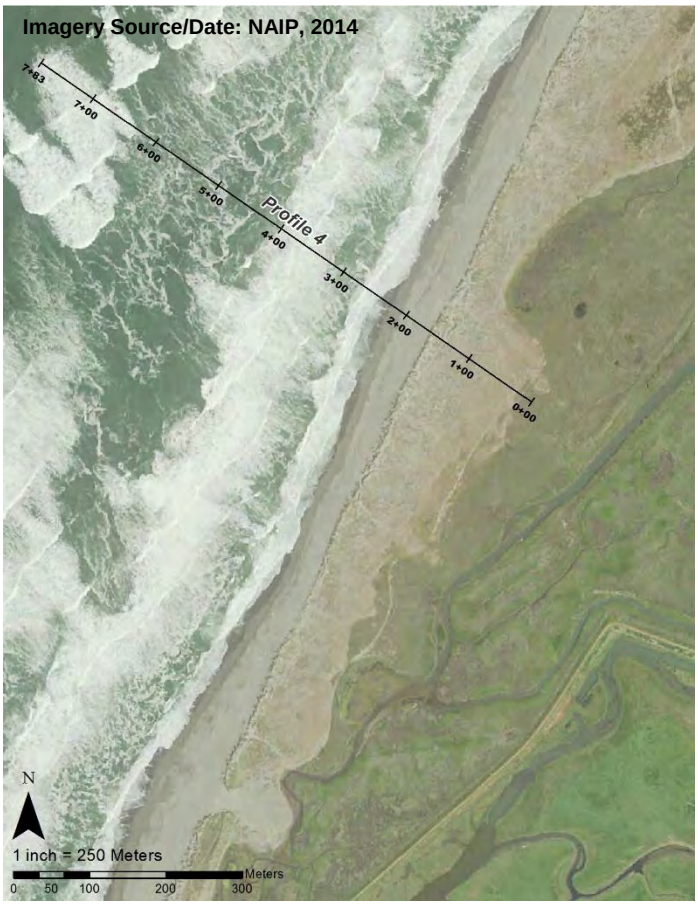
Imagery Source/Date: California Coastal Records Project, 2013


Imagery Source/Date: California Coastal Records Project, 2002

Imagery Source/Date: California Coastal Records Project, 1987

Imagery Source/Date: California Coastal Records Project, 1972

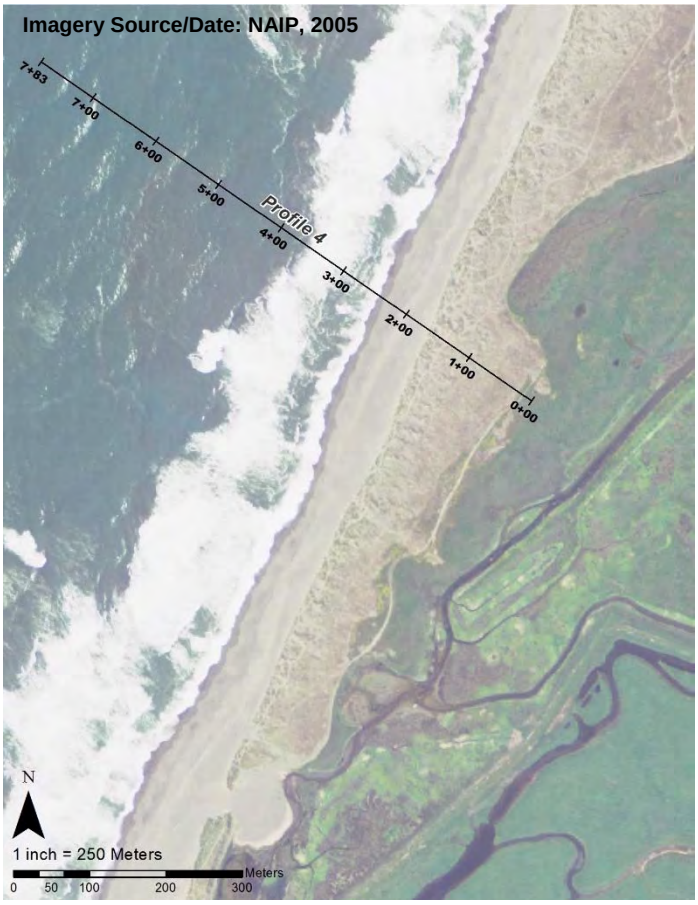
Profile 4 Imagery


Imagery Source/Date: NAIP, 2014
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

Imagery Source/Date: NAIP, 2012
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

Imagery Source/Date: NAIP, 2010
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

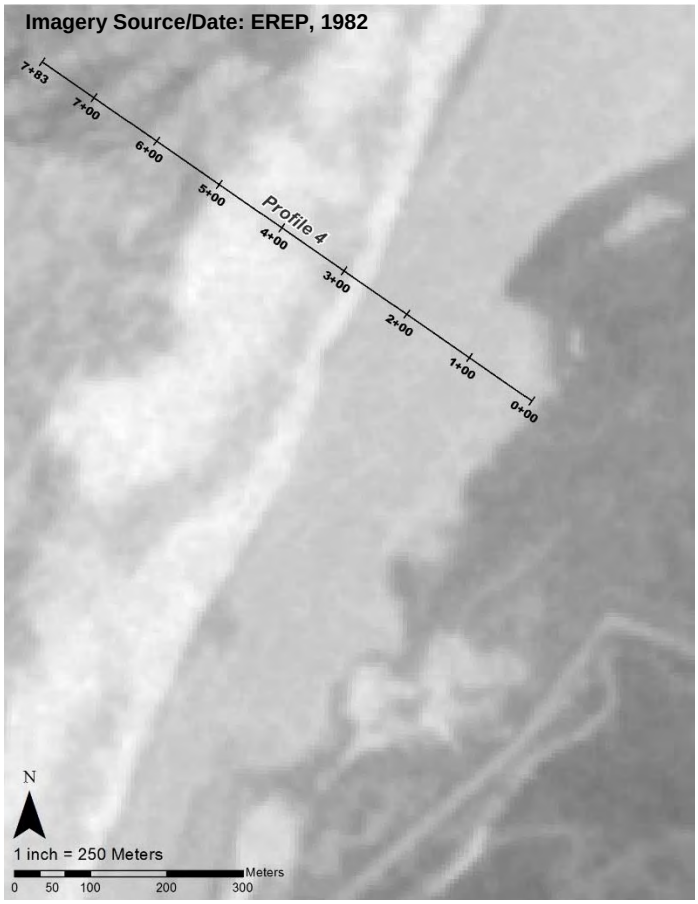
Imagery Source/Date: NAIP, 2009
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

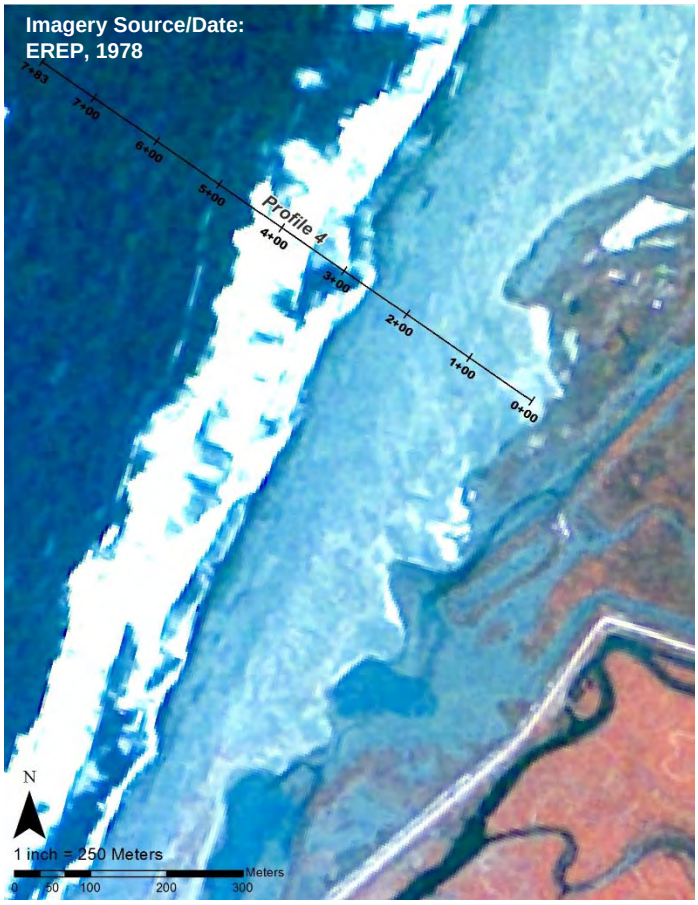

Imagery Source/Date: NAIP, 2005
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

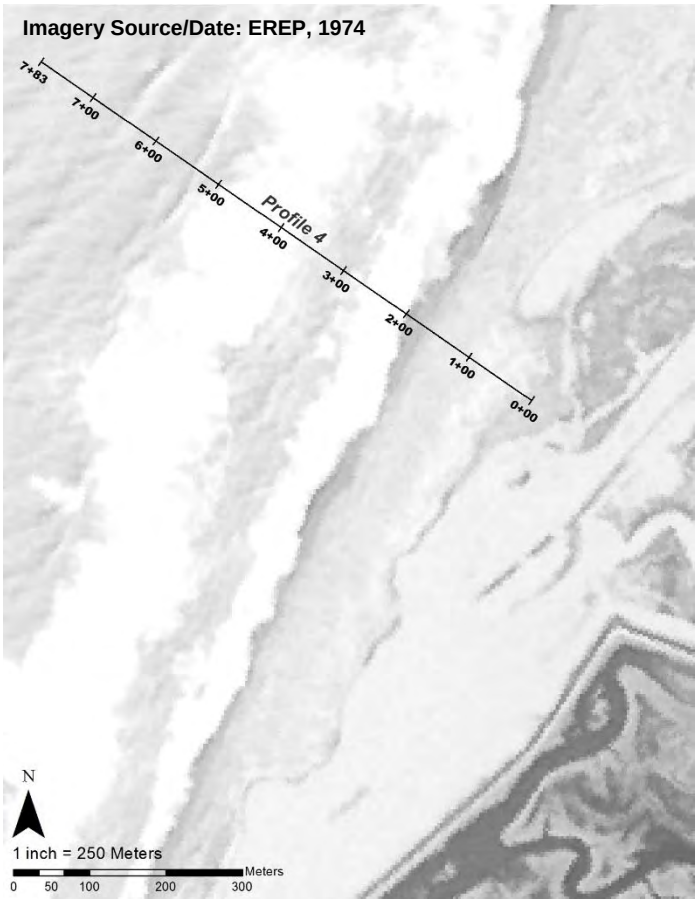
Imagery Source/Date: California Coastal Records Project, 1993
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 250 Meters
0 50 100 200 300
Meters

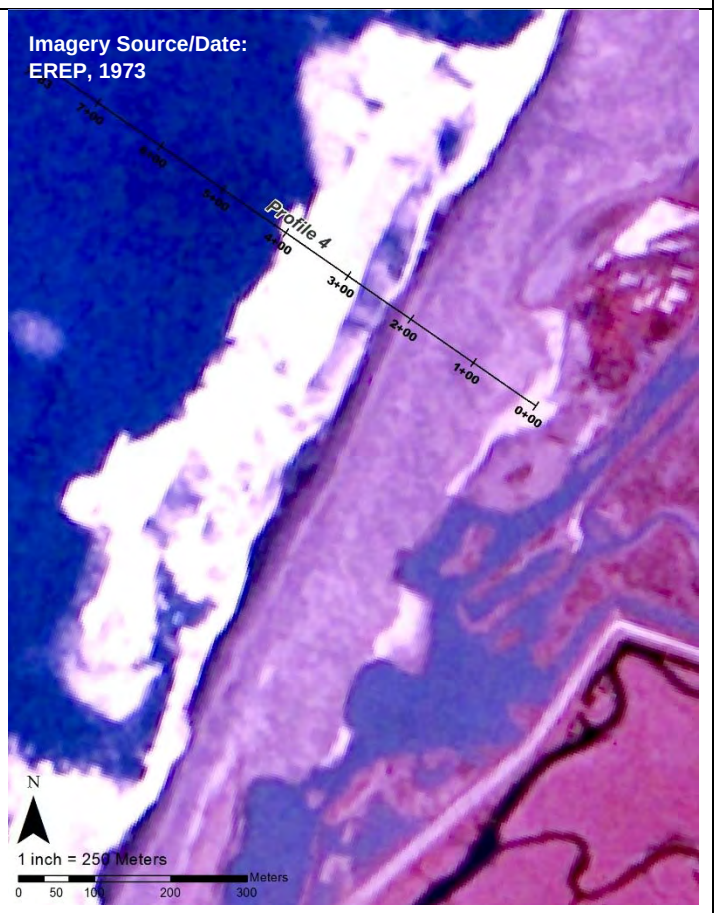
Imagery Source/Date: Humboldt County, 1988
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

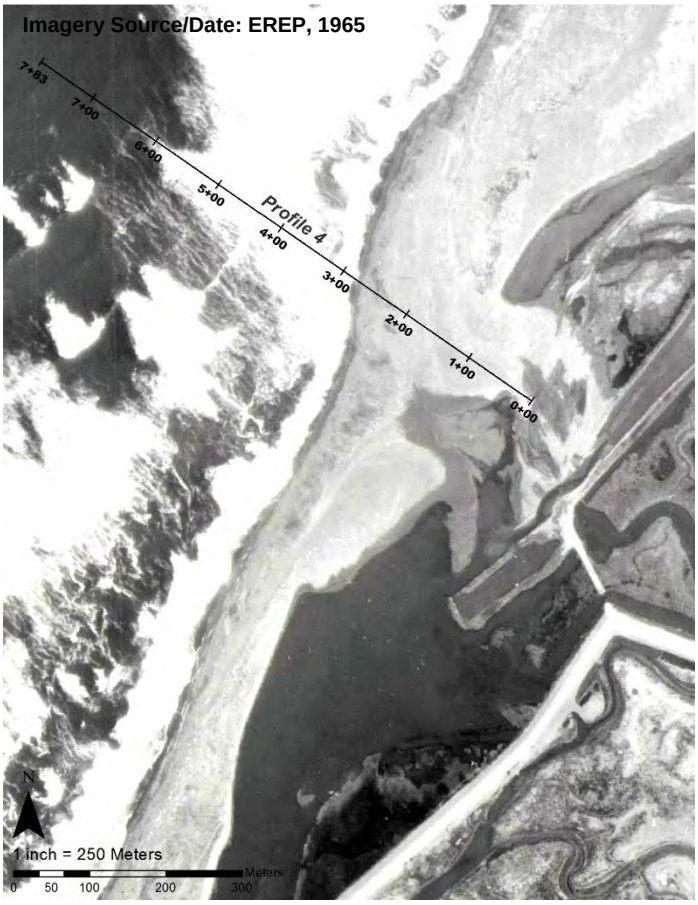
Imagery Source/Date: EREP, 1985
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

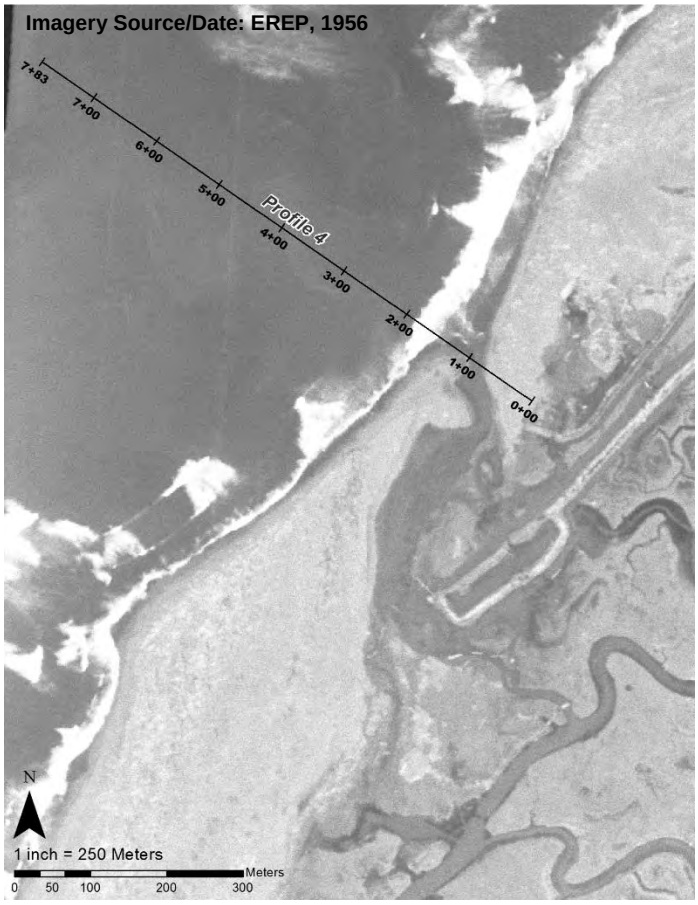

Imagery Source/Date: EREP, 1982
7+83
7+00
6+00
5+00
Profile 4
4+00
3+00
2+00
1+00
0+00
N
1 inch = 250 Meters
Meters
0 50 100 200 300


Imagery Source/Date:
EREP, 1978
7+83
7+00
6+00
5+00
Profile 4
4+00
3+00
2+00
1+00
0+00
N
1 inch = 250 Meters
Meters
0 50 100 200 300


Imagery Source/Date: EREP, 1974
7+83
7+00
6+00
5+00
Profile 4
4+00
3+00
2+00
1+00
0+00
N
1 inch = 250 Meters
Meters
0 50 100 200 300

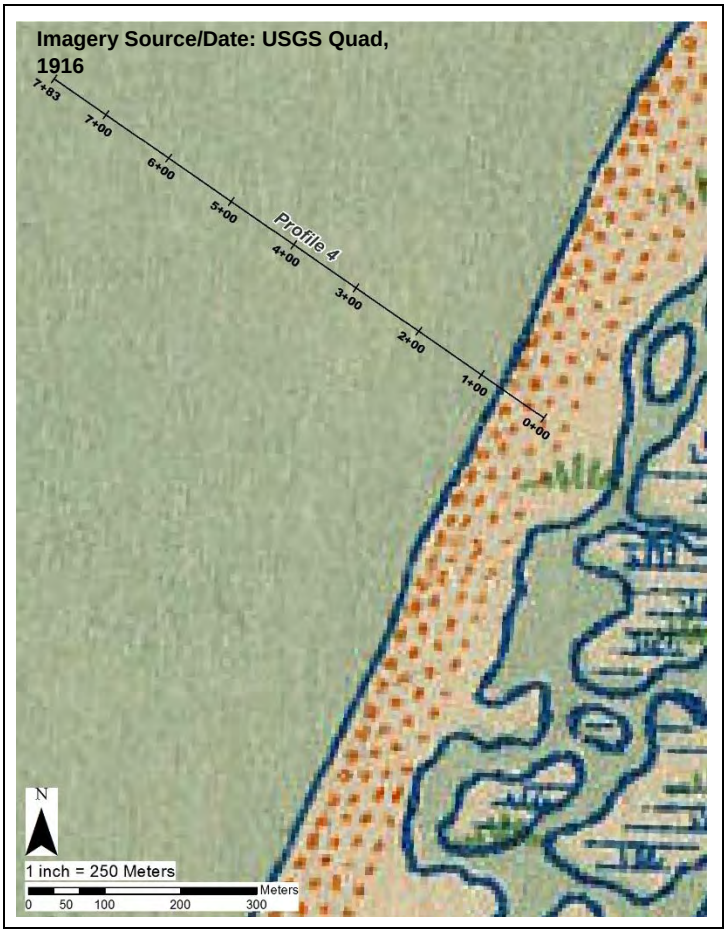

Imagery Source/Date:
EREP, 1973
Profile 4
3+00
2+00
1+00
0+00
N
1 inch = 250 Meters
Meters
0 50 100 200 300


Imagery Source/Date: EREP, 1965
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

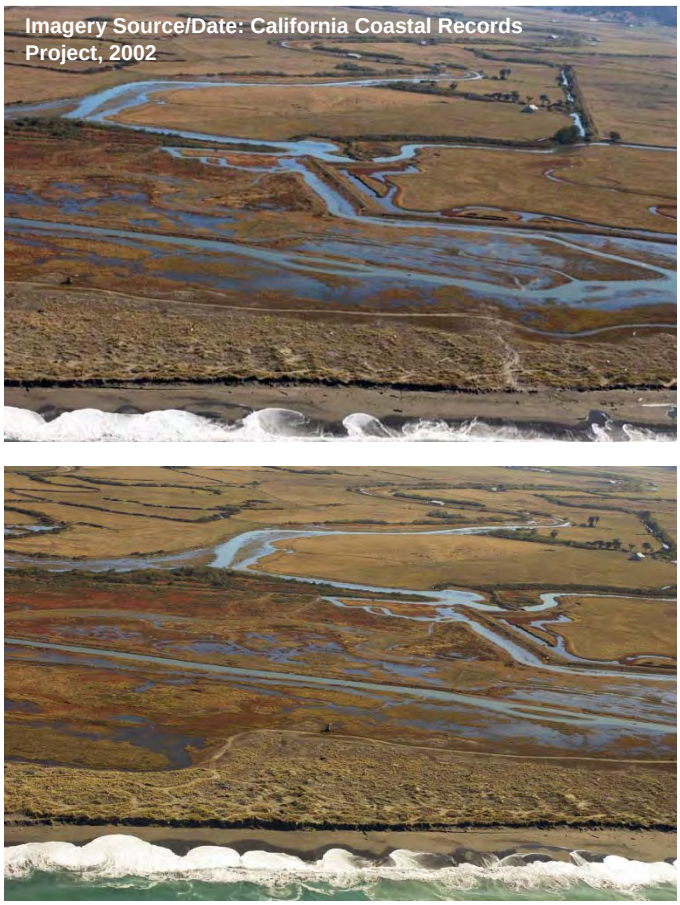

Imagery Source/Date: EREP, 1956
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

Imagery Source/Date:
EREP, 1948
Profile 4
4+00
1+00
0+00
N
1 inch = 250 Meters
0 50 100 200 300
Meters

Imagery Source/Date: EREP, 1940
7+83
6+00
5+00
Profile 4
2+00
1+00
0+00
N
1 inch = 250 Meters
0 50 100 200 300
Meters


Imagery Source/Date: USGS Quad, 1916
7+83
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 4
N
1 inch = 250 Meters
0 50 100 200 300
Meters

Imagery Source/Date: California Coastal Records Project, 2013


Imagery Source/Date: California Coastal Records Project, 2002

Imagery Source/Date: California Coastal Records Project, 1987

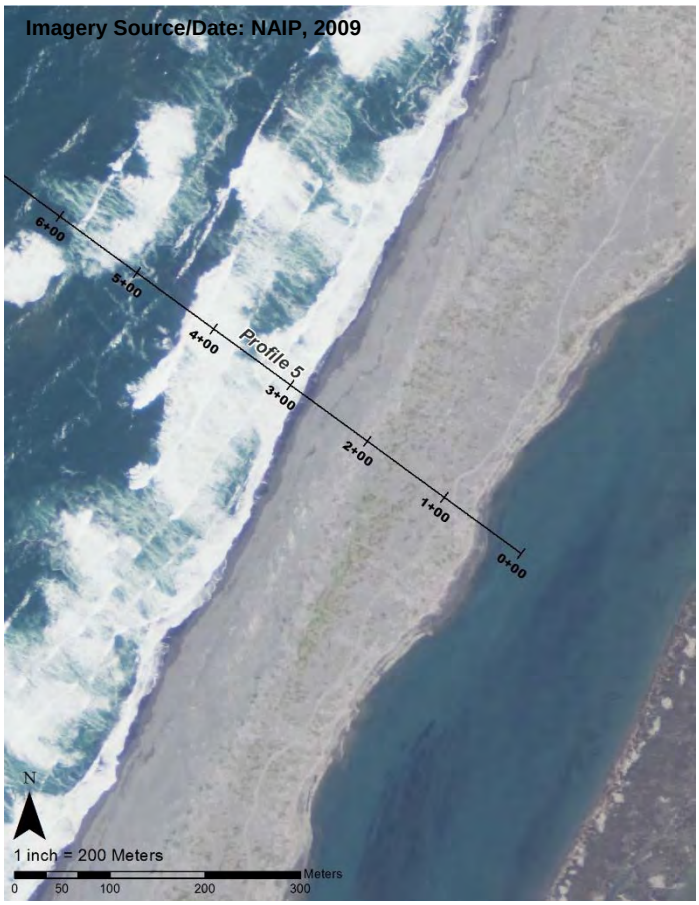
Imagery Source/Date: California Coastal Records Project, 1972

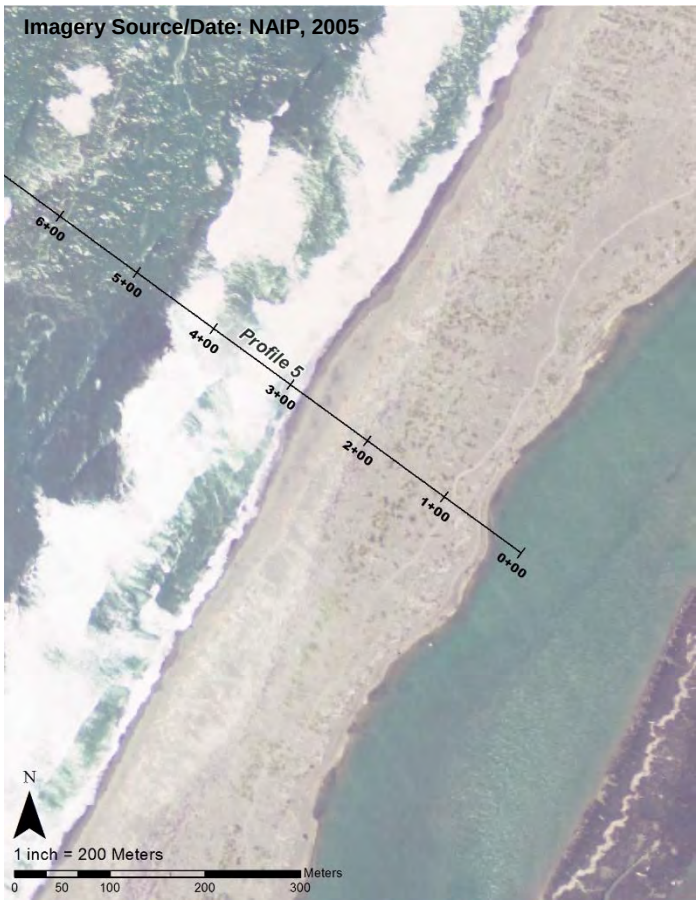
Profile 5 Imagery

Imagery Source/Date: NAIP, 2014
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

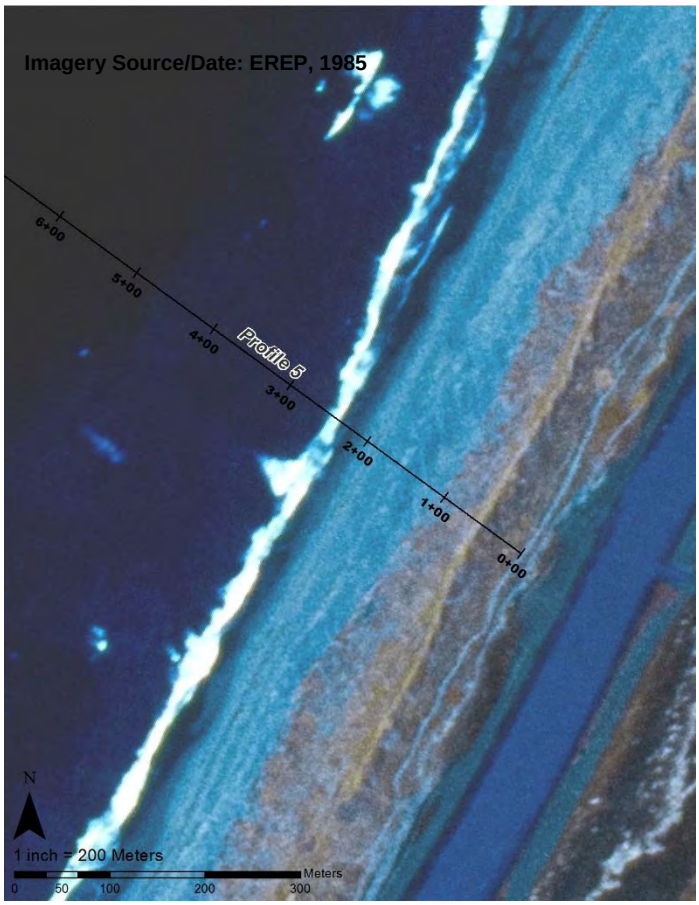
Imagery Source/Date: NAIP, 2012
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

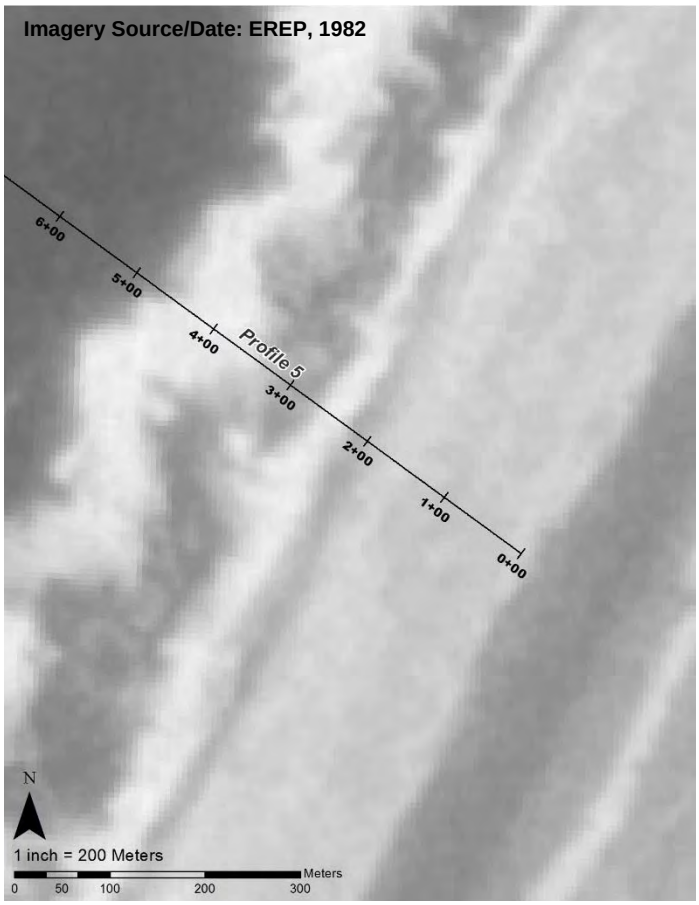
Imagery Source/Date: NAIP, 2010
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

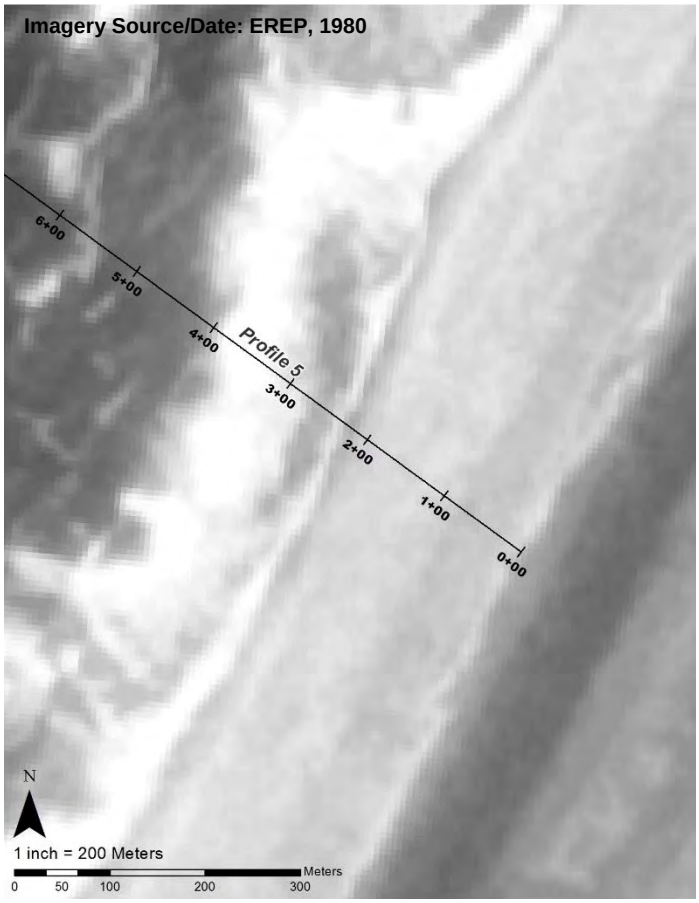

Imagery Source/Date: NAIP, 2009
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: NAIP, 2005
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

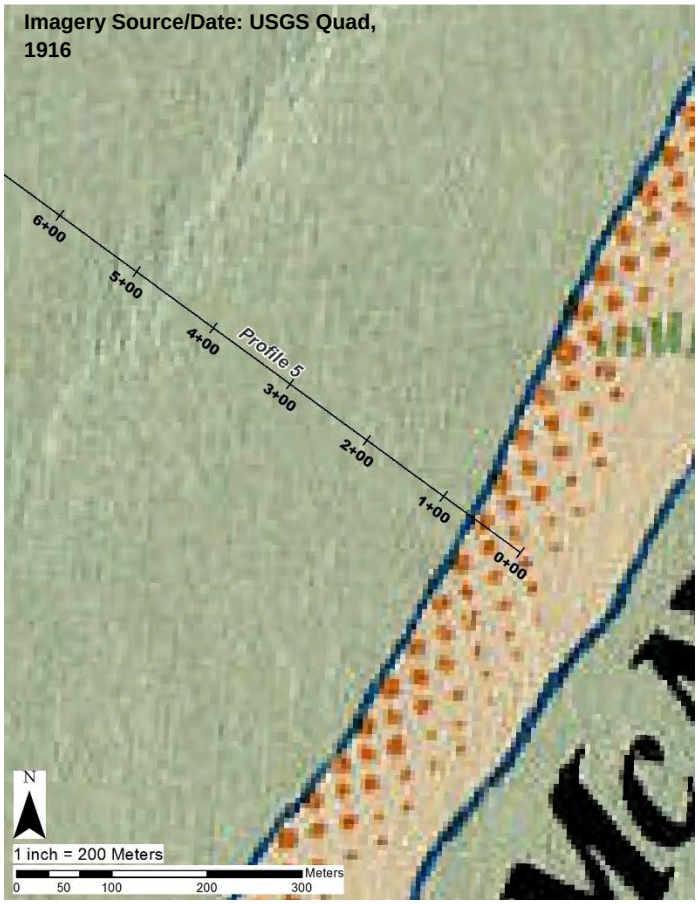
Imagery Source/Date: California Coastal Records Project, 1993
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1985
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1982
Profile 5
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1980
6+00
5+00
4+00
Profile 5
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300

Imagery Source/Date: CDF, 1948
6+00
5+00
4+00
Profile 5
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300


Imagery Source/Date: USGS Quad, 1916
6+00
5+00
4+00
Profile 5
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
Meters
0 50 100 200 300

Imagery Source/Date: California Coastal Records
Project, 2013

Imagery Source/Date: California Coastal Records
Project, 2002

Imagery Source/Date: California Coastal Records
Project, 1987

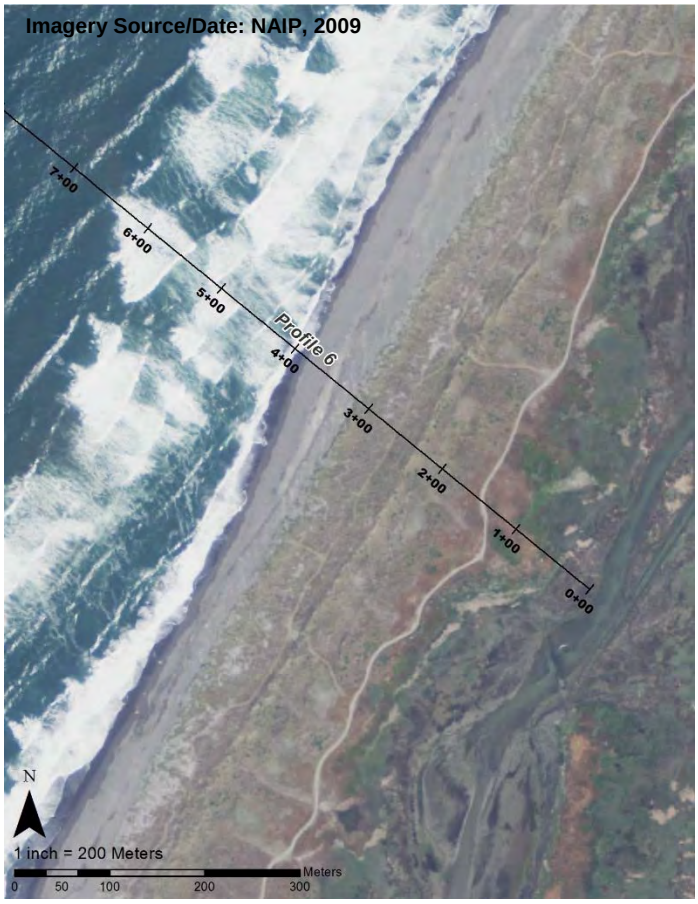
Imagery Source/Date: California Coastal Records
Project, 1972

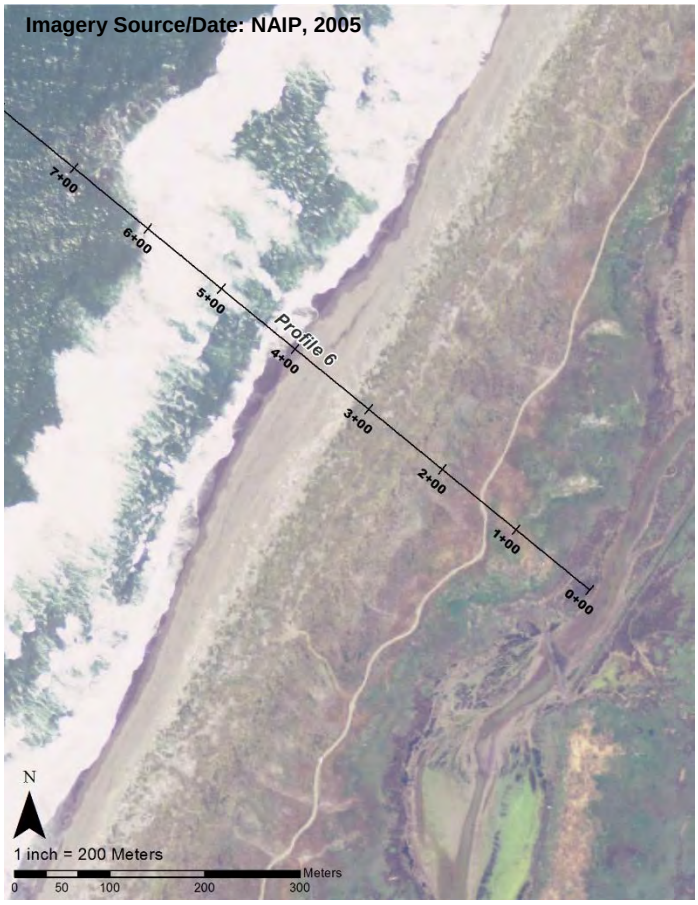
Profile 6 Imagery

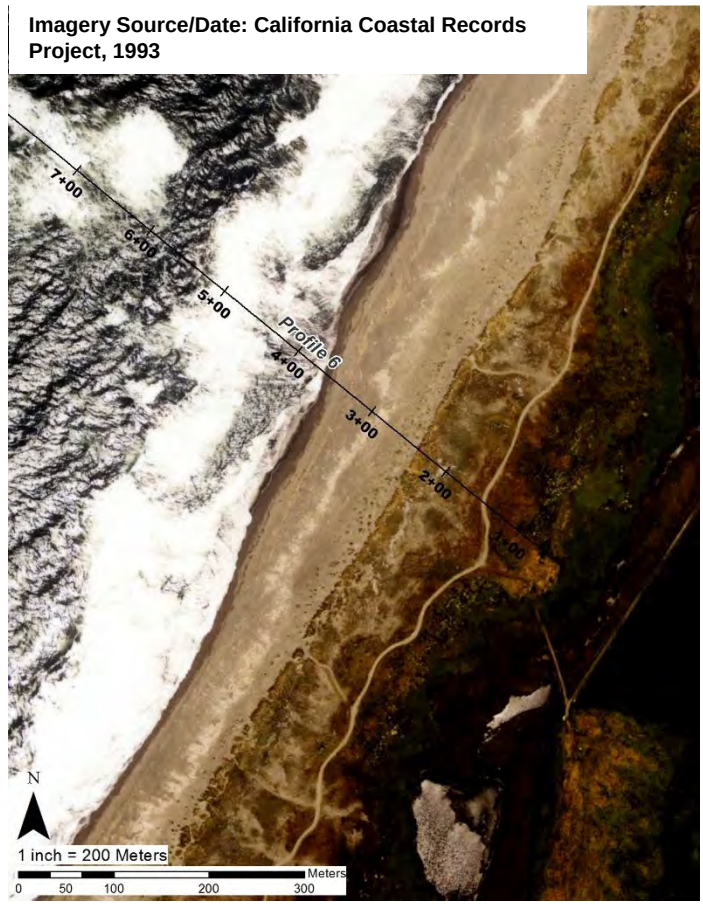
Imagery Source/Date: NAIP, 2014
Profile 6
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

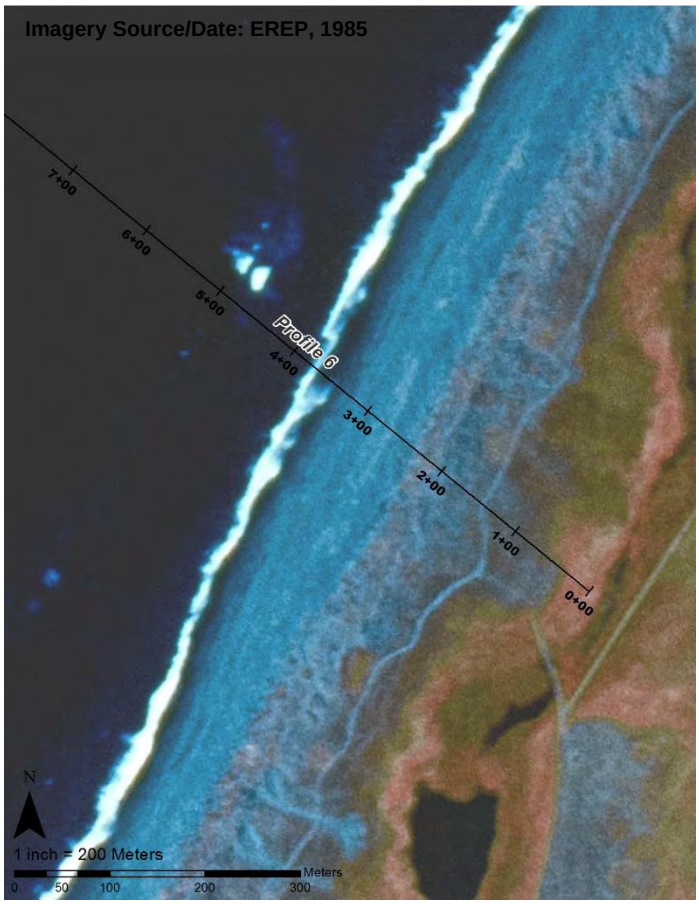
Imagery Source/Date: NAIP, 2012
Profile 6
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

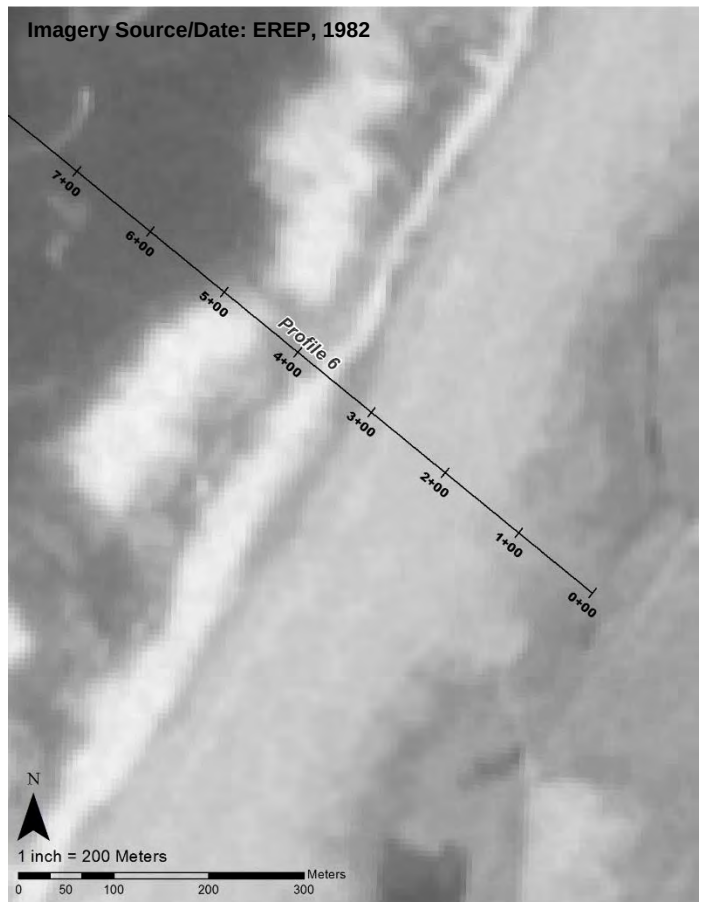
Imagery Source/Date: NAIP, 2010
Profile 6
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

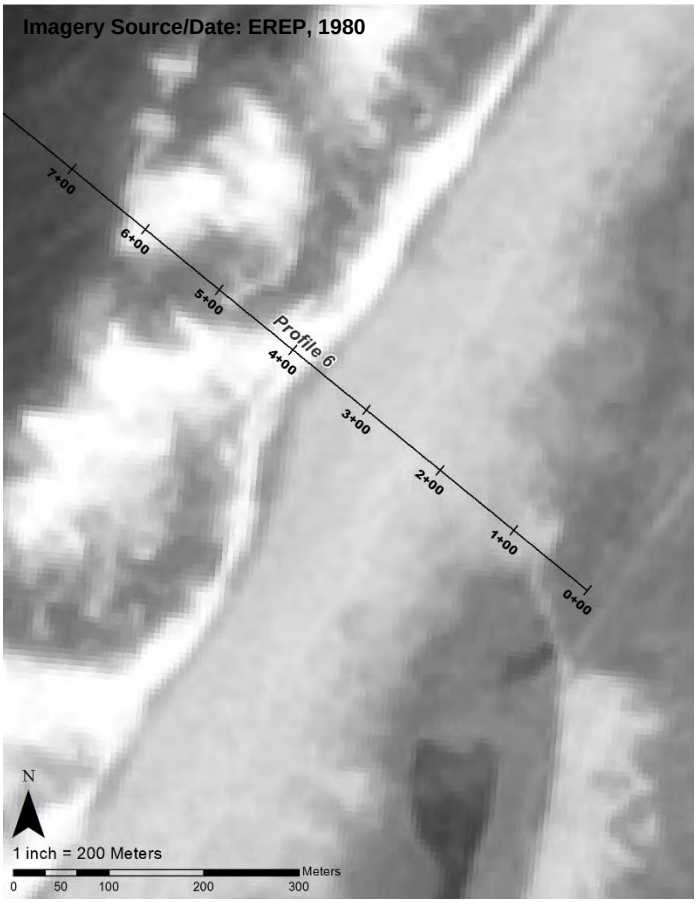

Imagery Source/Date: NAIP, 2009
Profile 6
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
N
1 inch = 200 Meters
0 50 100 200 300
Meters

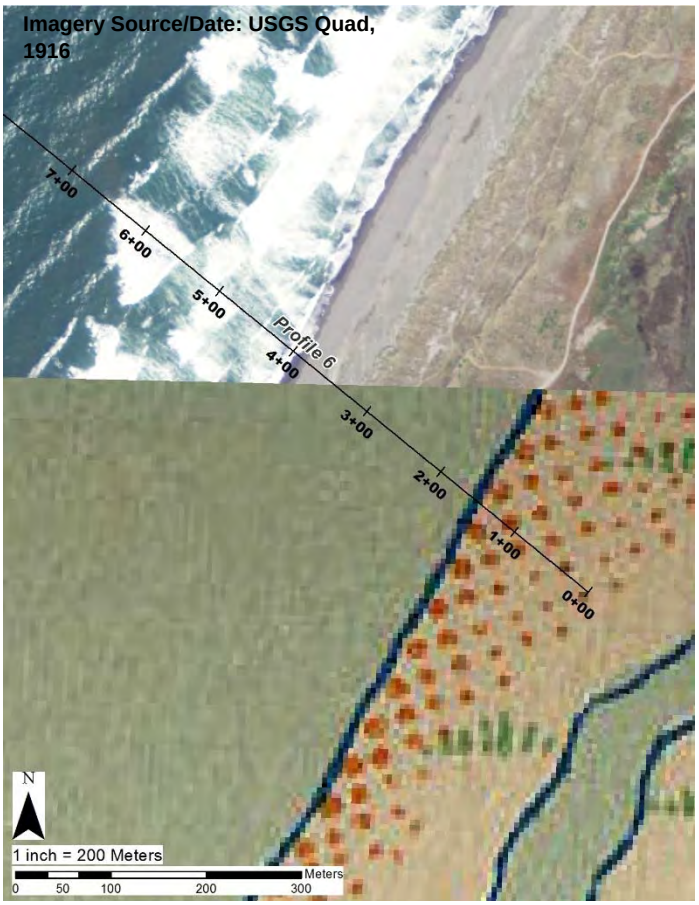

Imagery Source/Date: NAIP, 2005
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 6
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: California Coastal Records Project, 1993
7+00
6+00
5+00
4+00
3+00
2+00
1+00
Profile 6
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1985
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 6
N
1 inch = 200 Meters
0 50 100 200 300
Meters

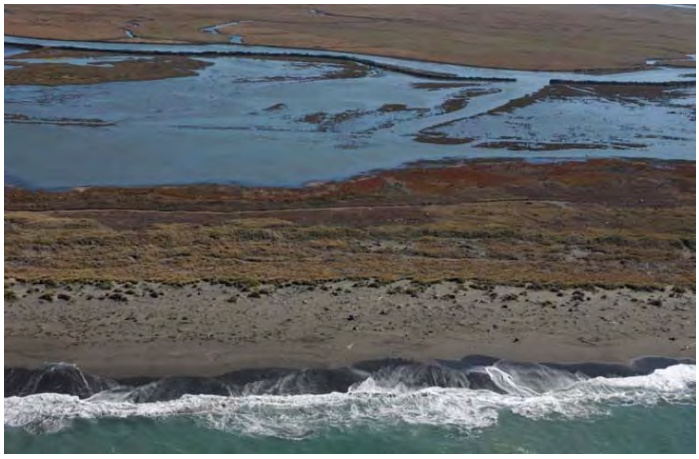

Imagery Source/Date: EREP, 1982
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 6
N
1 inch = 200 Meters
0 50 100 200 300
Meters


Imagery Source/Date: EREP, 1980
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 6
N
1 inch = 200 Meters
Meters
0
50
100
200
300


Imagery Source/Date: USGS Quad, 1916
7+00
6+00
5+00
4+00
3+00
2+00
1+00
0+00
Profile 6
N
1 inch = 200 Meters
Meters
0
50
100
200
300

Imagery Source/Date: California Coastal Records
Project, 2013

Imagery Source/Date: California Coastal Records
Project, 2002



Imagery Source/Date: California Coastal Records
Project, 1987

Imagery Source/Date: California Coastal Records
Project, 1972

Appendix B – Eel River Mouth Imagery

Imagery Source/Date: NAIP, 2014
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

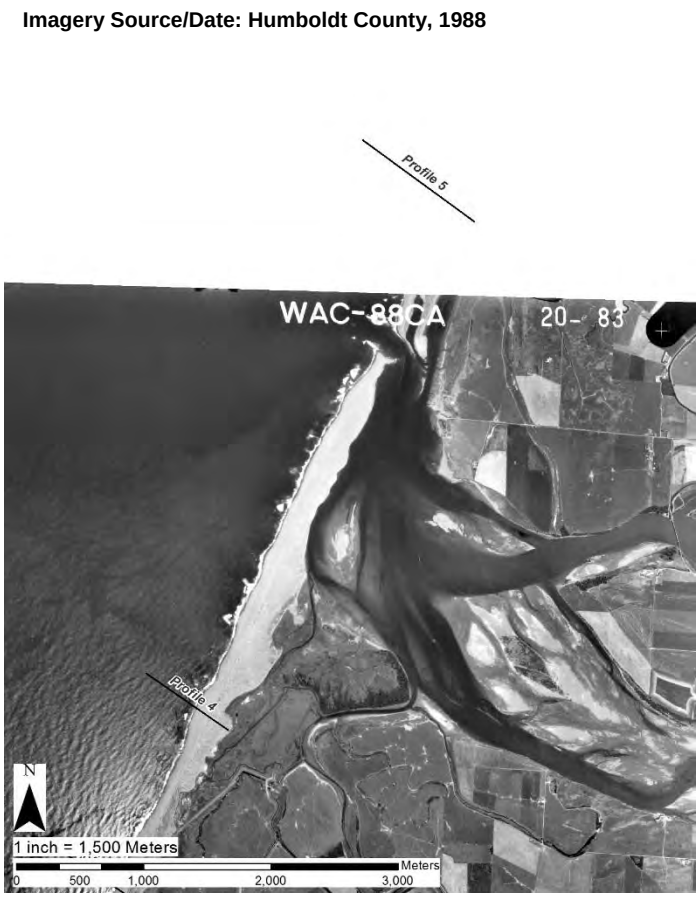
Imagery Source/Date: NAIP, 2012
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

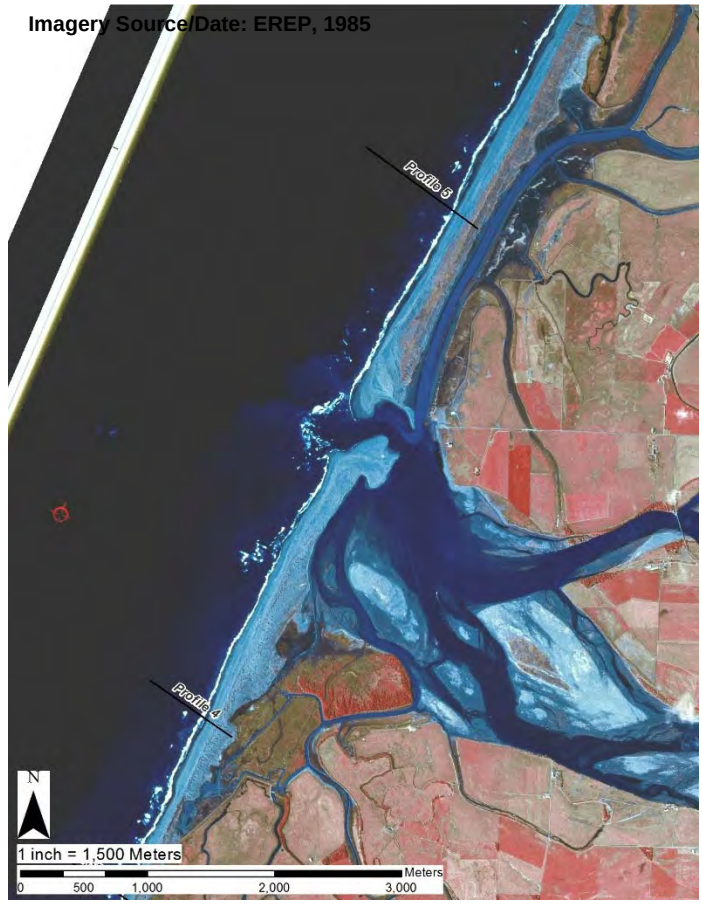
Imagery Source/Date: NAIP, 2010
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

Imagery Source/Date: NAIP, 2009
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

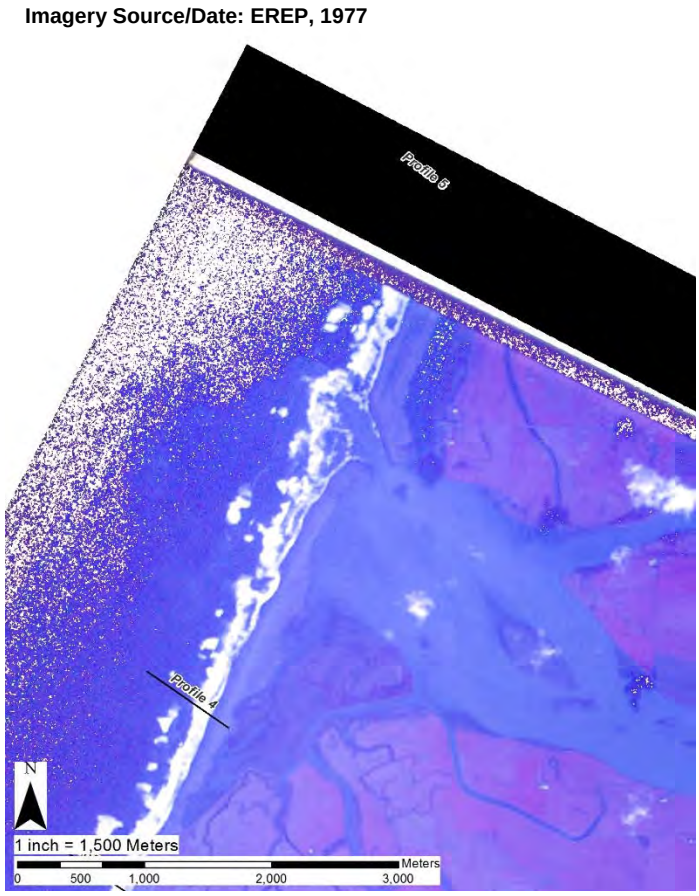
Imagery Source/Date: NAIP, 2005
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

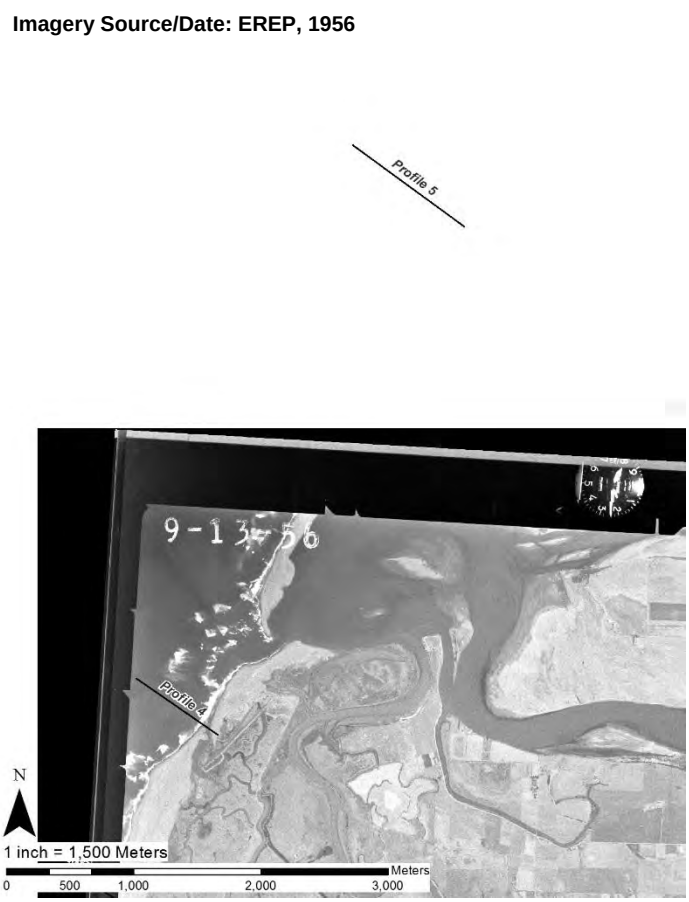
Imagery Source/Date:
California Coastal Records,
1993
6-16-93
CDBW-BBK-C
188-18
188-17
Profile 5
6-16-93
CDBW-BBK-C
188-13
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

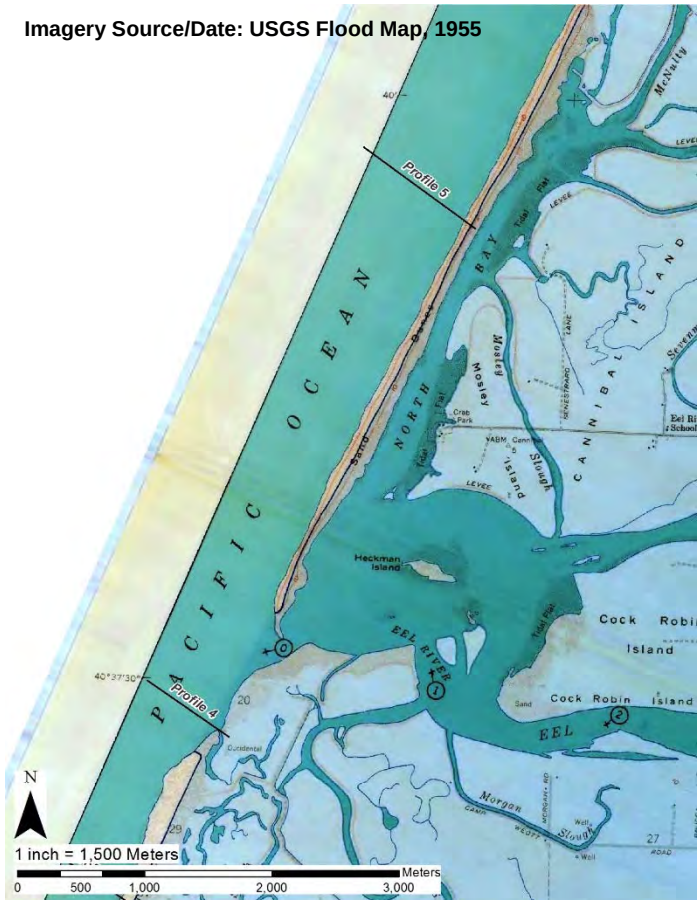

Imagery Source/Date: Humboldt County, 1988
Profile 5
WAC-88CA
20- 83
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000


Imagery Source/Date: EREP, 1985
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

Imagery Source/Date: EREP, 1982
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

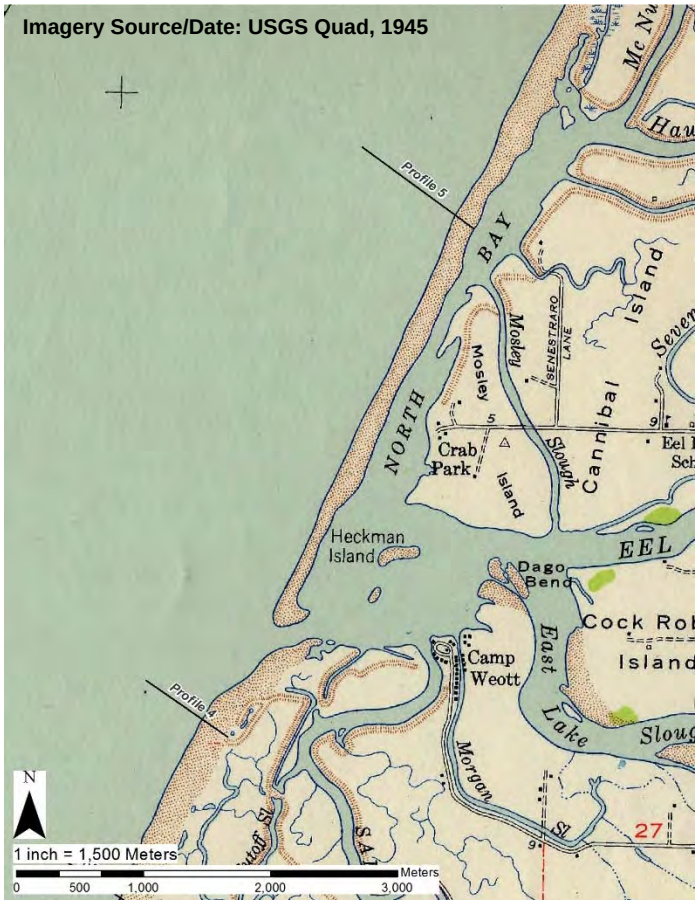

Imagery Source/Date: EREP, 1977
Profile 5
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000


Imagery Source/Date: EREP, 1956
Profile 5
9-13-56
Profile 4
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

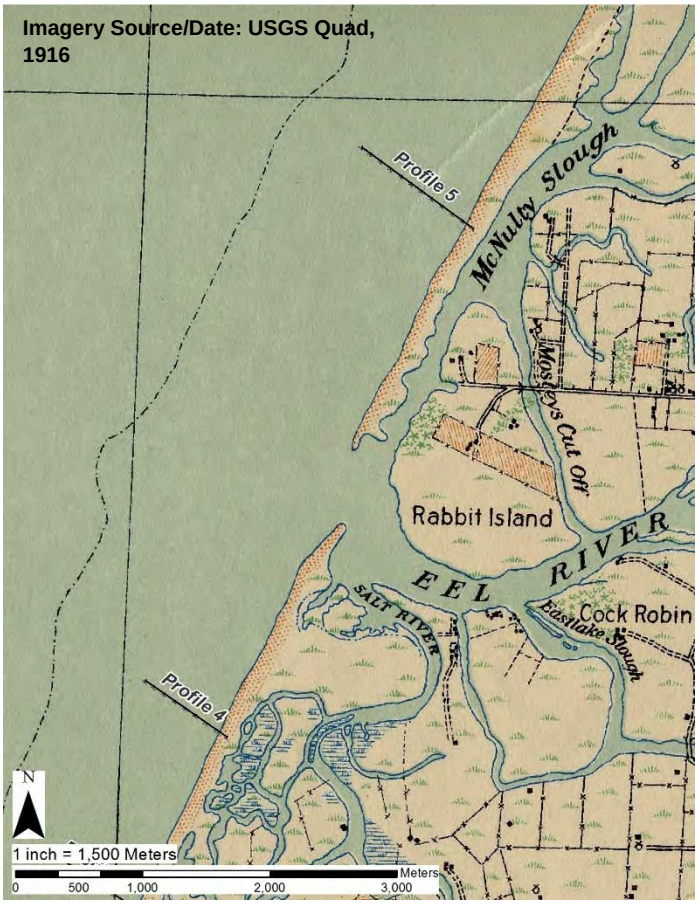

Imagery Source/Date: USGS Flood Map, 1955
Profile 5
Profile 4
PACIFIC OCEAN
NORTH BAY
CANIBAL ISLAND
Mosley Slough
Heckman Island
EEL RIVER
Cock Robin Island
Morgan Slough
McNally
N
1 inch = 1,500 Meters
Meters
0 500 1,000 2,000 3,000

Imagery Source/Date: CDF, 1948

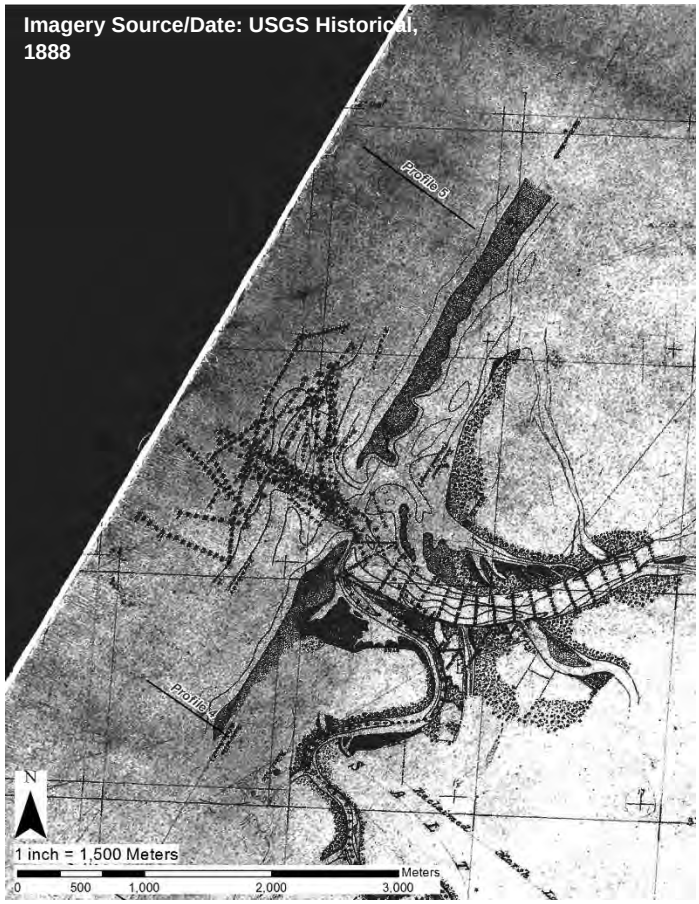
Imagery Source/Date: USGS Quad, 1945



Imagery Source/Date: USGS Quad, 1916

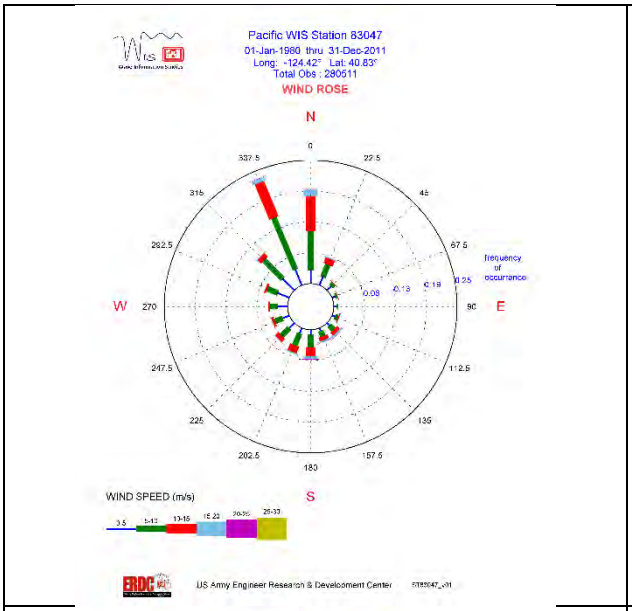


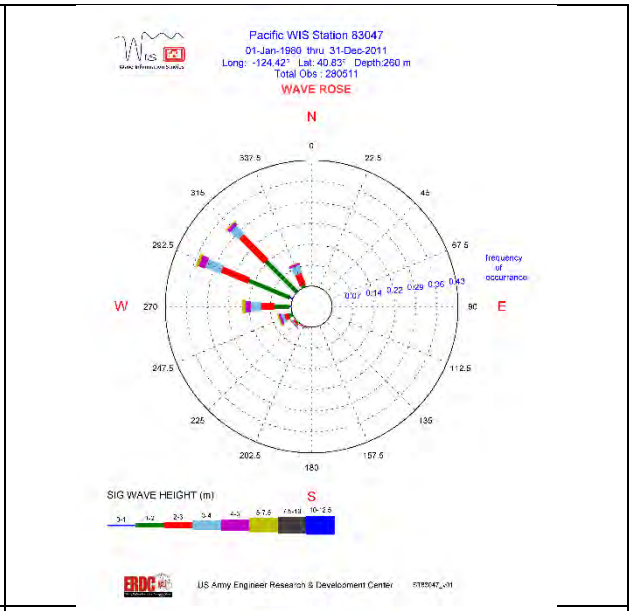
Imagery Source/Date: USGS Historical, 1888

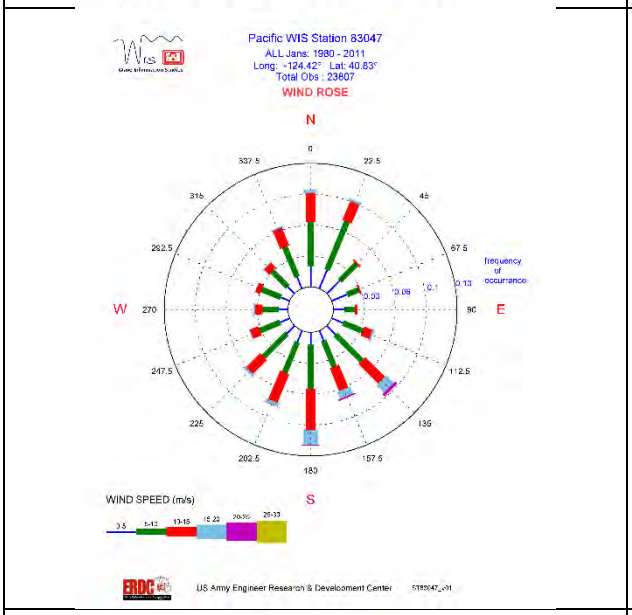


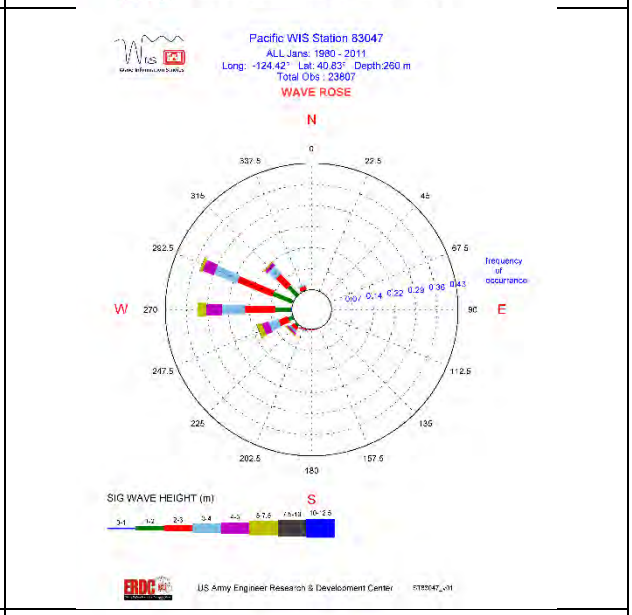
Appendix C – WIS Wind and Wave Roses

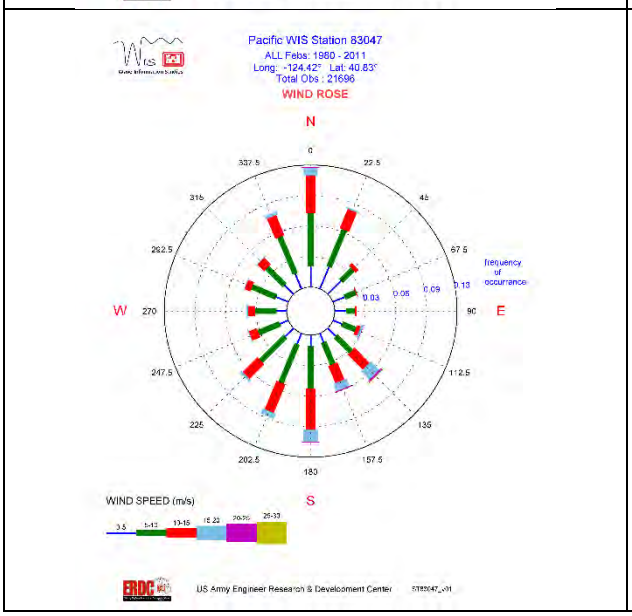
Buoy 83047

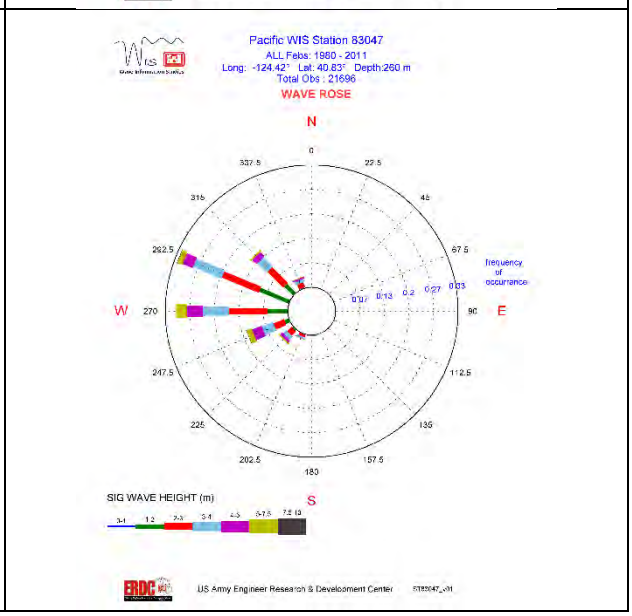

Pacific WIS Station 83047
01-Jan-1980 thru 31-Dec-2011
Long: -124.42° Lat: 40.83°
Total Obs : 280511
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

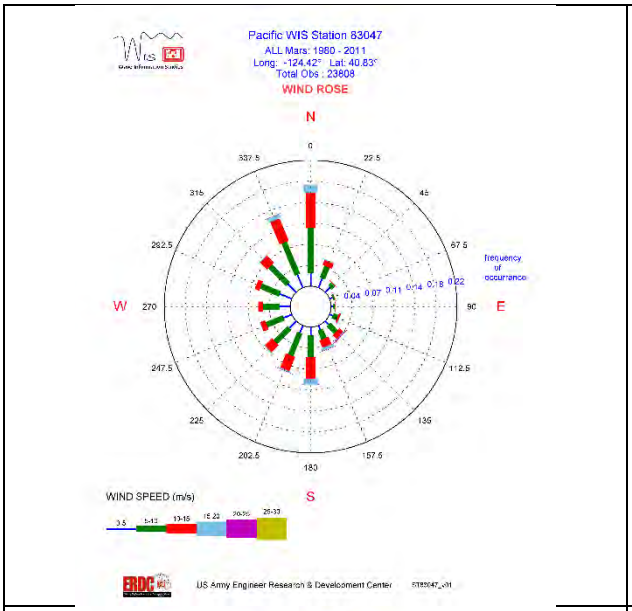

Pacific WIS Station 83047
01-Jan-1980 thru 31-Dec-2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 280511
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

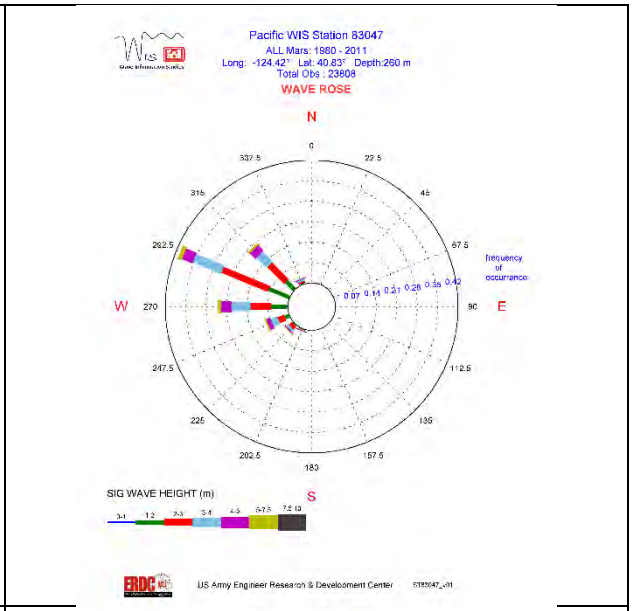

Pacific WIS Station 83047
ALL Jans: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23607
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

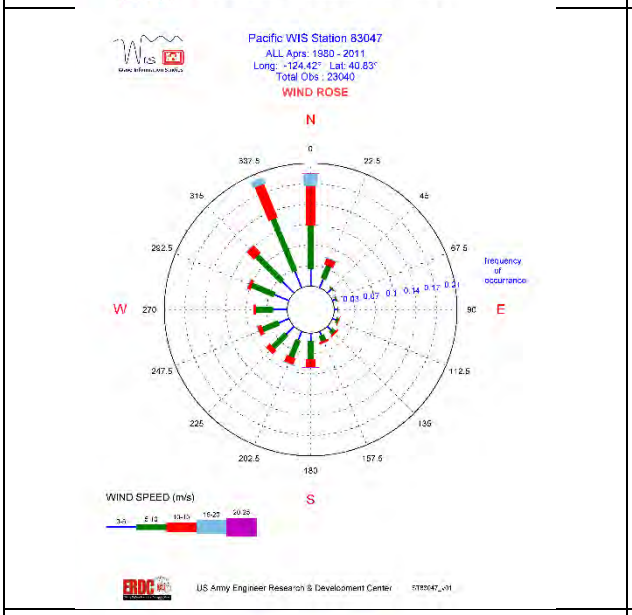

Pacific WIS Station 83047
ALL Jans: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23607
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

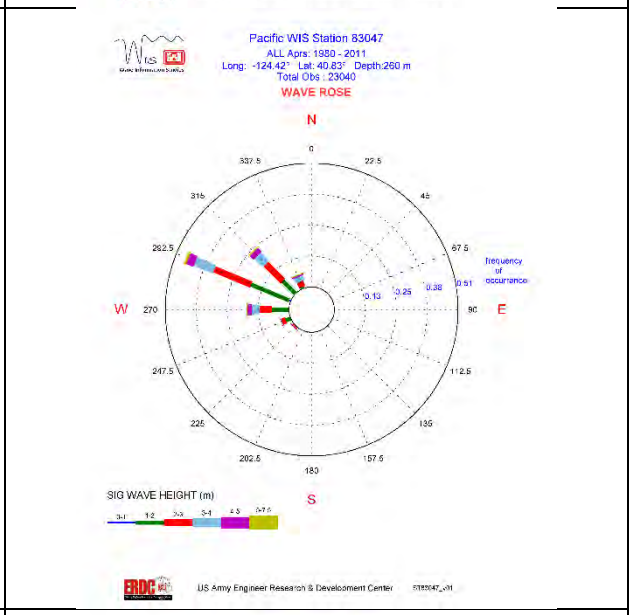

Pacific WIS Station 83047
ALL Febs: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 21696
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

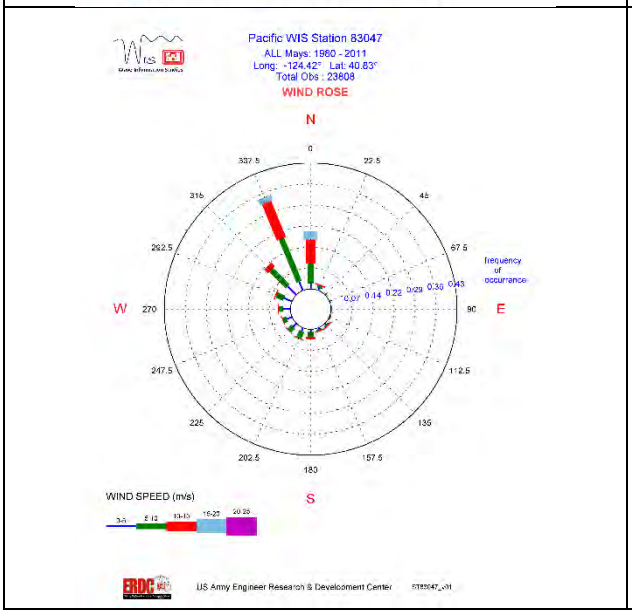

Pacific WIS Station 83047
ALL Febs: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 21696
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

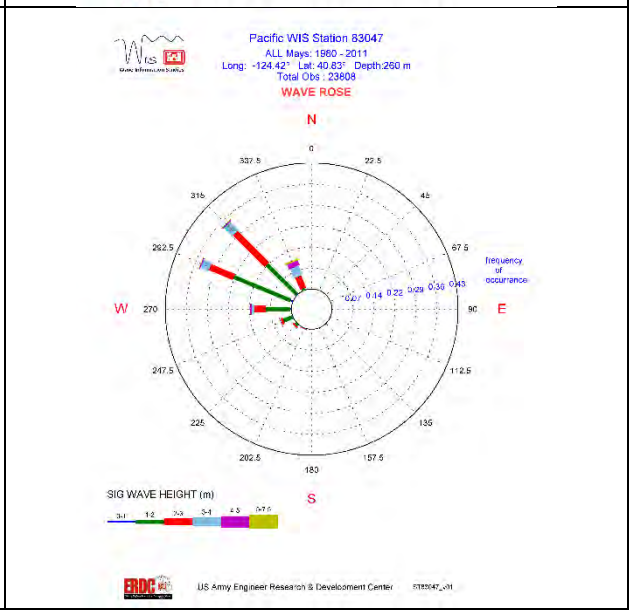

Pacific WIS Station 83047
ALL Mars: 1960 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23608
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

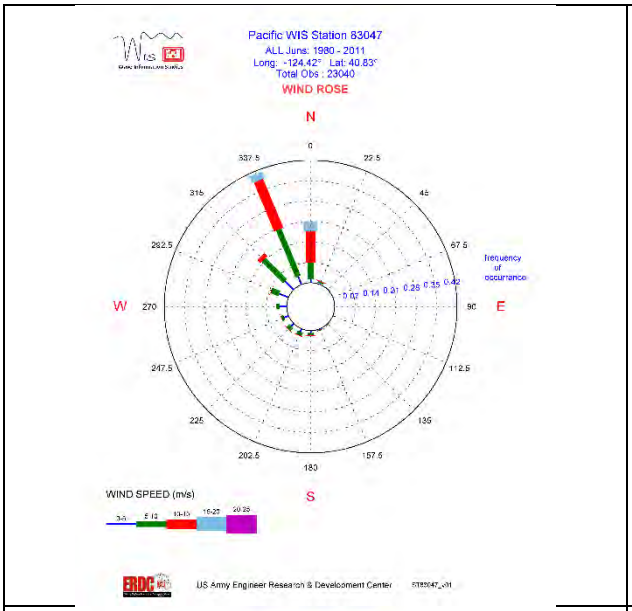

Pacific WIS Station 83047
ALL Mars: 1960 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23608
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

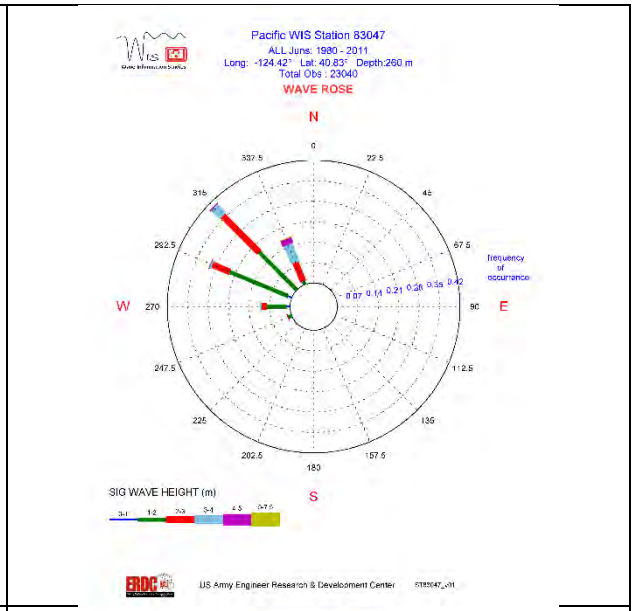

Pacific WIS Station 83047
ALL Aprs: 1960 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23040
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

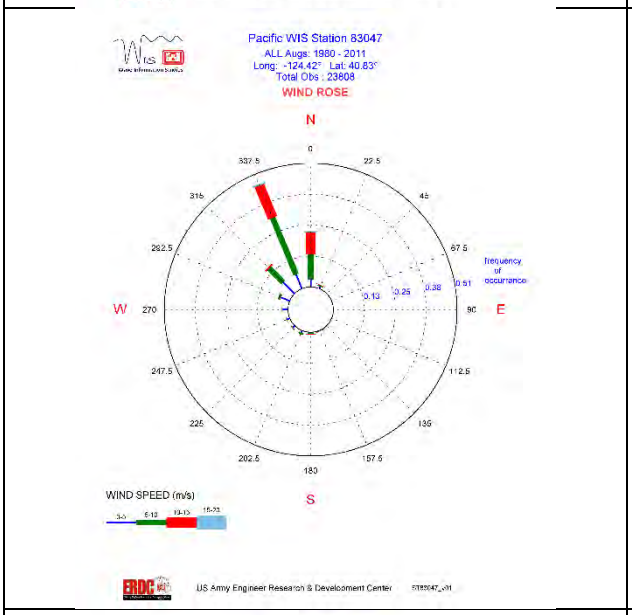

Pacific WIS Station 83047
ALL Aprs: 1960 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23040
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

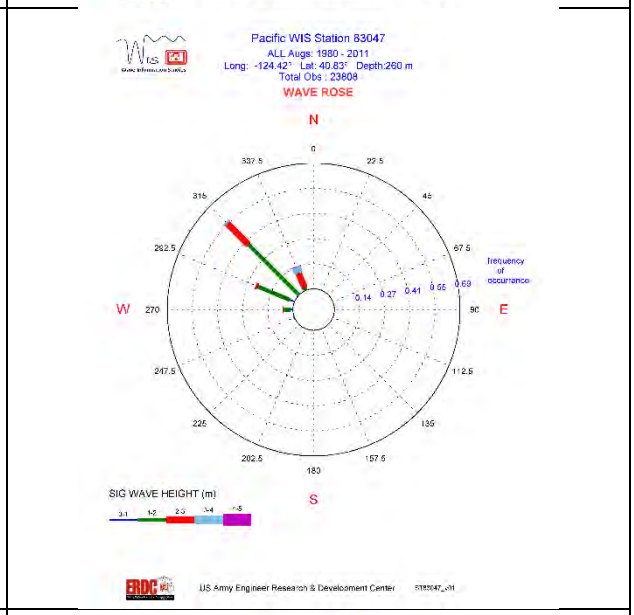

Pacific WIS Station 83047
ALL Mays: 1960 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23608
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

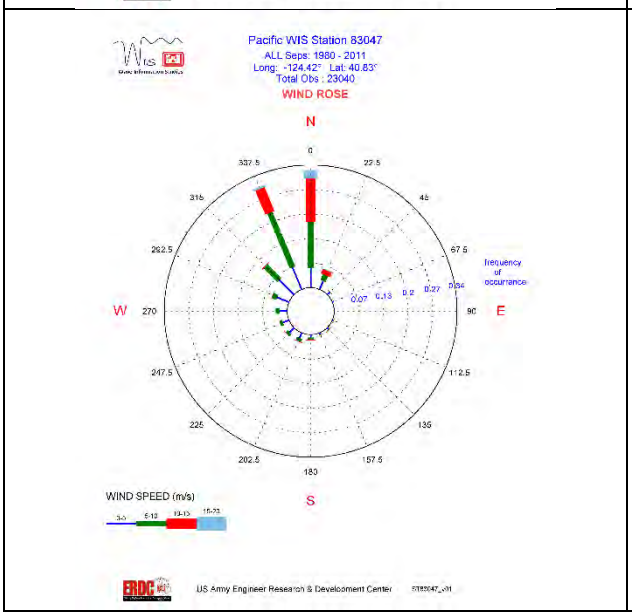

Pacific WIS Station 83047
ALL Mays: 1960 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23608
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

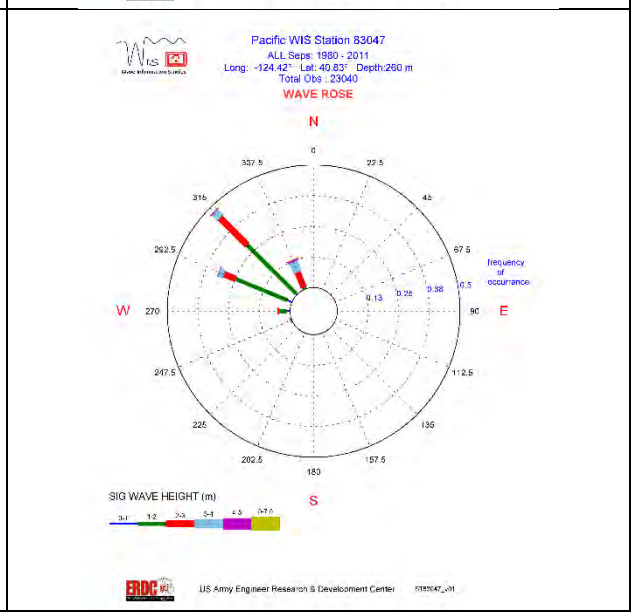

Pacific WIS Station 83047
ALL Juns: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23040
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

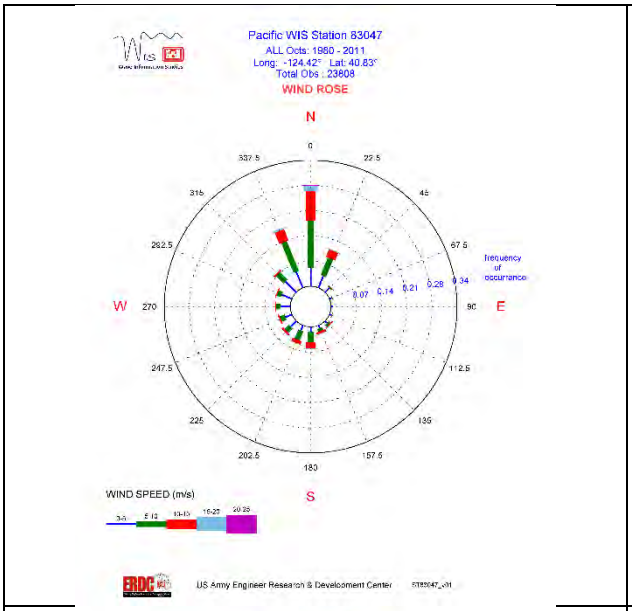

Pacific WIS Station 83047
ALL Juns: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23040
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

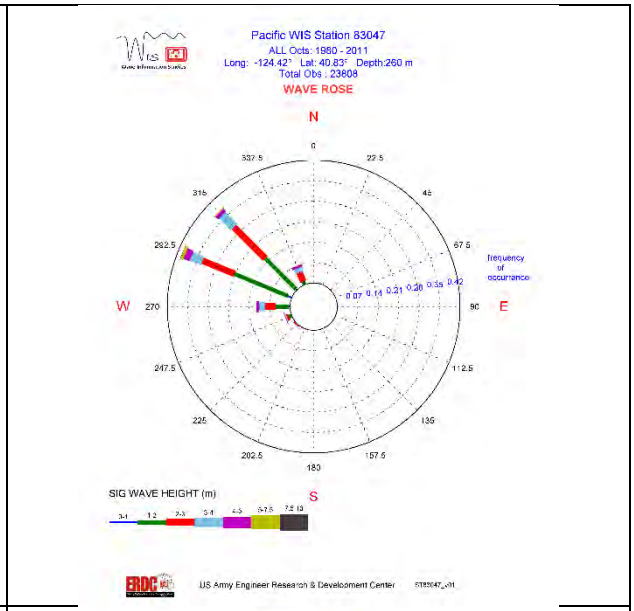

Pacific WIS Station 83047
ALL Augs: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23608
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

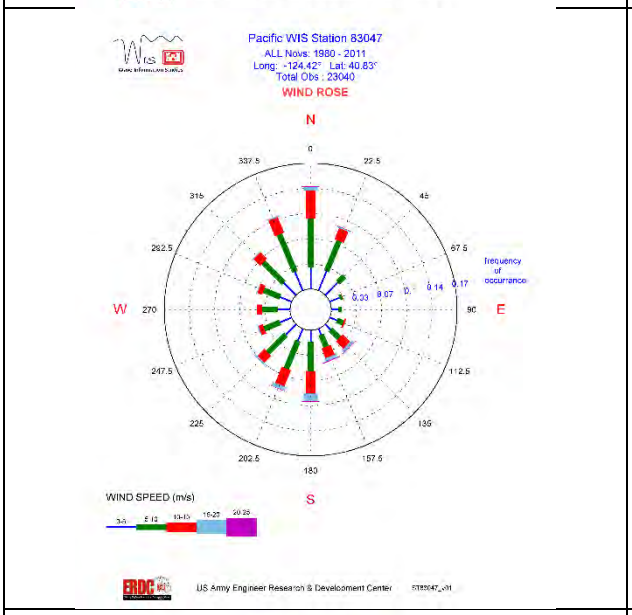

Pacific WIS Station 83047
ALL Augs: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23608
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

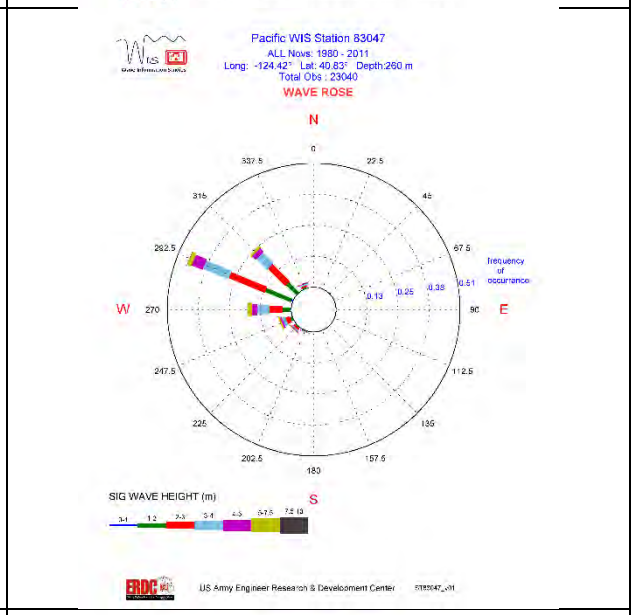

Pacific WIS Station 83047
ALL Seps: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23040
WIND ROSE
N
W
E
S
frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center

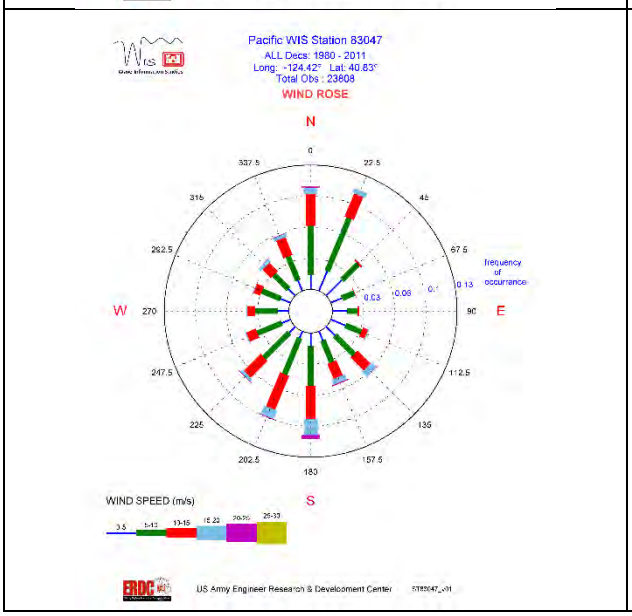

Pacific WIS Station 83047
ALL Seps: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23040
WAVE ROSE
N
W
E
S
frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

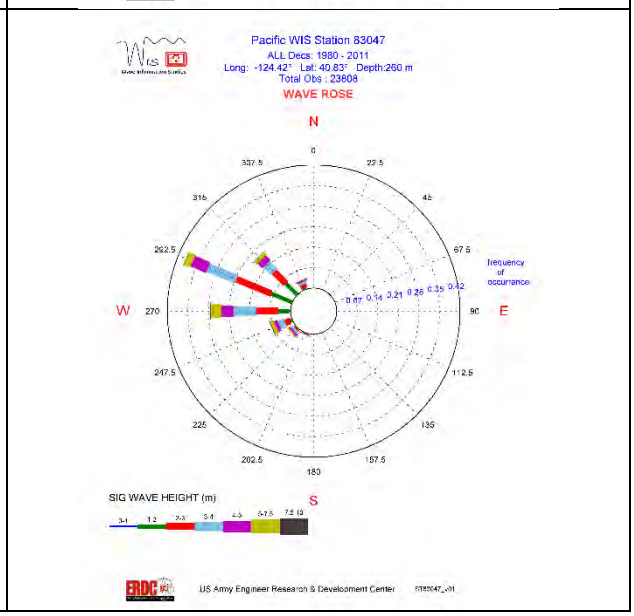

Pacific WIS Station 83047
ALL Octs: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23608
WIND ROSE
N
W
E
S
Frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center


Pacific WIS Station 83047
ALL Octs: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23608
WAVE ROSE
N
W
E
S
Frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center


Pacific WIS Station 83047
ALL Novs: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23040
WIND ROSE
N
W
E
S
Frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center


Pacific WIS Station 83047
ALL Novs: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23040
WAVE ROSE
N
W
E
S
Frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center


Pacific WIS Station 83047
ALL Decs: 1980 - 2011
Long: -124.42° Lat: 40.83°
Total Obs : 23608
WIND ROSE
N
W
E
S
Frequency of occurance
WIND SPEED (m/s)
US Army Engineer Research & Development Center


Pacific WIS Station 83047
ALL Decs: 1980 - 2011
Long: -124.42° Lat: 40.83° Depth:260 m
Total Obs : 23608
WAVE ROSE
N
W
E
S
Frequency of occurance
SIG WAVE HEIGHT (m)
US Army Engineer Research & Development Center

Appendix D CalEEMod Emissions Estimates

Eel River Estuary Preserve Ecosystem Enhancement Project

Humboldt County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
	0.00		600.00		0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	103
Climate Zone	1			**Operational Year**	2017
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - per the engineer spreadsheet.

Construction Phase - per the engineer spreadsheet.

Off-road Equipment - per the engineer spreadsheet.

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	930.00	110.00
tblConstructionPhase	PhaseEndDate	10/13/2017	10/15/2017
tblOffRoadEquipment	OffRoadEquipmentType	Tractors/Loaders/Backhoes	Off-Highway Trucks
tblOffRoadEquipment	OffRoadEquipmentType	Scrapers	Rubber Tired Loaders
tblOffRoadEquipment	OffRoadEquipmentType		Tractors/Loaders/Backhoes
tblOffRoadEquipment	OffRoadEquipmentType		Other Material Handling Equipment
tblOffRoadEquipment	OffRoadEquipmentType		Graders
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	8.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblOffRoadEquipment	UsageHours	8.00	10.00
tblProjectCharacteristics	OperationalYear	2014	2017
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	1.5437	17.4387	10.5220	0.0179	4.0463	0.7613	4.8076	1.6759	0.7004	2.3763	0.0000	1,658.5403	1,658.5403	0.5055	0.0000	1,669.1564
Total	**1.5437**	**17.4387**	**10.5220**	**0.0179**	**4.0463**	**0.7613**	**4.8076**	**1.6759**	**0.7004**	**2.3763**	**0.0000**	**1,658.5403**	**1,658.5403**	**0.5055**	**0.0000**	**1,669.1564**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	1.5437	10.0637	10.5220	0.0179	1.8281	0.7613	2.5894	0.7561	0.7004	1.4565	0.0000	1,658.5383	1,658.5383	0.5055	0.0000	1,669.1544
Total	**1.5437**	**10.0637**	**10.5220**	**0.0179**	**1.8281**	**0.7613**	**2.5894**	**0.7561**	**0.7004**	**1.4565**	**0.0000**	**1,658.5383**	**1,658.5383**	**0.5055**	**0.0000**	**1,669.1544**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**42.29**	**0.00**	**0.00**	**54.82**	**0.00**	**46.14**	**54.88**	**0.00**	**38.71**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Grading	Grading	5/15/2017	10/15/2017	5	110	Grading/Excavation

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 2325

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Grading	Tractors/Loaders/Backhoes	3	10.00	97	0.37
Grading	Other Material Handling Equipment	2	10.00	167	0.40
Grading	Graders	2	10.00	174	0.41
Grading	Excavators	4	10.00	162	0.38
Grading	Rubber Tired Dozers	4	10.00	255	0.40
Grading	Scrapers	3	10.00	361	0.48
Grading	Off-Highway Trucks	8	10.00	400	0.38
Grading	Rubber Tired Loaders	3	10.00	199	0.36

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Grading	8	20.00	0.00		16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					4.0331	0.0000	4.0331	1.6724	0.0000	1.6724	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5371	17.4268	10.4260	0.0178		0.7612	0.7612		0.7003	0.7003	0.0000	1,647.3924	1,647.3924	0.5048	0.0000	1,657.9923
Total	**1.5371**	**17.4268**	**10.4260**	**0.0178**	**4.0331**	**0.7612**	**4.7943**	**1.6724**	**0.7003**	**2.3726**	**0.0000**	**1,647.3924**	**1,647.3924**	**0.5048**	**0.0000**	**1,657.9923**

3.2 Grading - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-003	0.0120	0.0961	1.6000e-004	0.0132	1.2000e-004	0.0133	3.5100e-003	1.1000e-004	3.6300e-003	0.0000	11.1479	11.1479	7.7000e-004	0.0000	11.1641
Total	**6.6000e-003**	**0.0120**	**0.0961**	**1.6000e-004**	**0.0132**	**1.2000e-004**	**0.0133**	**3.5100e-003**	**1.1000e-004**	**3.6300e-003**	**0.0000**	**11.1479**	**11.1479**	**7.7000e-004**	**0.0000**	**11.1641**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.8149	0.0000	1.8149	0.7526	0.0000	0.7526	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5371	10.0517	10.4259	0.0178		0.7612	0.7612		0.7003	0.7003	0.0000	1,647.3904	1,647.3904	0.5048	0.0000	1,657.9903
Total	**1.5371**	**10.0517**	**10.4259**	**0.0178**	**1.8149**	**0.7612**	**2.5761**	**0.7526**	**0.7003**	**1.4528**	**0.0000**	**1,647.3904**	**1,647.3904**	**0.5048**	**0.0000**	**1,657.9903**

3.2 Grading - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-003	0.0120	0.0961	1.6000e-004	0.0132	1.2000e-004	0.0133	3.5100e-003	1.1000e-004	3.6300e-003	0.0000	11.1479	11.1479	7.7000e-004	0.0000	11.1641
Total	**6.6000e-003**	**0.0120**	**0.0961**	**1.6000e-004**	**0.0132**	**1.2000e-004**	**0.0133**	**3.5100e-003**	**1.1000e-004**	**3.6300e-003**	**0.0000**	**11.1479**	**11.1479**	**7.7000e-004**	**0.0000**	**11.1641**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Total					

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.424780	0.106685	0.174383	0.131324	0.085777	0.009018	0.014311	0.037694	0.002248	0.001589	0.007851	0.001308	0.003034

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Appendix E Biological Studies

Eel River Estuary Preserve Ecosystem Enhancement Project

Habitat and Vegetation Mapping

December 2013

1. Introduction

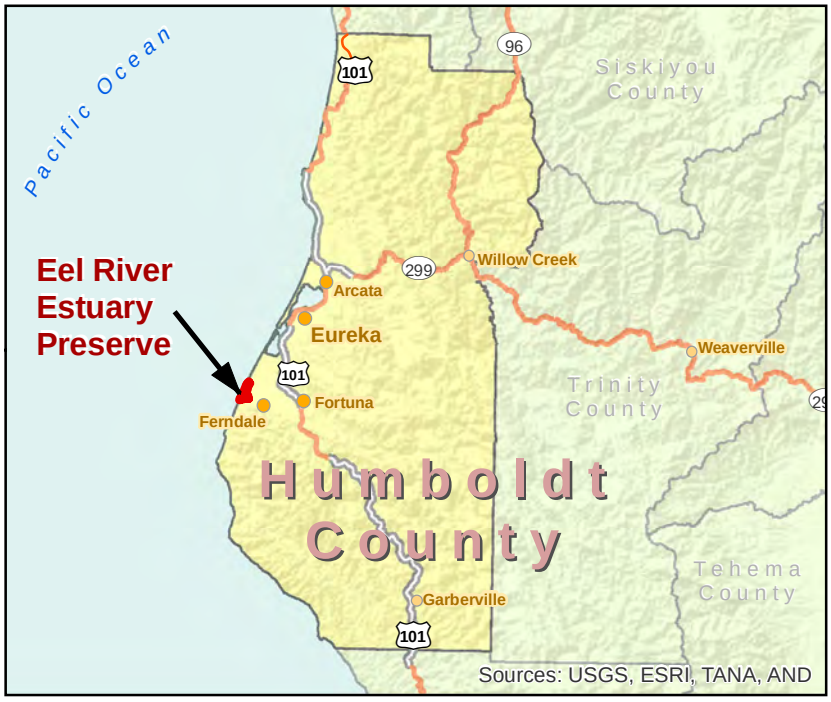
1.1 Overview

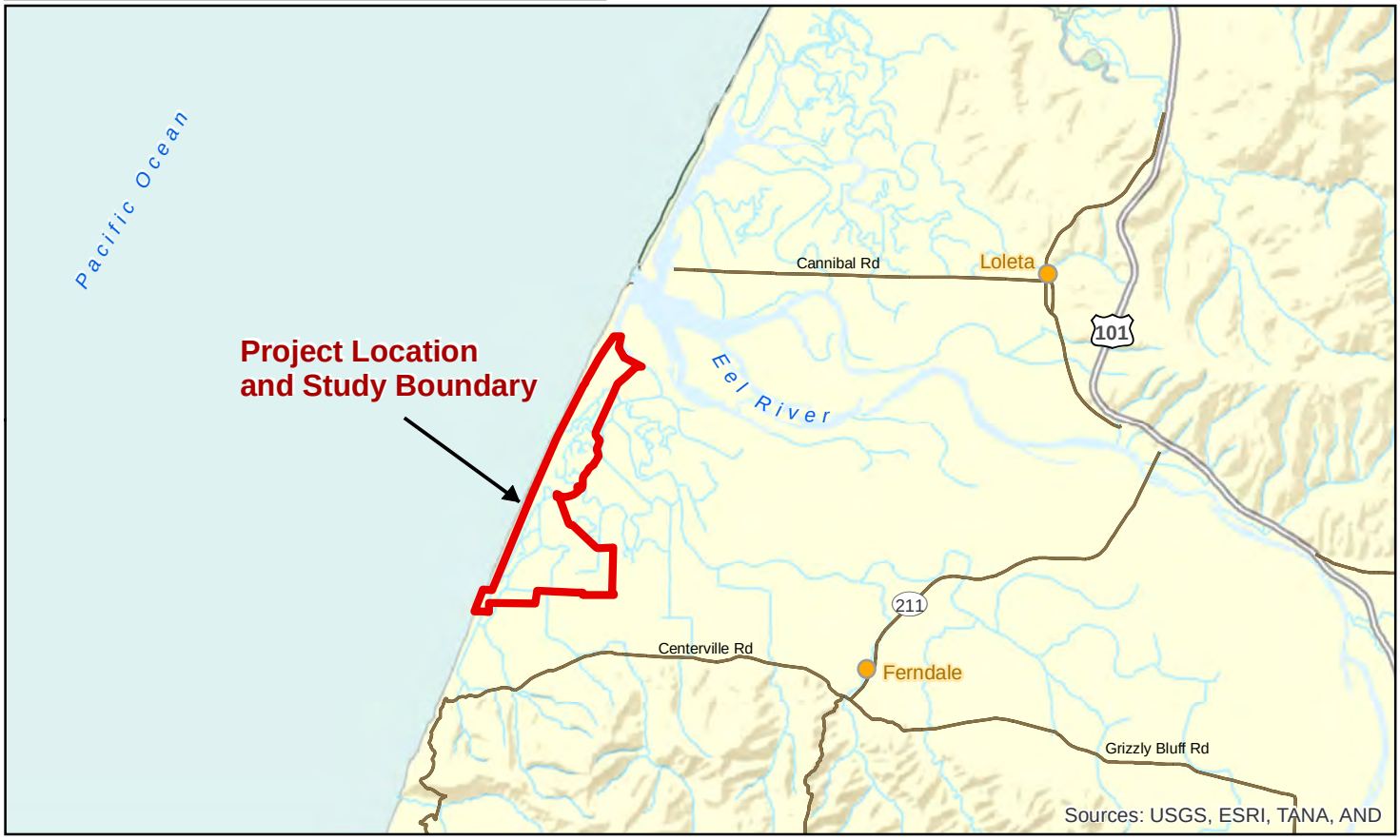
In October 2013, GHD Inc. (GHD) environmental scientists and botanists and an H. T. Harvey & Associates (HTH) plant ecologist conducted habitat and vegetation mapping for the Eel River Estuary Preserve (EREP) Ecosystem Enhancement Project. The project site is owned by The Wildlands Conservancy (TWC). Habitats at the site include nearshore dunes, estuarine wetlands, agricultural wetlands/pasture, and riparian swamp and scrub. Areas of the site with the highest potential to be affected by proposed restoration activities were prioritized for vegetation characterization and mapping. Restoration alternatives are currently being evaluated, but in general target specific wetland areas (KHE 2013).

Most of the habitat information available for the region comes from studies conducted in Humboldt Bay just to the north, with relatively little work representing habitats in the Eel River estuary. In Humboldt Bay, studies including vegetation classification have been done for diked herbaceous wetlands (Pickart 2006), for dune habitats (Pickart and Solomescsh unpublished data), and for tidal salt marshes (Eicher 1987). The Eel River estuary has a higher freshwater influence and a greater degree of seasonal variability than Humboldt Bay, and this is reflected in the vegetation (Schlosser and Eicher 2012). A vegetation survey of the Eel River delta was conducted by Eicher and Bivin (1991), but classification studies are lacking. More work is needed to better understand and classify vegetation in the Eel River estuary, especially for brackish estuarine habitats. Previous studies at the EREP site include a biological evaluation and wetland delineation by Mad River Biologists (2009, 2011), a wetland delineation by Morrissette (2012), and a wetland delineation by Lovelace (2011). Some information is also available for the Salt River restoration project, which is nearly contiguous to EREP.

1.2 Location

The EREP is located west of Ferndale, California, and north of Centerville Beach (Figure 1). The site can be accessed via Centerville Road. TWC owns the approximately 1,100-acre EREP property, which includes agricultural (grazing) land, tidal salt marsh, brackish marsh, riparian scrub, sloughs/open water channels, freshwater ponds and ditches, and nearshore dune ridges and swales. The climate is Mediterranean with precipitation most abundant in the winter months, and the average annual rainfall is approximately 48.5 inches. Approximately two thirds of the year, the site is influenced by coastal fog. Prominent water features include Russ Creek, remnant Centerville Slough, Cutoff Slough, and the Western Drainage as well as smaller (seasonal) slough channels and drainage ditches. The northern end of the site borders the mouth of the Eel River.





- Eel River Estuary Preserve
- Humboldt County
- Counties
- Freeway
- Highway
- Roadway
- Streams

Paper Size ANSI A

0 0.5 1 2 3

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision 1
Date 04 Dec 2013

Vicinity and Location

Figure 1

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F1_Vicinity.mxd

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, and County of Del Norte make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:amshows

2. Methods

Prior to field investigations, aerial imagery, remote sensing and existing data and reports for the region were reviewed to serve as background for focusing habitat mapping efforts. On October 10, 14, 17, 18, 25, 28, and Nov 1, 2013, GHD staff conducted vegetation characterization and mapping field efforts. GHD staff was accompanied by HTH on October 10, 14, 25, and 28. The field staff worked in coordination with the Project Engineer and the Applicant to develop the limits of the Project Study Boundary (PSB) (Figure 2). The PSB approximately corresponds to the TWC property boundary (excluding portions of the beach), but mapping efforts were especially focused on areas within the PSB where project-related impacts may potentially occur. Detailed survey and mapping was not performed where the potential for ground disturbing work was determined to be low. Vegetation presented on Figures 3.1 through 3.4 for the Outboard Marsh (north of the existing levee, and northwest of the Outer Marsh and the tidegate) was not formally surveyed; and was mapped based on a limited reconnaissance site visit (to readily accessible sections on the west side) and photo-interpretation of aerial imagery. The Outer Marsh and the Western Drainage area were described and mapped in more detail because these areas are included within preliminary project alternatives being evaluated and with potential ground-altering work in these areas (KHE 2013). While in the field, staff used either a Trimble Juno 5 or a Tablet PC with a Qstarz receiver which has standard GPS accuracy of two to four meters depending on environmental and site conditions. A total of seven field days were spent mapping vegetation communities within the PSB.

The use of vegetation classification standards in describing vegetation provides consistency in the documentation of ecological diversity (FGDC 2008). Vegetation types for the project site were classified following California vegetation classification standards per A Manual of California Vegetation (MCV) (Sawyer et al. 2009), with updated regional information as available. Efforts are currently underway to revise the National Vegetation Classification Standard, in which California vegetation classification will be a part, with the goal of having a single national standard (NatureServe 2013, D. Faber-Langendoen, personal communication, T. Keeler-Wolf, personal communication).

In MCV, the basic unit of classification is called an alliance. Alliances are based on the dominant or diagnostic species of the stand, usually of the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others. Alliances reflect regional to sub-regional climates, substrates, hydrology, and disturbance regimes. Sub-units called associations are used to further refine alliances, capturing variety in species composition and structure. Vegetation types dominated by non-native plant species are referred to as semi-natural stands rather than alliances and have stand types rather than associations (Sawyer et al. 2009).

It is important to recognize the difference between vegetation classification and vegetation mapping. In general, vegetation classification involves more floristic and structural details than are perceptible in aerial imagery or that are practical to map on the ground depending on a project's scale; therefore, map units are typically not the same as vegetation classification units. Map units may relate to the classification at different levels of the hierarchy. Large map units may contain inclusions of vegetation patches too small to map. Map unit complexes can be created when the individual vegetation types are not recognizable on the aerial photographs but repeatedly occur together in the landscape. Mosaic map units are created when the individual vegetation types are recognizable on the aerial photographs but occur in an intermixed pattern too intricate to map as separate polygons (Faber-Langendoen 2007, FGDC 2008, Sawyer et al. 2009).

Some habitat features, such as slough channels and improvements including the barns, roads, and levees, were digitized using high resolution true color and infrared imagery available through NOAA (National Oceanic and Atmospheric Administration) (2009 and 2012) and NAIP (National Agriculture Imagery Program) (2012). When possible, aerial signatures visible on the imagery were confirmed in the field and relayed to the GIS analyst for further digitizing.

3. Results

3.1 Overview

The distribution of vegetation types at the Eel River Estuary Preserve is influenced by hydrology, salinity, and past and current land use and modifications. Historically, much of the site was tidelands which have been diked for agricultural use and remain actively managed for grazing. Many of the alliances described here were previously classified and described by Pickart (2006) for diked wetlands of HBNWR. Pickart (2006) collected elevation, salinity, and soil moisture data to characterize the vegetation alliances. The results of that study are used here as basis for groupings relating to salinity, with dominant species indicating various salinity regimes.

Table 1 is a summary of vegetation alliances grouped by generalized vegetation name (underlined) and habitat type (bolded), at Eel River Estuary Preserve within the PSB. Some Alliances occurred in more than one habitat type. Vegetation types were described within the context of existing vegetation classification standards. It is possible that further investigation would reveal new associations of existing alliances and/or new alliances, but this is beyond the scope of the current study.

The vegetation map produced for EREP uses the following map conventions:

- Map units may relate to the classification at different levels of the hierarchy. In general, alliance names were used. In one case, the association name was used because it was the only type within that alliance type present at EREP (the *Juncus breweri* association of the *Abronia latifolia-Ambrosia chamissonis* Herbaceous Alliance)
- Map unit complexes were created when the individual vegetation types repeatedly occurred together in the landscape but were not distinct on the aerial photographs and were not practical to delineate in the field. These were: *Agrostis-Distichlis* complex, the *Agrostis-Argentina* complex, and the *Sarcocornia* complex (which contains multiple vegetation types, mostly the *Sarcocornia pacifica* Herbaceous Alliance).
- In a few cases, large patches of individual species were mapped that do not represent a level in the classification hierarchy, but may be notable for management purposes. These include a dense infestation of the noxious weed *Rumex crispus* affiliated with the *Eleocharis macrostachya* Herbaceous Alliance, and discrete patches of the native sedge *Schoenoplectus pungens* that appear to be affiliated with the *Argentina egedii* Herbaceous Alliance.

Table 1 Vegetation alliances, grouped by generalized vegetation name (underlined) and habitat type (bolded), at Eel River Estuary Preserve.	
Tidal salt marsh and brackish marshes	
Salt marsh	
	Sarcocornia pacifica Herbaceous Alliance (pickleweed mats)
	Spartina densiflora Semi-Natural Herbaceous Stands (denseflower cordgrass marshes)
Tidal brackish marsh	
	Deschampsia caespitosa Herbaceous Alliance (tufted hairgrass grass meadows)
Diked/muted saline marshes and brackish marshes	
Saline marsh	
	Sarcocornia pacifica Herbaceous Alliance (pickleweed mats)
Brackish marsh	
	Argentina egedii Herbaceous Alliance (Pacific silverweed marshes)
	Atriplex prostrata-Cotula coronopifolia Semi-Natural Herbaceous Stands (fields of fat hen and brass buttons)
	Bolboschoenus maritimus Herbaceous Alliance (salt marsh bulrush marshes)
	Distichlis spicata Herbaceous Alliance (salt grass flats)
Freshwater marsh	
Freshwater marsh	
	Juncus effusus Herbaceous Alliance (soft rush marshes)
	Juncus lescurii Herbaceous Alliance (salt rush swales)
Pasture and/or Agricultural Wetland	
Freshwater wetland pasture	
	Lolium perenne Semi-Natural Herbaceous Stands (perennial rye grass fields)
Wet Brackish pasture	
	Argentina egedii Herbaceous Alliance (Pacific silverweed marshes)
	Agrostis stolonifera Semi-Natural Herbaceous Stands (creeping bent grass flats)
	Eleocharis macrostachya Herbaceous Alliance (pale spike rush marshes)
Nearshore Dune Ridges	
Foredune grassland	
	Ammophila arenaria Semi-Natural Herbaceous Stands (European beach grass swards)

Table 1 Vegetation alliances, grouped by generalized vegetation name (underlined) and habitat type (bolded), at Eel River Estuary Preserve.
Nearshore Dune Swales
Herbaceous swales
Abronia latifolia-Ambrosia chamissonis Herbaceous Alliance, *Juncus breweri* association (Brewer's rush swales)
Riparian Scrub and Freshwater Swamp
Willow swamp
Salix hookeriana Shrubland Alliance (coastal dune willow thickets)
Riparian scrub

3.2 Vegetation communities mapped within EREP

Tidal salt marsh and brackish marshes

The northern portion of the EREP site north of the Outer Marsh is tidally inundated, although the historical configuration of tidal channels has been partially lost. Now the area receives tidal input via side channels of the Salt River and also some input directly from the Eel River via a small channel. The area supports a complex of tidal salt and brackish marshes. The area was described and mapped based on limited reconnaissance of readily accessible areas on the west side, aerial photo-interpretation, and available regional mapping of the invasive cordgrass *Spartina densiflora* (Grazul and Rowland 2011). Dense stands of *Spartina densiflora*, easily discernible in aerial imagery, were mapped as the *Spartina densiflora* Herbaceous Alliance. The remaining areas of tidal marsh were mapped as a "Sarcocornia complex" in which the *Sarcocornia pacifica* (Pickleweed) Herbaceous Alliance is the dominant alliance type and other vegetation types are not clearly discernible. Further investigation is needed to fully describe and map the vegetation types in this complex.

Salt marsh

Sarcocornia pacifica (Pickleweed) Herbaceous Alliance

Sarcocornia pacifica is dominant or co-dominant with a variety of associated species, including *Spartina densiflora, Distichlis spicata, Jaumea carnosa, Plantago maritima, Carex lyngbyei, Triglochin maritima, Triglochin striata, and Isolepis cernua.* Several associations that have been previously described based on co-dominant or diagnostic species are present at EREP, and it is possible that additional associations could be identified with further investigation. Associations previously described for Northern California tidal marshes include *Sarcocornia pacifica—Cuscuta salina—Spartina densiflora* association, the *Sarcocornia—Distichlis spicata* association, and the *Sarcocornia pacifica—Jaumea carnosa—Distichlis spicata* association. Additionally, on higher ground with less frequent tidal inundation, *Grindelia stricta* var. stricta often is a co-dominant with *Sarcocornia* and could represent a *Sarcocornia pacifica-Grindelia stricta* association, as previously described for Central California tidal marshes, or where *Grindelia* is dominant the *Grindelia stricta* Provisional Herbaceous Alliance described in MCV. The *Sarcocornia* complex includes areas of potential rare plant habitat.

Deschampsia caespitosa and *Carex lyngbyei* are two marsh species typically considered indicative of brackish conditions. Both species are common and locally abundant in tidal marshes at EREP. *Deschampsia caespitosa* often occurs as a co-dominant or sub-dominant with

Sarcocornia pacifica. A *Deschampsia caespitosa* Herbaceous Alliance is recognized in MCV and discussed here under brackish marshes for areas where *Deschampsia caespitosa* dominates, although only the largest occurrences are mapped here. Smaller areas are included in the *Sarcocornia*-complex for mapping purposes.

Carex lyngbyei was locally abundant as a dominant species, generally bordering slough channels, and also occurred in association with *Sarcocornia pacifica* and other species away from channels. Where dense, there were few other species, or it was intermixed with the invasive *Spartina densiflora*. In other locations, *C. lyngbyei* grew in association with *Jaumea carnosa, Distichlis spicata, Plantago maritima, Sarcocornia pacifica, Triglochin maritima,* and *Deschampsia caespitosa*.

The occurrence of *Carex lyngbyei* stands at the upper edge of salt marsh and near the mouths of tidal creeks has been noted in general descriptions for regional tidal coastal marshes (Schlosser and Eicher 2012). The species is typically associated with brackish conditions, and stands are more prominent in the Eel River estuary than in Humboldt Bay marshes. Further investigation is needed to clarify whether *Carex lyngbyei* stands may represent a floristically distinct alliance in California. *Carex lyngbyei* is a dominant species in estuarine marshes in Oregon and Washington, and NatureServe previously reported a *Carex lyngbyei* Alliance for these regions (NVCS alliances currently undergoing major revision) (NatureServe 2013, D. Faber-Langendoen, personal communication, T. Keeler-Wolf, personal communication).

Lyngbye's sedge has as CNPS Rank of 2.2, fairly endangered in California, but more common elsewhere (CNPS 2012). Lyngbye's sedge is locally abundant in intertidal coastal marshes along the coasts of Alaska, Washington, and Oregon. In California, the species extends as far south as Bolinas Lagoon. In California, *Carex lyngbyei* is possibly threatened by grazing, non-native plants, and habitat disturbance (CNPS 2013). At EREP, the main threat to existing stands is encroachment by the invasive cordgrass *Spartina*. Control measures for *Spartina* at the EREP site will need to follow mitigation measures to protect *Carex lyngbyei* per the PEIR (H. T. Harvey & Associates 2013a or b) for the regional *Spartina* eradication plan (H. T. Harvey & Associates 2013a or b).

Spartina densiflora Semi-Natural Stands

Spartina densiflora Semi-Natural Stands are characterized by over 50% cover by *Spartina densiflora.* In these stands, *Spartina densiflora* forms monocultures with few associated species. The map shows these areas where *Spartina densiflora* is the dominant species; it should be noted that *Spartina densiflora* also occurs at lower density throughout much of the remaining tidal marsh, which is depicted as the *Sarcocornia* complex on the vegetation map.

Spartina densiflora is an invasive plant identified by the California Invasive Plant Council (Cal-IPC) with a high alert rating. Since its inadvertent introduction to the region in the 1870s, it has invaded an estimated 90% of salt marshes, and brackish marshes to a lesser degree, throughout Humboldt Bay and the Eel River estuary, and there is evidence of continuing encroachment. *Spartina densiflora* invasion reduces biodiversity by displacing native plant species and altering habitat for fish and wildlife species, and it alters ecological processes such as biogeochemical cycling and sediment dynamics. A regional eradication program is underway to control *Spartina densiflora* throughout the region, as part of a larger effort along the West Coast of North America (H. T. Harvey & Associates 2013)

At EREP, dense stands of *Spartina densiflora* are found bordering slough channels and open water areas where salinity is high. The largest concentration of dense *Spartina* is located at the

furthest southern extent of tidal influence, on the northwest side of the Outer Marsh west of the levee. Dense *Spartina* also occurs in the northern part of the site, near the main channel of the Eel River. Additionally, a few small, narrow stands border Cutoff Slough behind the large tidegate and otherwise the plants occur as scattered individuals. Restrictions to tidal input limit the degree of *Spartina densiflora* invasion.

Tidal brackish marsh

Deschampsia caespitosa Herbaceous Alliance

Tufted hair grass, *Deschampsia caespitosa*, is a perennial grass often found in sand dunes, coastal terraces and seasonally flooded areas with moderate salinity (Sawyer et al. 2009). in the tidal marshes outside the Outer Marsh, *Deschampsia caespitosa* dominates some areas, but more often occurs as a co-dominant with *Sarcocornia pacifica*, *Grindelia stricta* var. *stricta*, and *Distichlis spicata* (Figure. 3-4), and for mapping purposes all but the largest occurrences were included in the *Sarcocornia* complex (Figure. 4)

Diked/muted saline marshes and brackish marshes

Diked/muted saline marshes and brackish marshes occur at EREP behind leaking tidegates, bordering channels, and in wet depressions having residual soil salinity.

Saline marsh

Sarcocornia pacifica Herbaceous Alliance

Domination by the species *Sarcocornia pacifica* is an indicator of high salinity, and at EREP the diked marshes dominated by *Sarcocornia pacifica* can be referred to as saline marshes. The term “saline marsh” is used to distinguish diked marshes having high salinity from tidal salt marshes (Pickart 2006). These marshes are part of the *Sarcocornia pacifica* Herbaceous Alliance, but floristically distinct from *Sarcocornia pacifica* dominated tidal salt marshes, which have a higher diversity of associated species. In diked marshes, a frequently associated species is *Distichlis* spicata, but overall species diversity is low.

In diked areas at EREP the *Sarcocornia pacifica* Herbaceous Alliance occurs where there is muted tidal inundation and in wet areas with residually high soil salinity, such as along slough channel banks and in wet saline depressions within the Outer Marsh. Bordering Cutoff Slough, the pickleweed mat occurs along the channel banks adjacent to *Bolboschoenus maritimus* growing on the water’s edge. Small patchy areas were found at the toe of levees on the western and eastern edges of Western Drainage and around the Russ Creek washout area (Figure. 3.4).

Diked Brackish marsh

Atriplex prostrata-Cotula coronopifolia Semi-Natural Herbaceous Stands

Small patches of this community type were observed in brackish marshes along the Western Drainage (Figure 3.3). Most areas where this community type was mapped did not include *Cotula coronopifolia.* Areas with this alliance type were mapped in the Russ Creek washouts south of the duck ponds. Associated species included the native species *Distichlis spicata* and *Sarcocornia pacifica,* as well as non-native *Agrostis stolonifera*.

Bolboschoenus maritimus Herbaceous Alliance

Bolboschoenus maritimus (saltmarsh bulrush), a perennial herb commonly found in tidal brackish to saline coastal marshes, was found growing on slough channel margins and in areas of standing water (Figure. 3.3). Areas where salt marsh bulrush was mapped included wet areas adjacent to

pickleweed mats in the Outer Marsh associated with brackish depressions. Additionally, this alliance was found growing sporadically along the Western Drainage, as well as along the margins of Cutoff Slough. Sub-dominants of this alliance type observed include *Argentina egedii*, *Schoenoplectus pungens*, *Juncus bolanderi,* and *Juncus patens*.

Distichlis spicata Herbaceous Alliance

Distichlis spicata (saltgrass*)* is a halophytic perennial plant of salt marshes, coastal dunes, and moist alkaline areas (Sawyer et al. 2009). Salt grass flats at EREP have been severely invaded by *Agrostis stolonifera*, which has altered this native plant community sufficiently to be considered a different vegetation type: *Agristis stolonifera* Semi-Natural Stands. Where *Distichlis spicata* was dominant, it can be considered the *Distichlis spicata* Herbaceous Alliance; however, most of these areas had *Agrostis stolonifera* present, often with high cover, and this type occurred in a patchy fashion with *Agrostis stolonifera* Semi-Natural Stands*.* Boundaries between these types were indistinct and not readily discernible; and were therefore mapped as the *Agrostis-Distichlis* complex. In general, *Distichlis* was dominant in areas with higher salinity and flooding. These patterns were described by Pickart (2006), however, large areas of clear dominance by *Distichlis spicata* observed in that study and in other diked wetlands in the region are lacking at EREP.

Salt grass flats occurred along the channel banks and saline wet depressions of the Outer Marsh and the edges of the Western Drainage. Associated species included *Sarcocornia pacifica, Atriplex prostrata, Jaumea carnosa,* and *Agrostis stolonifera.* Occasionally, *Cotula coronopifolia*, *Schoenoplectus pungens,* and *Argentina egedii* were present.

Freshwater marsh

Freshwater marsh

Juncus effusus Herbaceous Alliance

Juncus effusus (common rush), a caespitose perennial rush of seeps, shores and damp sunny ground, was mapped in an area south of the north barn (Figure. 3.3). Small patches of *J. effusus* alliance were observed by H.T. Harvey between the Western Drainage and areas comprised of the *Juncus breweri* alliance. Co-dominants consist of *Rumex conglomeratus*, *Triglochin striata* and *Oenanthe sarmentosa* with non-native such as *Holcus lanatus* and *Ranunculus repens*.

Juncus lescurii Herbaceous Alliance

Juncus lescurii, a creeping perennial herb, occurred as a dominant species along the western edge of the Outer Marsh and near the Russ Creek washout areas. Co-dominant species included *Argentina egedii, Agrostis stolonifera, Schoenoplectus pungens, Juncus patens* and *Festuca perennis*. (Figure 3.3). Pickart (2006) found the *Juncus lescurii* Herbaceous Alliance to occur in freshwater conditions.

Pasture (or agricultural wetland)

Historically, much of the site was tidelands which have been diked for agricultural use and remain actively managed for grazing. The fields flood seasonally and in general have poorly drained soils. Upland pasture occurs in the southeast portion of the site, but the rest can be referred to as agricultural wetlands or wet pasture, and in some locations support marsh plant species. Areas with residually high soil salinity and/or muted tidal seepage are brackish.

Freshwater wetland pasture

Lolium perenne Semi-Natural Herbaceous Stands

Perennial rye grass (synonym: *Festuca perennis*[1]), an invasive non-native grass with a moderate Cal-IPC rank, was mapped extensively in the wet pastures and diked upland areas of EREP. Within the PSB and in close proximity, ranchers have historically seeded pastures with perennial rye grass for cattle feed. (Figure. 3.2). Associated species included the weedy species *Cirsium vulgare*, *Cirsium arvense Holcus lanatus*, *Rumex crispus,* and *Plantago lanceolata* in the upland areas. In the perennial brackish seeps, *Atriplex prostrata*, *Cotula coronopifolia* and *Eleocharis macrostachya* were commonly found. These areas were often found trampled and grazed by cattle. Smaller discrete patches of other vegetation alliances/types occur as inclusions within the area mapped as *Lolium perenne* Semi-Natural Herbaceous Stands. However, due to time constraints, this area was not mapped with the same detail as the more complex areas on site.

Eleocharis macrostachya Herbaceous Alliance

*Eleocharis macrostachya (*pale spike rush), a mat or hummock forming perennial rush of freshwater and brackish wetlands, was present on EREP (Figure. 3.3). Much of the area mapped with this alliance type was observed in or near standing water in close proximity to the duck ponds south of the Outer Marsh. *Argentina egedii* and *Agrostis stolonifera* comprised the sub-dominant component of this community type. Other associated species included *Distichlis spicata, Juncus effusus, Rumex crispus, Cirsium arvense* and *Festuca perennis*.

Wet Brackish pasture

Agrostis stolonifera Semi-Natural Herbaceous Stands

Extensive stands of this vegetation type are prominent in the grazed areas at EREP (Figure. 3.3). In brackish locations at EREP, *Distichlis spicata* was a frequently associated species, and in fresher areas included *Festuca perennis*.

Agrostis stolonifera, a perennial herb not native to California, has invaded native vegetation types throughout the state, especially mesic ones (Sawyer et al. 2009). It has a Cal-IPC Inventory rank of Limited, meaning the ecological impact of this species is considered minor on a state-wide level (Cal-IPC 2013). Within our region; however, Pickart (2006) suggested a local rating of High, based on its widespread invasion of diked wetlands and ability to alter native plant communities. This aggressive competitor has a wide environmental tolerance, a long growing season, and the ability to spread vegetatively. Once established, *Agrostis stolonifera* causes changes to soil and water characteristics, such as forming a thick thatch layer that buffers it from high salinities in underlying soils, and alters native plant communities (Pickart 2006). At EREP, this non-native community type is very aggressive and is frequently out competing the salt grass flats and pickleweed mats, both native halophyte communities.

Argentina egedii Herbaceous Alliance (Pacific silverweed marshes)

Pacific silverweed (currently named *Potentilla anserina* ssp. *pacifica*[2]) is a salt-tolerant perennial herb commonly found in seasonally coastal brackish wetlands. At EREP, Pacific silverweed occurred as a dominant species within perennial seeps other brackish wetlands (Figure. 3.2). Associated species found within this herbaceous layer included non-native grasses such as, *Agrostis stolonifera, Holcus lanatus, Festuca perennis*, and the non-native forbs *Lotus corniculatus and Rumex crispus*. Occurrences of this alliance were identified near the Russ Creek

[1] Baldwin et al. (2012) *The Jepson Manual*. pg. 1454

[2] Baldwin et al. (2012) *The Jepson Manual*. pg. 1192

washouts, along the Western Drainage and in lower elevation depression of the levees and berms.

Pacific silverweed marshes at EREP have been severely invaded by *Agrostis stolonifera*, which has altered this native plant community sufficiently to be considered a different vegetation type: *Agrostis stolonifera* Semi-Natural Stands. Where *Potentilla anserina* ssp. *pacifica* was dominant, it can be considered the *Argentina egedii* Herbaceous Alliance; however, most of these areas had *Agrostis stolonifera* present, often with high cover, and this type occurred in a patchy fashion with *Agrostis stolonifera* Semi-Natural Stands. Boundaries between these types were indistinct and not readily discernible; and were therefore mapped as the *Agrostis-Argentina* complex

Nearshore Dune Ridges

The EREP site includes a dune system on the sand spit south of the mouth of the Eel River, and extending south beyond the PSB to Centerville Beach. Toward the north end the dunes are low and broad, and they generally become higher and narrower to the south with interspersed blowouts

Foredune grassland

Ammophila arenaria Semi-Natural Herbaceous Stands

The foredune ridge is dominated by the invasive *Ammophila arenaria* (European beachgrass), a Cal-IPC clumping perennial grass of high priority, *Abronia latifolia*, *Calystegia soldanella*, *Tanacetum bipinnatum* and *Erigeron glaucus* (Figure. 3.4). An area northwest of the Outer Marsh contains a stand of *Ammophila arenaria* with scattered coastal shrubs, including the native shrub *Baccharis pilularis* (coyote brush) and a shrubby lupine which appears to be a hybrid between the native *Lupinus rivularis* and the invasive *L. arboreus*.

Nearshore Dune Swales

Herbaceous dune swales occur landward of the foredune

Herbaceous swales

Abronia latifolia-Ambrosia chamissonis Herbaceous Alliance (dune mat alliance), *Juncus breweri* association (Brewer's rush swales)

On the backside of the foredune are herbaceous dune swales dominated by *Juncus breweri*. These "dry swales" have been described for the South Spit of Humboldt Bay (Pickart 2005) and for the North Spit of Humboldt Bay (Pickart 2009), and identified as the *J. breweri* association of the *Abronia latifolia-Ambrosia chamissonis* Alliance (aka dune mat) in a recent floristic classification of Humboldt County dunes (Pickart and Solomescsh unpublished data). At EREP, a few associated species typically characteristic of dune mat were present in *Juncus breweri* swales. There was occasional *Abronia latifolia, Ambrosia chamissonis, Calystegia soldanella,* and *Cardionema ramosissimum.*

Lower, wetter swales were vegetated primarily by *Schoenoplectus pungens*, with *Argentina egedii* and *Agrostis stolonifera*. This species composition differs from wet dune swales described for the North Spit of Humboldt Bay, which are characterized by *Carex obnupta* (Pickart 2009).

Riparian and Freshwater Swamp

Willow swamps and riparian scrub occur on channel banks near the Salt River, where the elevation is higher and there is a greater freshwater influence than in the adjacent marshlands.

Willow swamp

Salix hookeriana Shrubland Alliance

A small stand of *Salix hookeriana*, a coastal willow often found in floodplains, creeks, rivers and dune hollows, occurs near the Russ Creek washout area. (Figure 3.1). Associated species consisted of wetland herbaceous species such as *Argentina egedii* and *Juncus effusus*.

Within EREP, willow swamps also occur on channel banks near the Salt River, where the elevation is higher and there is a greater freshwater influence than in the adjacent marshlands. The willows are evident in the aerial imagery but were not visited in the field. *Salix hookeriana* is the only willow that has been reported occurring on the EREP (TWC unpublished data). Willows have also been planted along freshwater ditch margins in the southeast part of the preserve but at this time the stand is too small to map.

Riparian scrub

Baccharis pilularis Shrubland Alliance (coyote brush scrub)

Baccharis pilularis ssp. *consanguinea*, a common native shrub of coastal and inland areas of California, was observed intergrading with various non-natives. Coyote brush scrub occurred in association with willow swamps bordering the Salt River, at the upper margin of tidal marsh, bordering slough channels, and sporadically on levees.

Levee/berm and Ruderal Areas

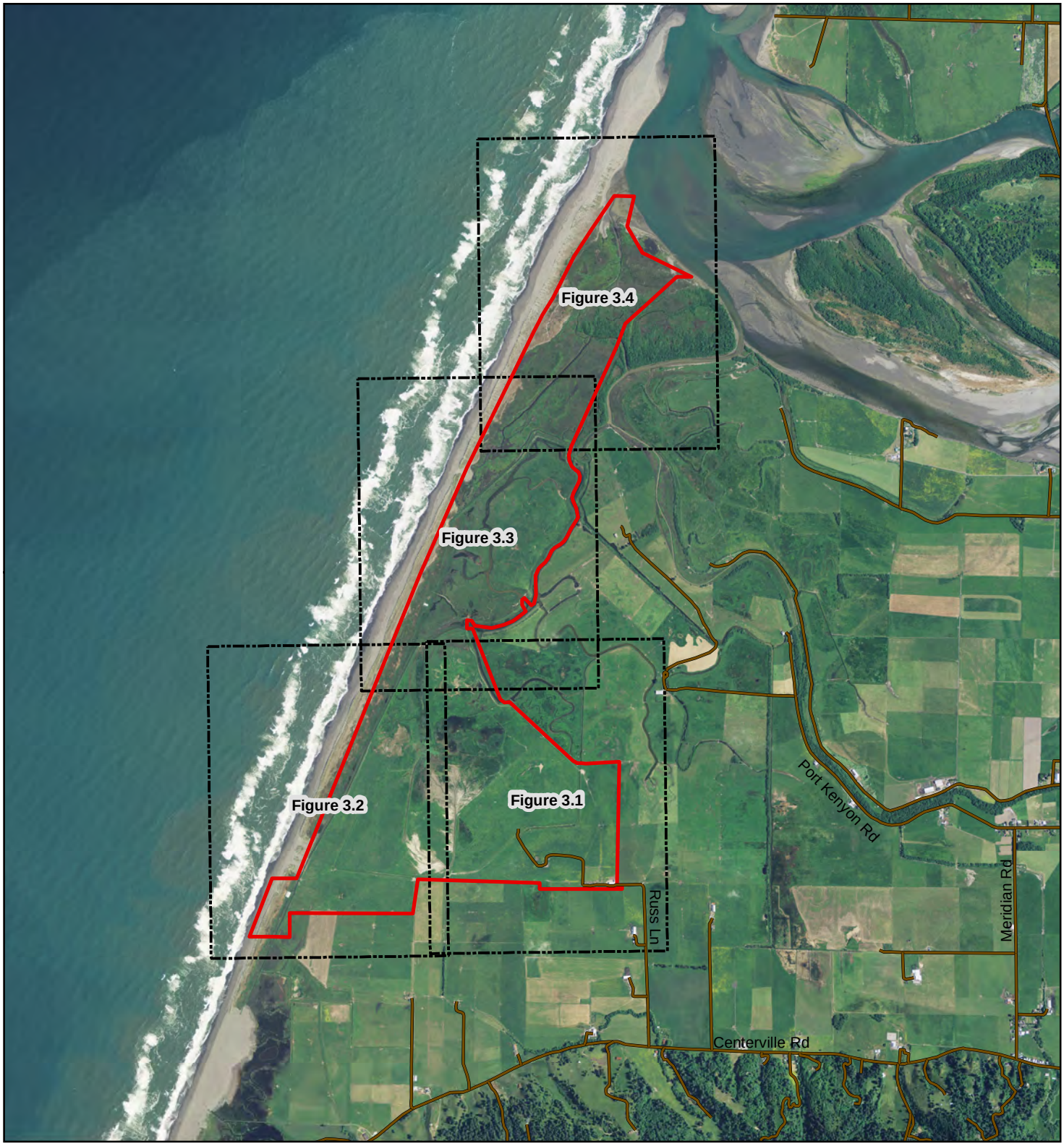
The EREP PSB is interspersed with old levee and berm systems constructed to control seasonal flooding. The vegetation associated with these levees was often ruderal (Figure 3.4). Along the levees and berms, species composition included various non-native and invasive species including *Cirsium vulgare, Cirsium arvense, Festuca perennis, Ranunculus repens, Holcus lanatus, Agrostis stolonifera, Trifolium repens,* and *Trifolium fragerium*. Additionally, a few native species occurred on the levees, including *Symphyotrichum chilense*, *Achillea millefolium, Grindelia stricta var. stricta* and *Baccharis pilularis* ssp. *consanguinea*. A small stand of the *Grindelia stricta* Provisional Herbaceous Alliance was observed at the upper margin of tidal marsh along the north-western levee of the Outer Marsh.

4. Conclusions

In October 2013, GHD and H.T Harvey mapped existing habitats at EREP and associated vegetation alliances/associates. The habitats mapped within the PSB include:

- Tidal salt marsh and brackish marsh;
- Diked/muted saline marshes and brackish marshes;
- Freshwater marsh;
- Pasture and/or Agricultural Wetland;
- Near-shore Dune Ridges;
- Near-shore Dune Swales;
- Riparian Scrub and Freshwater Swamp;
- Levee/berm and Upland Ruderal Areas.

The most extensive habitat type at the EREP is pasture/agriculture wetland, mostly brackish pasture. The most abundant vegetation type was *Agrostis stolonifera Semi-Natural Herbaceous Stands.*



Roadway

Study Boundary

Figure Key

Paper Size 8.5" x 11" (ANSI A)

0 1,000 2,000 3,000 4,000 5,000

Feet

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 10N

N

CalTrout
EREP Ecosystem Enhancement Project

Eel River Estuary Preserve
Vegetation Map Figure Key

Job Number	8410882
Revision	A
Date	04 Dec 2013

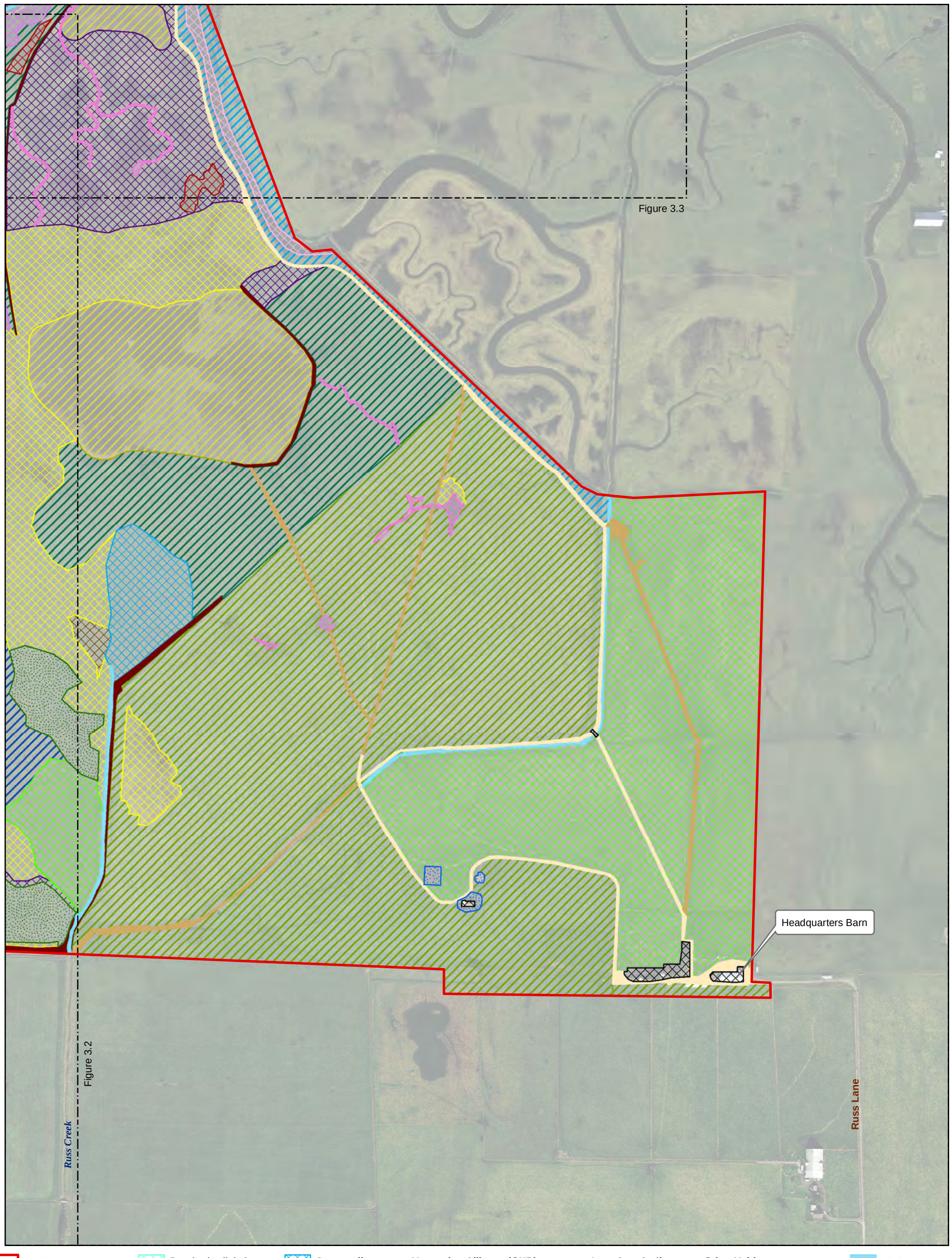
Figure 2

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F2_HabitatMBKey.mxd

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Aerial, 2012 USDA NAIP, 1m; Roads, County of Humboldt, 2008. Created by:amshows



Study Boundary
Map Match Lines

Vegetation Alliance (MCV)
- *Ammophila arenaria*
- *Argentina egedii*
- *Atriplex prostrata-Cotula coronopifolia*
- *Baccharis pilularis*
- *Bolboschoenus maritimus*
- *Deschampsia caespitosa*
- *Eleocharis macrostachya*
- *Juncus effusus*
- *Juncus lescurii*
- *Lolium perenne*
- *Sarcocornia pacifica*
- *Salix hookeriana*
- *Spartina densiflora*

Vegetation Alliance (GHD)
- *Agrostis stolonifera*
- *Agrostis stolonifera-Distichlis spicata* Complex
- *Agrostis stolonifera-Argentina egedii* Complex
- *Distichlis spicata*
- *Juncus breweri*
- *Rumex crispus*
- *Schoenoplectus pungens*

Other Habitat
- Bareground
- Beach
- Ruderal
- Mudflat
- *Sarcocornia pacifica* Complex
- Ditch
- Levee/Berm
- Open Water
- Slough
- Development
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)
0 200 400 600 800
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 04 Dec 2013

Eel River Estuary Preserve Vegetation Map

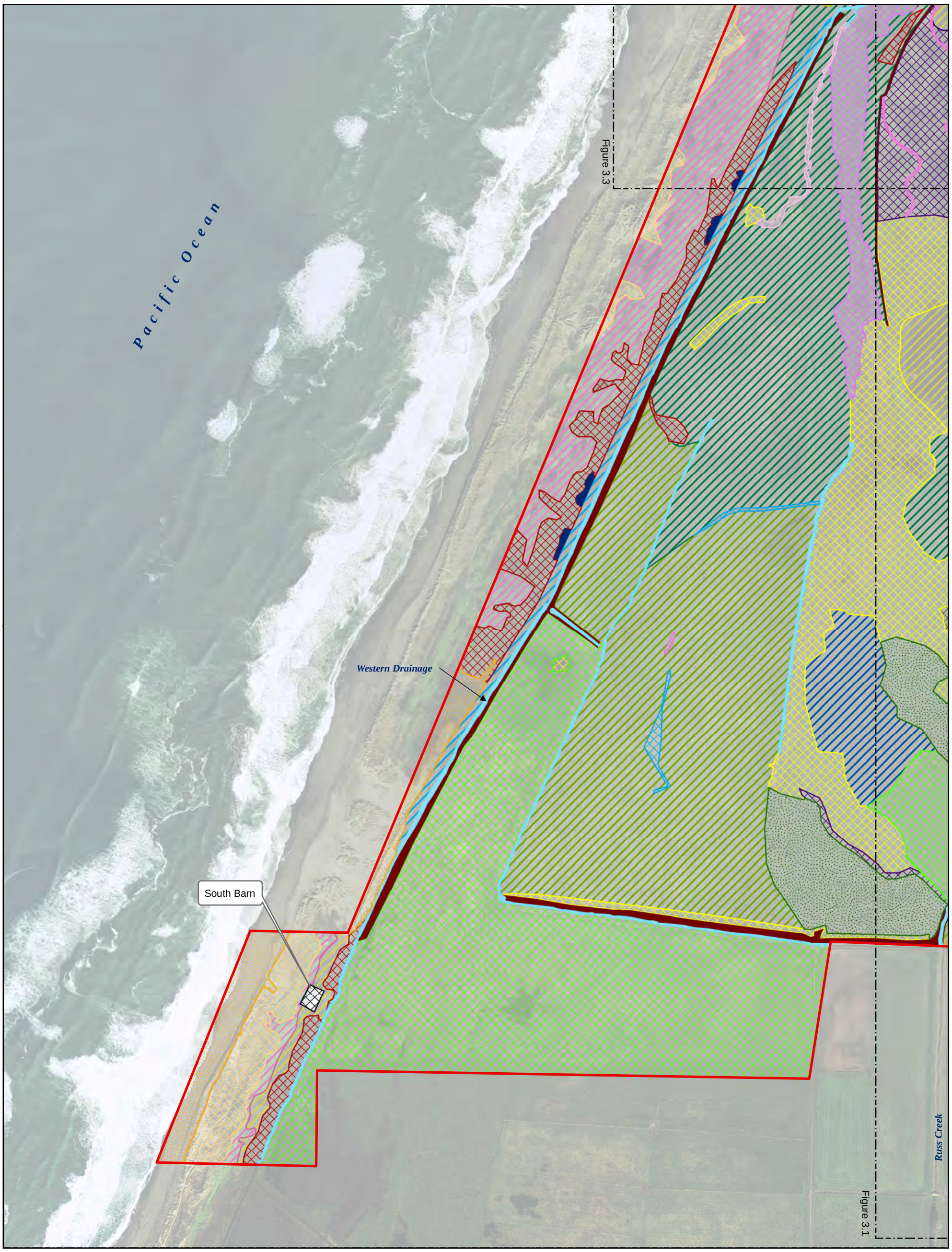
Figure 3.1

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F3_HabitatMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows



Study Boundary
Map Match Lines

Vegetation Alliance (MCV)
- *Ammophila arenaria*
- *Argentina egedii*
- *Atriplex prostrata-Cotula coronopifolia*
- *Baccharis pilularis*
- *Bolboschoenus maritimus*
- *Deschampsia caespitosa*
- *Eleocharis macrostachya*
- *Juncus effusus*
- *Juncus lescurii*
- *Lolium perenne*
- *Sarcocornia pacifica*
- *Salix hookeriana*
- *Spartina densiflora*

Vegetation Alliance (GHD)
- *Agrostis stolonifera*
- *Agrostis stolonifera-Distichlis spicata* Complex
- *Agrostis stolonifera-Argentina egedii* Complex
- *Distichlis spicata*
- *Juncus breweri*
- *Rumex crispus*
- *Schoenoplectus pungens*

Other Habitat
- Bareground
- Beach
- Ruderal
- Mudflat
- *Sarcocornia pacifica* Complex
- Ditch
- Levee/Berm
- Open Water
- Slough
- Development
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)
0 200 400 600 800
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 04 Dec 2013

Eel River Estuary Preserve Vegetation Map

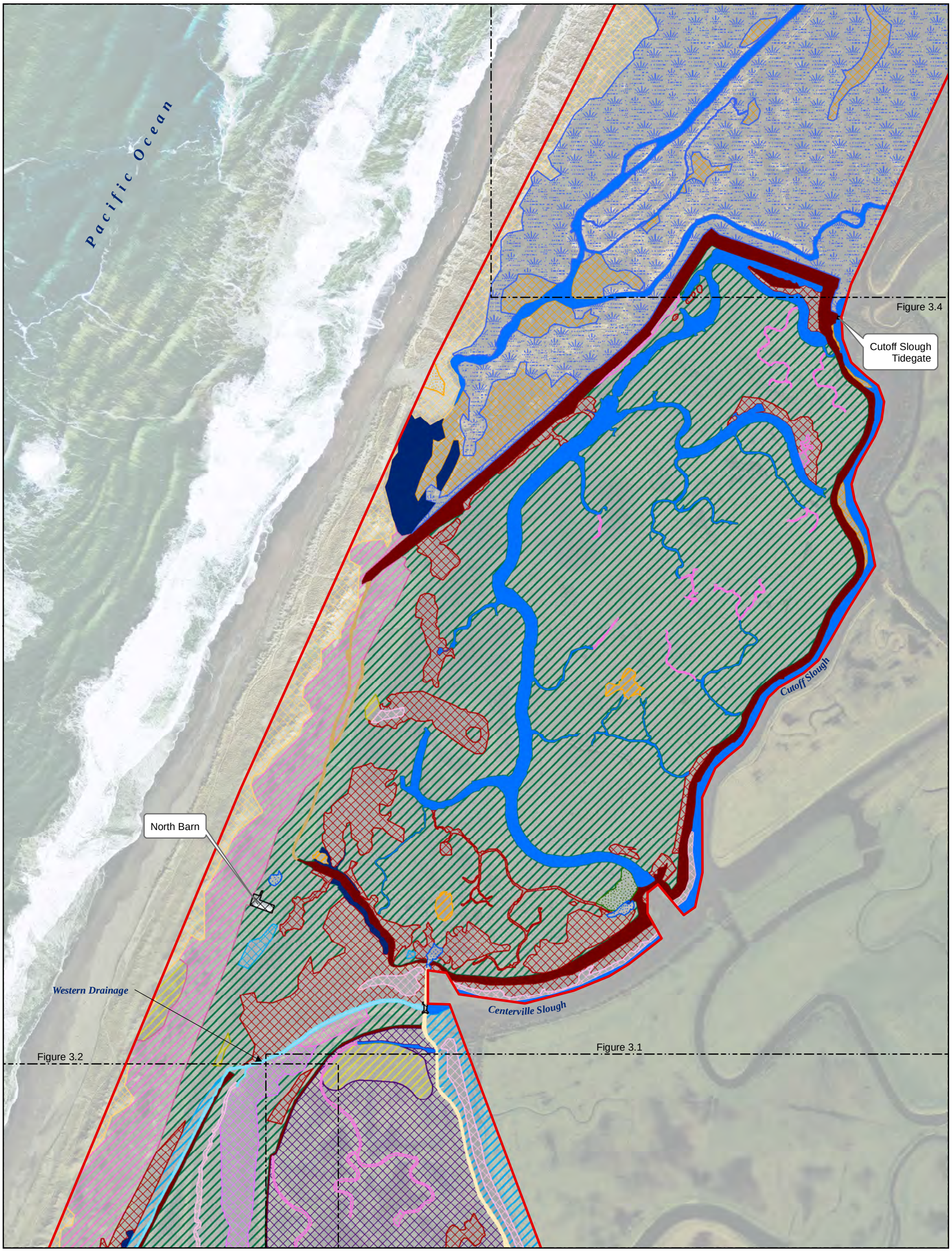
Figure 3.2

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F3_HabitatMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows



Study Boundary
Map Match Lines

Vegetation Alliance (MCV)
- *Ammophila arenaria*
- *Argentina egedii*
- *Atriplex prostrata-Cotula coronopifolia*
- *Baccharis pilularis*
- *Bolboschoenus maritimus*
- *Deschampsia caespitosa*
- *Eleocharis macrostachya*
- *Juncus effusus*
- *Juncus lescurii*
- *Lolium perenne*
- *Sarcocornia pacifica*
- *Salix hookeriana*
- *Spartina densiflora*

Vegetation Alliance (GHD)
- *Agrostis stolonifera*
- *Agrostis stolonifera-Distichlis spicata* Complex
- *Agrostis stolonifera-Argentina egedii* Complex
- *Distichlis spicata*
- *Juncus breweri*
- *Rumex crispus*
- *Schoenoplectus pungens*

Other Habitat
- Bareground
- Beach
- Ruderal
- Mudflat
- *Sarcocornia pacifica* Complex
- Ditch
- Levee/Berm
- Open Water
- Slough
- Development
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)
0 200 400 600 800
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 04 Dec 2013

Eel River Estuary Preserve Vegetation Map

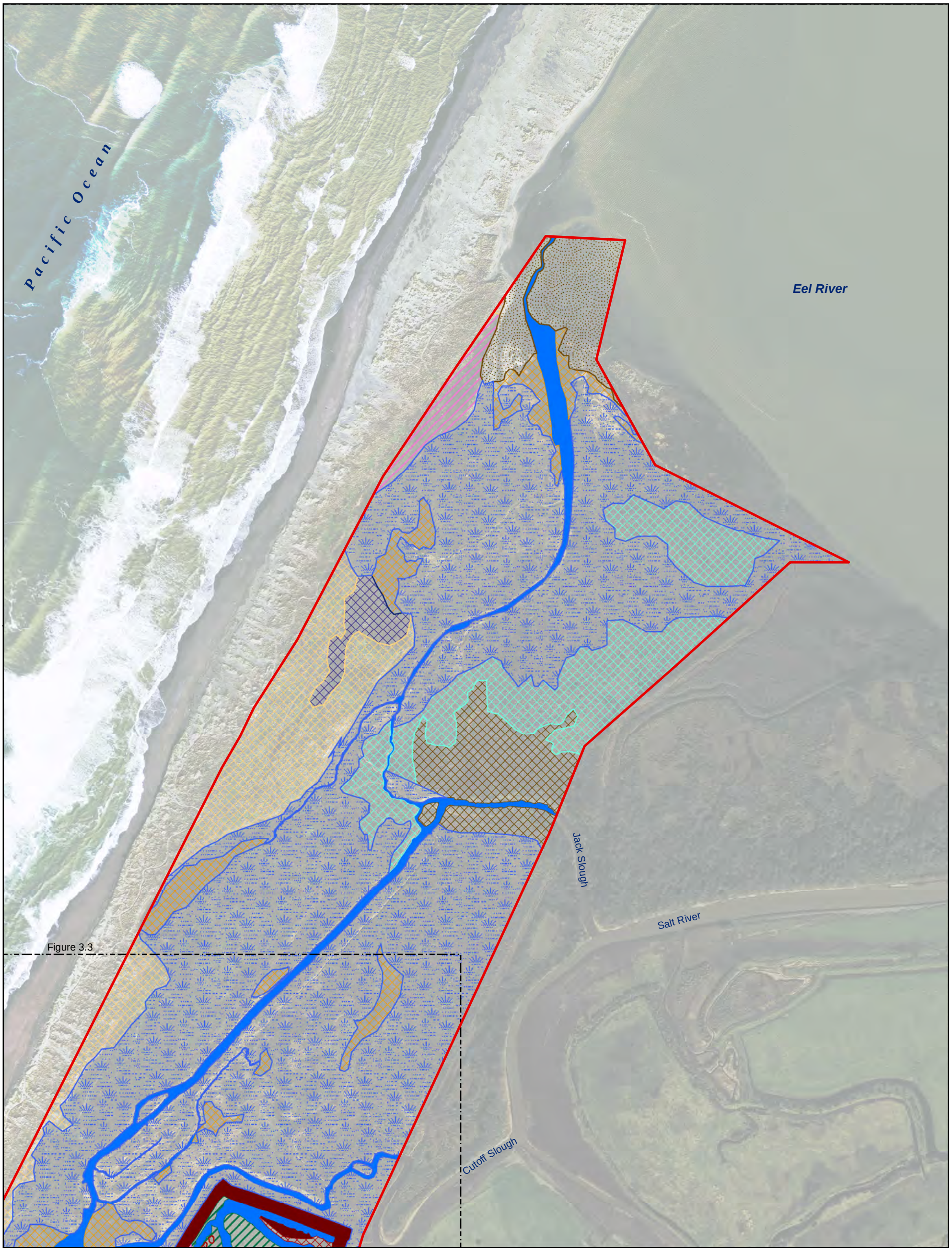
Figure 3.3

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F3_HabitatMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows



Study Boundary
Map Match Lines

Vegetation Alliance (MCV)
- *Ammophila arenaria*
- *Argentina egedii*
- *Atriplex prostrata-Cotula coronopifolia*
- *Baccharis pilularis*
- *Bolboschoenus maritimus*
- *Deschampsia caespitosa*
- *Eleocharis macrostachya*
- *Juncus effusus*
- *Juncus lescurii*
- *Lolium perenne*
- *Sarcocornia pacifica*
- *Salix hookeriana*
- *Spartina densiflora*

Vegetation Alliance (GHD)
- *Agrostis stolonifera*
- *Agrostis stolonifera-Distichlis spicata* Complex
- *Agrostis stolonifera-Argentina egedii* Complex
- *Distichlis spicata*
- *Juncus breweri*
- *Rumex crispus*
- *Schoenoplectus pungens*

Other Habitat
- Bareground
- Beach
- Ruderal
- Mudflat
- *Sarcocornia pacifica* Complex
- Ditch
- Levee/Berm
- Open Water
- Slough
- Development
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)
0 200 400 600 800
Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 04 Dec 2013

Eel River Estuary Preserve Vegetation Map

Figure 3.4

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Habitat\F3_HabitatMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows

5. Literature Cited

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, editors. 2012. *The Jepson Manual: Vascular Plants of California, Second Edition*. University of California Press, Berkeley.

California Invasive Plant Council 213. http://www.cal-ipc.org/.

Eicher, A. 1987. Salt marsh vascular plant distribution in relation to tidal elevation, Humboldt Bay, California. Master's Thesis. Humboldt State University, Arcata, CA.

Eicher, A. and Bivin, M. 1991. Vegetation Survey of the Eel River Delta. in R. C. Roberts. 1992. Biological Conditions in the Eel River Delta. Report prepared for the Eel River Resource Conservation District.

Eicher, A. Memorandum to GHD: Wildland Conservancy Eel River Property Restoration, Notes RE: habitat characterization and mapping. November 12, 2013. Email)

Evens, J. and S.Sans. 2005. *Vegetation Alliances of the San Dieguito River Park Region, San Diego County, California*. Unpublished report, revised 2006. California Native Plant Society, Sacramento, CA.

Faber-Langendoen, D., N. Aaseng, K. Hop, M. Lew-Smith, and J. Drake, J. 2007. Vegetation classification, mapping, and monitoring at Voyageurs National Park, Minnesota: An application of the U.S. National Vegetation Classification. Applied Vegetation Science 10: 361-374

FGDC. 2008. National Vegetation Classification Standard, Version 2 FGDC-STD-005-2008 (version 2). Vegetation Subcommittee, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey. Reston, VA. 55 pp. + Appendices.

Grazul, Z. and P. Rowland. 2011. The Distribution of *Spartina densiflora* in the Humboldt Bay Region: Baseline Mapping. Available: http://www.fws.gov/humboldtbay/spartina.html#references.

H. T. Harvey & Associates. 2013a. Humboldt Bay regional Spartina eradication plan: final report. Report prepared for the California State Coastal Conservancy, Oakland, CA.

H. T. Harvey & Associates. 2013b. Final programmatic environmental impact report for the Humboldt Bay regional Spartina eradication plan, volumes 1 and 2. Report prepared for the California State Coastal Conservancy, Oakland, CA.

Keeler-Wolf, T., and M.Vaghti. 2000. *Vegetation mapping of Suisun Marsh, Solano County: A Report to the California Department of Water Resources*. California Department of Fish and Game, California Natural Diversity Database, Sacramento, CA.

Keeler-Wolf, T., D. Schirokauer, J. Meinke, and P. van derLeeden. 2003a. *Classification of the Vegetation of Point Reyes National Seashore, Golden Gate National Recreation Area, Samuel P. Taylor, Mount Tamalpais, and Tomales State Parks, Marin, San Francisco, and San Mateo Counties, California*. California Department of Fish and Game, Wildlife Habitat Data Analysis Branch, Sacramento, CA.

Klein, A., J. Crawford, J. Evens, T. Keeler-Wolf, and D. Hickson. 2007. *Classification of the Vegetation Alliances and Associations of the northern Sierra Nevada foothills, California, Volumes 1 and 2*. Report prepared for California Department of Fish and Game, Habitat Conservation Division. California Native Plant Society, Sacramento, CA.

Lovelace, J. B. 2011. Delineation of Wetlands and Waters of the U.S. for the Eel River Estuary Preserve, Humboldt County, Illinois. Mad River Biologists, Eureka CA.

Mad River Biologists. 2009. Delineation of Wetlands and Waters of the US for Connick Ranch. Mad River Biologists, Eureka CA.

Mad River Biologists. 2011. Eel River Estuary Preserve biological evaluation and wetland delineation for proposed bridge construction and road improvement project. Mad River Biologists, Eureka CA.

Morrissette, S. 2012. Eel River Estuary Preserve biological evaluation and wetland delineation for Russ Creek bridge replacement project. Biological Resource Consulting, Eureka CA.

NatureServe. 2013. Version 7.1 (2 February 2009), data last updated: July 2013. Last accessed 30 November 2013 through the US National Vegetation Classification USNVC Hierarchy Explorer website http://usnvc.org/explore-classification/

Pickart, A. 2005. A preliminary description of the Table Bluff unit wetland vegetation, Humboldt Bay National Wildlife Refuge 18

Pickart, A. 2006. *Vegetation of diked herbaceous wetlands of Humboldt Bay National Wildlife Refuge: classification, description, and ecology*. Arcata, CA, U.S. Fish and Wildlife Service, Humboldt Bay National Wildlife Refuge: 93.

Potter, D.A. 2005. *Riparian Community Classification: west slope. central and southern Sierra Nevada, California*. Technical Report R5-TP-022, USDA, Forest Service, Pacific Southwest Region, Berkeley, CA.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. *A Manual of California Vegetation, Second Edition*. California Native Plant Society, Sacramento, CA.

Schlosser, S., and A. Eicher. 2012. Humboldt Bay and Eel River Estuary Benthic Habitat Project. California Sea Grant Publication T-075. 246 p.

6. List of Preparers

Prepared by:

Cara Scott, Botanist, GHD Inc., Eureka CA

Annie Eicher, Senior Plant Ecologist, H.T. Harvey & Associates, Arcata CA

Stephanie Klein, Restoration Ecologist, GHD Inc., Eureka CA

Reviewed by:

Ken Mierzwa, Senior Project Manager, GHD Inc., Eureka CA

Lia Webb, Senior Scientist, GHD Inc., Eureka CA

www.ghd.com

Eel River Estuary Preserve (EREP) Ecosystem Enhancement Project

Delineation of Uplands

July 2014

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

Table of contents

1. Summary ..... **Error! Bookmark not defined.**
2. Introduction 1
3. Methodology 1
   - 3.1 Project Study Boundary (PSB) 3
   - 3.2 Botanical Methodology 3
   - 3.3 Soils Methodology 4
   - 3.4 Hydrology Methodology 4
   - 3.5 Wetland Determination 5
4. Results 7
   - 4.1 Soil 9
   - 4.2 Hydrology 9
5. Conclusions 9
6. Special Terms and Conditions 10
7. References 10
   - 7.1 Scope and limitations 12

Table Index

Table 1. Summary of Wetland Results

Appendices

Appendix A: Figures
Appendix B: Data Sheets

1. Introduction

On October 10-11, 15-18, 24-25, and 29-31, 2013, GHD Inc. (GHD) staff conducted a delineation of uplands within various agricultural fields and adjacent areas in preparation for the Eel River Estuary Preserve (EREP) proposed Ecosystem Enhancement Project. This project site is located northwest of the City of Ferndale, Humboldt County, California and is in the Coastal Zone (Figures 1 and 2, Appendix A). The site is in proximity to the Salt River.

The upland delineation procedure was completed pursuant to the U.S. Army Corps of Engineers (USACE) 1987 Manual; the *Regional Supplement to the USACE Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Regions* (2010); and California Coastal Commission (Commission) guidance for wetland delineations. Current and historic land use practices in the vicinity of the project area consist of active agricultural management. Portions of the project area are noted to be potential problematic areas (USACE 2010). The area is further complicated due to the seasonal nature of surface and/or groundwater and the observed absence of hydrology within 12 inches of the soil surface in the fall months.

This delineation report includes a discussion of site conditions, sampling methodology, sampling results, and conclusions as well as a map delineating proposed upland and wetland boundaries within the Project Study Boundary (PSB) (Figure 2, Appendix A). The area of investigation consists of evaluation of land owned by The Wildlife Conservancy (TWC) that is being considered for use as part of a habitat enhancement project at the EREP. A jurisdictional determination (JD) from the USACE (and Commission if deemed appropriate) should be requested to seek concurrence with results reported herein in preparation for anticipated permitting requirements of the proposed project.

2. Methodology

The delineation of uplands and wetlands were conducted by GHD field team consisting of two qualified technical staff, made up of combinations of soil scientist (Lia Webb), wetland ecologist (Stephanie Klein), botanist (Cara Scott), or environmental scientist (Anna Gower). The delineation was conducted in October 2013.

The 2013 GHD field effort focused on delineation of extent of uplands, the predominant matrix of seasonal agricultural wetlands and transitional areas present in the project area due to low gradient topography and proximity to Russ Creek and Salt River. The delineation effort also incorporates results of previous delineation efforts at portions of the site (Mad River Biologists 2011, Morrissette 2012). With this approach of relying on previous results and focusing on apparent upland areas within a matrix of wetland and transitional areas, many (yet not all) of the areas not mapped as uplands, by default likely fall under jurisdiction of the U.S. Army Corp of Engineers (USACE) based on the three parameter wetland definition and/or Waters of the U.S., as well as under the jurisdiction of the California Coastal Commission (Commission). This phase of delineation efforts required a streamlined approach to delineation that targeted larger upland areas that could be considered for use as project mitigation, staging, and/or access, and it is likely that other upland areas may exist on the site. Particularly due to micro-topography, it is noted that smaller upland areas could be present within the larger wetland and transitional complex that dominates the site. Further, without winter wetland hydrology present at the time of delineation coupled with the low

gradient topography, upland areas were challenging to discern at the time field work was conducted. The substantial upland dune complex on the western edge of the site was not evaluated.

GHD field staff delineated upland boundaries that meet the three-parameter upland definition as well as other areas that meet the USACE definition of upland (not under USACE jurisdiction) yet may be under the Commission jurisdiction based on presence of one or two parameter wetland indicators. The typical wetland delineation approach would be to determine one single wetland/upland boundary line that meets multi-jurisdictional requirements of both the Commission and USACE. However, due to a gradual ecotone and a low topographical gradient at this site, the field evaluation determined several areas that meet USACE upland definition, but could be considered jurisdictional by the Commission based on presence of one or two-parameters. Therefore, multiple jurisdictional lines were deemed appropriate to deleineate these areas to meet separate USACE and Commission jurisdictional definitions.

The delineation followed the USACE criteria three-parameter approach from the most current USACE wetland delineation manual for the area, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Regions (Version 2.0)* (USACE 2010), and per California Coastal Commission wetland definition which relies on a one parameter approach. Wetland determination data sheets from the most current version of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast* were used to document existing conditions for the field effort (USACE 2010) and are provided in Appendix B.

Vegetation, soil, and hydrology data were collected at sampling plots to typify areas with similar conditions of topography and vegetation communities in order to delineate the wetland/upland boundary. The defined upland boundaries are presented in figures provided in Appendix A. Upland confirmation points are provided as U#tp# naming convention where the test pits/plots are not paired in relation to a transect across wetland/upland boundary, yet were installed for confirmation of site conditions. Additional intermediate/confirmation pits/plots were installed in multiple presumed upland areas for verification of wetland/upland boundary and to confirm extrapolation of delineation boundaries based on previous test pits/plots, but are not recorded on data sheets in order to keep delineation efforts efficient (indicated with “-int” naming convention on maps).

Test pit/plots were evaluated at representative positions to allow onsite identification of upland areas. The surfaces of the fields were transected on foot to ensure no undetected changes in wetland/upland conditions existed. Typically, areas appearing to meet the criteria for wetlands were evaluated and determined individually for wetland characteristics. When possible upland areas were identified, a boundary was designated from the known wetland plot to the presumed edge of the upland. Typically, shifts in topography, soil, and/or vegetation were used to locate the wetland/upland boundary. In some places a complex mosaic of wetlands and uplands were encountered and topographic elevation was utilized in conjunction with plot observations in order to extrapolate the upland/wetland boundary from test pit locations around topographic features.

Along the levee berm west of the existing tidegate, elevation data was used to extrapolate results from vegetation transects conducted on adjacent agricultural lands in preparation for the nearby Salt River Restoration Project to determine the extent of brackish vegetation and wetland/upland boundary along the levee, which is along the 9 foot contour on the outboard/exterior. The adjacent vegetation transects on which this determination is based, included topographic survey and plots documenting extent of brackish hydrophyitic vegetation in relation to elevation in the project vicinity. This project proposes to leverage this extensive past data collection as a basis for delineation of

brackish wetlands along the outboard levee system. On the interior side of the levee, delineation results were extrapolated from south of the existing tidegate along the west side of existing levee, based on elevation. The area south of tidegate (Upland 1) determined wetland/upland boundary along the levee is along the 7.0 foot contour.

2.1 Project Study Boundary (PSB)

Prior to conducting field work, the PSB was discussed and determined in conjunction with the project manager, project engineer, and project ecologist/biologist. The PSB was established to focus delineation efforts on areas of the site where project features such as site modifications, project alternatives, mitigation, staging, and access could be considered. The delineation effort targeted areas that were topographically higher and thus might be confirmed/documented as uplands (in particular historic levees, roads, and visually higher and sloped areas) in order to identify possible mitigation opportunities, spoils disposal options, and temporary staging and stockpile areas for proposed various restoration activities. The delineation did not focus on evaluation/mapping of upland dune complex along the western portion of the parcel.

2.2 Botanical Methodology

Botanical/vegetation data collection consisted of listing the dominant species at each plot in each stratum layer. Species observed within a radius of five feet were listed in either the tree, shrub or herb stratum. The percent of absolute cover for each species was recorded along with their indicator status. Indicator status relied on using the standard reference for plant wetlands indicators, *Western Mountains, Valleys and Coasts Region- National Wetland Plant List Final Draft Ratings* (Lichvar 2013). This document classifies plants based on the probability of occurring within a wetland. Plants are given classifications ranging from the following:

Code	Wetland Indicator Category	Estimated Probability of Occurrence in Wetlands
OBL	Obligate Wetland	> 99% of the time
FACW	Facultative Wetland	67% to 99% of the time
FAC	Facultative	34% to 66% of the time
FACU	Facultative Upland	1% to 33% of the time
UPL	Obligate Upland	less than 1% of the time
NI	Non-Indicators	Not assigned a rating of wetland condition and are also included in the UPL category

(USFWS 1988, Tiner 1999, Lichvar 2013)

If greater than 50% of the dominant plant species at each plot are classified Obligate (OBL), Facultative/Wet (FACW), or Facultative (FAC), the vegetation is determined to be hydrophytic (wetland plants) so long as the plants are growing as hydrophytes.

The PSB is dominated by facultative (FAC) species in many areas and/or FAC or wetter species that are not growing as hydrophytes where present in absence of hydric soil and wetland hydrology indicators, GHD botanists deemed it appropriate to additionally utilize the descriptive prevalence index (PI) to further evaluate areas where greater than 50% of plant species were facultative or

wetter based on the dominance test. This result was contrary to observed upland soils and/or hydrology parameters, and/or the majority of plant species were facultative (FAC) meaning they are just as likely to be present in wetlands as uplands. The PI was utilized in these situations to convey that in the absence of hydric soils and hydrology indicators, and where the plant composition passed the PI as an upland (greater than 3.0), that these areas are considered three parameter uplands. Where the PI was calculated with scores greater than 3.0, this was used to as an indication that corroborates that the vegetation is not growing as hydrophytes. However, in some plots the predominance of facultative species (and presence of FAC or wetter species growing in upland topographic positions) present in the coastal plain resulted in PI of near or less than 3.0, and these areas were evaluated in context of upland soils and hydrology conditions to have vegetation not growing as hydrophytes.

2.3 Soils Methodology

The definition of a hydric soil is “a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” The USACE 1987 Manual procedures were combined with the Natural Resources Conservation Service’s (NRCS) definition of hydric soils presented in *Changes in Hydric Soils of the United States* and *Field Indicators of Hydric Soils in the United States* (United States Department of Agriculture [U.S.D.A.], 1995 and 2006, respectively), as well as the most recent wetland guidance document *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region* (USACE 2010). The regional supplement provides detailed descriptions of primary and secondary factors that help determine if wetland hydrology is present at a site. Soil data was recorded on data sheets from the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast* (USACE 2010; provided in Appendix B of this report.

To evaluate the soil matrix and qualitatively describe the presence or absence of redoximorphic features, reductions and concentrations, soil pits were dug to an approximate depth of 14-18 inches. Data on soil color, texture and redoximorphic features were collected. Care was taken to observe mottling (iron concentrations), distinguish between chromas of 1 and 2, and determine the percentage of redoximorphic features in the soil. Redoximorphic features at 2% and 5% are important thresholds for identification of hydric soils for both USACE and CCC delineation purposes.

Colors were described for the entire depth of the test pit. Colors were determined on moist ped surfaces which had not been crushed. To determine the soil matrix colors, mottle colors and mottle abundance, the *Munsell Color Chart* (Munsell Color 2000) was used. Soils with low chromas were verified as being hydric or upland using indicators for Depleted Matrix (F3) and Redox Dark Surface (F6) for fine grained soils (USACE 2010)

2.4 Hydrology Methodology

One primary indicator or two secondary indicators are required to identify the presence of wetland hydrology. Direct evidence of ground water (soil saturation, standing water, etc.) was not present in wetland soil pits that delineate the upland boundary due to low rainfall conditions and implementation of field work to meet the schedule required by the project. Therefore, secondary indicators used to delineate the wetland boundary in the absence of primary indicators include: Geomorphic Position (D2), FAC-Neutral Test (D5), and Drainage Pattern (B10).

2.5 Wetland Determination

2.5.1 Corps of Engineers Jurisdictional Wetland Determination

The USACE wetland determination utilized the three parameters (soils, hydrology, and vegetation) but was limited mostly to soils and hydrology (secondary parameters) as the vegetation was relatively uniform throughout the site (except where described in Section IV – Results of Wetland Delineation). An area was determined to be USACE and Commission uplands when all three wetland parameters were absent (hydric soils, wetland hydrology, and hydrophytes). If one of the three wetland parameters was not present, then the area was mapped as a USACE upland, yet identified as 2 parameter (likely considered by Coastal Commission to be a wetland). This property is considered a "Problematic Area" as the wetlands are considered seasonal (USACE 1987 Manual, page 91).

In addition, the USACE does note in the wetland delineation manual that "on a sub-regional basis, questions of indicator status of FAC species may use the following opinion: When FAC species occur as dominants along with other dominants that are not FAC (either wetter or drier than FAC), the FAC species can be considered neutral, and the vegetation decision can be based on the number of dominant species wetter than FAC as compared to the number of species drier than FAC. When a tie occurs or all the dominant species are FAC, the non-dominant species should be considered. The area has hydrophytic vegetation when more than 50 percent of all considered species are wetter than FAC. When either all species are FAC or the number of species wetter than FAC equals the number of species drier than FAC, the wetland determination will be based on the soil and hydrology parameters" (USACE 1987 Manual, page 18).

2.5.2 California Coastal Commission Jurisdictional Wetland Determination

Section 30121 of the California Coastal Act (1976) has a broad definition for a wetland:

> "Wetland means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater~~,~~ marshes, open or closed brackish water marshes, swamps, mudflats, or fens."

However, the CCC Administrative Regulations (Title 14 CCR Section 13577 (b)) provides a more explicit definition:

> "Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitat."

<u>1994 California Coastal Commission Procedural Guidance</u>

The 1994 CCC Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone provides the following information regarding wetland classification system:

Although the U.S. Fish and Wildlife Service (USFWS) classification system is complex, it does provide an objective method for identifying virtually most wetland landscapes. Relative to the USACE, the USFWS definition is generally regarded as being more inclusive in the classification and subsequent delineation of a wetland. This is because the USFWS classification system defines

a wetland by the presence “of the proper hydrology and either the presence of hydric soils or hydrophytic vegetation, except in non-soil areas, such as rocky intertidal areas, where only the presence of proper hydrology is required.”

Cowardin Wetland Definition

According to Cowardin 1979 the definition of a wetland is as follows:

“In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil.

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of the classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season each year.”

Based on the above definitions as well as the 1994 guidance, the Commission relies on a one-parameter approach for the determination of a wetland and utilizes the 1979 Cowardin wetland definition/classification. If an area is determined to have one of the three wetland parameters (hydric soils, wetland hydrology, or the predominance of hydrophytes) it is confirmed to be a Commission wetland. However, at this project site, vegetation is not a strong indicator of the wetland/upland boundary as the vegetation present on most of the site has been managed by continued farming and disking for agricultural purposes, is heavily influenced by the maritime climate. The site includes soils with high available water (silts) which can have a perching effect during rain/stormwater events, and has soils with near iso-mesic temperature regimes. Agricultural management of the vegetation present on this land is the dominating factor influencing the dominant vegetation type at this site (not strongly correlated with the natural community and/or environmental selection).

Some listed FAC species, such as perennial ryegrass (*Festuca perennis*), have been seeded on the property; and therefore, are not growing as hydrophytes in all cases. Vegetation classified as OBL, FACW, FAC, FACU, or UP can lose strong predictive power at managed or disturbed sites. It is likely that the continued intensive management at this site promotes FAC plant species to be dominant, yet not necessarily growing in hydric conditions (not functioning as hydrophytes), in which case these species are existing as phreatophytes. A hydrophyte is defined as “a plant that grows partly or totally submerged in water” and a phreatophyte is defined as “a deep-rooted plant that obtains its water from the water table or the layer of soil directly above it,” (Miriam-Webster Online Dictionary).

From a statistical perspective, when facultative wetland plants dominate an area, they are just as likely to occur in uplands or wetlands (34-66% chance) and therefore lose their predictive value. Field inspection to determine the presence of hydric soil conditions and/or wetland hydrology can alleviate potential technical misinterpretation as to actual hydric/wetland conditions. If the FAC plant species are not growing as hydrophytes (and no other parameters are present, i.e. hydric soil and/or hydrology), then the area should therefore not be considered a wetland based on various

descriptive verbage/definitions of wetlands, including language originating from the CCC and USACE.

3. Results

Table 1 quantifies a summary of upland areas mapped at the project site to date by various consultants (GHD and Mad River Biologists).

Table 1 Summary of Upland Results

Category	Acres
USACE 2-Parameter Uplands	**11.41**
Upland 5	0.20
Upland 6	0.10
Upland 13	1.28
MRB 1-parameter wetland / 2 parameter Upland	9.83
USACE/CCC Uplands	**11.57**
Upland 1	3.34
Upland 2	0.40
Upland 3	2.47
Upland 4	0.64
Upland 7	0.48
Upland 8	0.00
Upland 9	0.31
Upland 10	0.13
Upland 14	0.04
Upland 15	3.75
Mad River Biologists (MRB) [2009]	**39.29**
MRB Uplands	39.29
Unmapped Area (upland wetland mix)[1]	**1,036.89**
PSB Delineation Area TOTAL	**1,099.16**

1. Unmapped areas include upland dunes, wetland matrix at the site, and some small micro-topography that may be upland areas yet were not captured by this wetland delineation effort.

Note: Uplands 11-13 nomenclature was not used as these areas were either determined to be wetlands or were lumped into other Upland Complexes due to close proximity to each other.

The USACE jurisdiction defines a wetland based on the presence of all three wetland parameters, when the study area has normal circumstances and is neither significantly disturbed nor naturally problematic. The Commission defines a wetland based on the presence of one of the wetland parameters. The method used to identify USACE uplands (non USACE jurisdictional) on the project site are when wetland characteristics of the soil, hydrology, and vegetation are not present.

Current and historic land use practices in the vicinity of the site have consisted of active agricultural management primarily for grazing of dairy cows, hay production, and some areas have been disced and planted with agricultural pasture species. Many portions of the project area are noted to be potential Problematic Areas (USACE 1987, page 91) due to the altered nature of the site. Cattle currently being grazed on the site may complicate identification of some plant species, can alter the vegetation composition, and often results in surface soil compaction that can in turn create

ephemeral surface ponding (from episaturation) that is not related to groundwater conditions (endosaturation). The wetland/upland determination is further complicated due to the seasonal nature of surface and/or groundwater and absence of hydrology within 12 inches of the soil surface in the fall months. Historically, in average winter rainfall, portions of the site have been reported as being temporarily flooded after storm events, particularly in lower lying portions of the site, yet hydrology parameters were not observed in many locations during the fall delineation efforts due to flashy nature of hydrology and active use of the site.

Wetlands observed at the site are palustrine emergent seasonal wetlands (NWI code PEM1Cd, National Wetlands Inventory 1987; Cowardin 1979) and two-parameter USACE upland areas that are potentially considered jurisdictional (degraded/seasonal) according to Coastal Commission definitions. The upland areas are predominantly perennial grassland series within the open agricultural bottoms. The upland areas observed at the site consist predominantly of ruderal non-native vegetation (*Agrostis stolonifera-Festuca arundinacea* Semi-Natural Herbaceous Stands). The upland/wetland delineation field results are presented within Figure Set 3 (Appendix A). General descriptions of vegetation, soils, and hydrology site conditions observed are presented below, followed by more specific description of the upland areas mapped at the site. Vegetation

Within the PSB, dominant species within wetlands along the upland edges consist of creeping bentgrass (*Agrostis stolonifera*, FAC), perennial ryegrass (*Festuca perennis,* FAC), birds-foot trefoil (*Lotus corniculatus*, FAC), clover species (*Trifolium* sp., FAC), velvet grass (*Holcus lanatus*, FAC), and silverweed (*Argentia anserina*, OBL) and these species are also present in upland plots yet in conjunctions with other species in most cases. In some low-lying portions of the site including broad pasture areas as well as along roadsides and some levees, current or historic brackish inputs allow for dominant species assemblage to include non-native cordgrass (*Spartina densiflora*, NL) and fat-hen (*Atriplex prostrata*, FAC) as well as native brackish species such as pickleweed (*Sarcocornia pacifica*, OBL), salt grass (*Distichlis spicata*, FACW), and occasionally tufted hairgrass (*Deschampsia caespitosa*, FACW).

Upland areas included many of the FAC species listed above as dominant in the wetland and transitional areas, as well as presence of some dominant upland species which were used to key in on the wetland/upland boundary, including sweet vernal grass (*Anthoxanthum odoratum*, FACU), yarrow (*Achillea millefolium*, FACU), and English plantain (*Plantago lanceolata*, FACU). As previously mentioned, in addition, upland sample plots included some dominant herbaceous species that are FAC or wetter such as velvet grass (*Holcus lanatus*, FAC)*,* bentgrass (*Agrostis stolonifera*, FAC), and bird's-foot trefoil (*Lotus corniculatus,* FAC).

The absence of wetland soil and hydrology indicators in upland areas corroborates the assumption that plants within some portions of the property that are listed as FAC are not actually growing as hydrophytes. This assumption is based on the definition that plants identified as FAC are just as likely to be found in both wetland and upland areas. The upland areas that did not have hydric soil or hydrology; yet with vegetation that fell on the cusp are an example of this condition (U1T2). From a statistical perspective, when facultative wetland plants dominate an area, they are just as likely to occur in uplands or wetlands (34-66% chance) and therefore lose their predictive value. Field inspection to determine the presence of hydric soil conditions and wetland hydrology can alleviate potential technical misinterpretation as to actual hydric/wetland conditions. If the FAC plant species are not growing as hydrophytes (as no other wetland parameters are present, i.e. hydric soil nor wetland hydrology), then the area would therefore not be considered a wetland based on various descriptive verbage/definitions of wetlands, including language originating from the Commission and USACE.

The Prevalence Index (PI) was calculated for areas where both soil and hydrology parameters (including topographic position) pointed toward an area being defined as upland, yet the vegetation was dominated by facultative (FAC) species. Where the additional evaluation using the PI determined a value greater than 3.0, the areas were mapped as three parameter upland. If upon consideration of PI the vegetation still was determined to be have predominance of hydrophytic vegetation, this area was mapped as a two parameter wetland per Coastal Commission except in the following situations:

1) The PI values were very close to 3.0 and rounding up would have brought the PI to 3.0. Although this value is not greater than 3.0, it still does not officially pass the PI for upland vegetation.

2) Dominant species within an area were all FAC consisting of one to three FAC pasture species. While the PI is less than 3.0, the area does not include any dominant (> 20% absolute cover) wetter than FAC.

3) An area is topographically high and has absence of hydric soils and hydrology, therefore even if vegetation did not pass PI in these cases, the determination was made that these plants were not growing as hydrophytes due to topographic position, in conjunction with absence of wetland hydrology or hydric soils.

3.1 Soil

In general, upland soils associated with transects did not meet hydric soil indicators due to either high matrix chroma and/or absence of redoximorphic features. The high chroma soils often had mixed color soil due to source material from levee construction and historic drainage and slough modifications at the site. Where redoximorphic features were observed, in some cases the contrast was faint and therefore did not meet wetland indicators, and/or the layer was not thick enough or close enough to the surface to meet hydric soil indicators. In some cases, redoximorphic features consisted of a thin band originating at the surface and therefore can be attributed to surface compaction. Where lower chromas were present, soils did not exhibit redoximorphic features, or the redoximorphic layer did not meet depth and/or thickness requirements to qualify for wetland indicator(s).

3.2 Hydrology

The field work was conducted in the fall during an unusually dry period prior to onset of wet season conditions. Primary indicators that might be utilized as indicators of seasonal wetland hydrology during a normal year were absent. Two secondary wetland hydrology indicators, FAC neutral test (D5) and Geomorphic Position (D2), were observed and were the basis of most wetland hydrology indicator determination.

The absence of wetland hydrology indicators and hydric soil indicators confirmed the assumption that plants within some portions of the property that are listed as FAC are not actually growing as hydrophytes if the area lacks wetland hydrology and hydric soils. This assumption is based on the fact that plants identified as FAC are just as likely to be found in both wetland and upland areas.

4. Conclusions

Based on GHD 2013 upland/ wetland evaluation conducted in at the site, 11.57 acres of three-parameter uplands were mapped that meet USACE and Coastal Commission definitions and are non-jurisdictional. Additionally, 1.58 acres of two-parameter uplands were mapped by GHD, along

with 9.83 acres previously mapped by MRB as one-parameter wetland (i.e., two parameter upland) that meet the USACE definition of upland, but may be considered jurisdictional by the Coastal Commission due to presence of one wetland parameter. Additionally, to date an additional 39.29 acres of uplands have been mapped by others on the project site (MRB, 2011; Stephanie Morrisette, 2012). The uplands mapped at the site by GHD, MRB, and Morrisette, consist of levees, roads, developed areas, stockpiled material uplands, as well as natural topographically higher areas. The identified upland areas are within a matrix of predominantly palustrine agricultural wetlands, transitional areas, brackish marsh, and slough channels. Additional upland areas exist on the site that were not mapped as part of the current effort, including the large upland dune complex to the west and likely some additional upland micro-topographic areas within the predominant wetland and transitional matrix.

Upon jurisdictional review of the delineation results, please submit jurisdictional review/determination to The Wildlands Conservancy as well to GHD Inc. Please feel free to call us if you have questions at (707) 443-8326.

5. Special Terms and Conditions

To achieve the delineation objectives stated in this report, conclusions are based on the information available during the period of the investigation, October, 2013. This report does not authorize individuals to develop, fill or alter the wetlands delineated. Verification of the delineation by jurisdictional agencies, including the USACE and the California Coastal Commission may be necessary prior to the use of this report for site development purposes. Permits to affect wetlands must be obtained from the involved government agencies. If permits are obtained to develop the delineated wetlands after agency review, and with written verification, the delineation is given a 5-year expiration period. If filling is used under permitted authority, care should be given to maintain a sufficient quantity of fill to prevent a reestablishment of wetlands. Land use practices and regulations can change thereby affecting current conditions and delineation results.

This report was prepared for the exclusive use of the The Wildlands Conservancy and Cal Trout. GHD is not liable for any action arising out of the reliance of any third party on the information contained within this report.

6. References

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors, 2012. *The Jepson Manual: Vascular Plants of California*, *Second Edition*. University of California Press, Berkeley

California Coastal Act, 1976. http://www.coastal.ca.gov/coastact.pdf.

California Coastal Commission, 1994. *Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone*. http://www.coastal.ca.gov/wetrev/wettitle.html.

Cowardin/United States Fish and Wildlife Service, 1979*. Classification of Wetlands and Deepwater Habitats of the United States*, FWS/OBS 79/31.

Gretag Macbeth, 2000. *Munsell Soil Color Charts.*

Lichvar, R.W, 2013. *The National Wetland Plant List*: 2013 Wetland Ratings. Phytoneuron 2013-49: 1-241.

Lovelace, J.B. and Mad River Biologists, 2011. *Delineation of Wetlands and Waters of the U.S. for the Eel River Estuary Preserve, Humboldt County, California*.

Mad River Biologists, 2011. *Eel River Estuary Preserve Biological Evaluation and Wetland Delineation for Proposed Bridge Construction and Road Improvement Project*.

Morrissette, S., 2012. *Eel River Estuary Preserve Biological Evaluation and Wetland Delineation for Russ Creek Bridge Replacement Project*.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evans, 2009. *A Manual of California Vegetation, 2nd Edition*. California Native Plant Society. Sacramento, CA.

Soil Survey Staff,1992. *Keys to Soil Taxonomy*, 5th Edition, SMSS Technical Monograph No. 19, Blacksburg, Virginia.

U.C. Davis, 1965. *Soils of Western Humboldt County*. University of California at Davis, Department of Soils and Plant Nutrition, in Cooperation with County of Humboldt, California.

USACE, 2010*. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region.* J. S. Wakeley, R. W. Lichvar, and C. V. Noble, eds. Army Engineer Research and Development Center, U.S. Army Corps of Engineers (USACE).

USACE, 1987. *Wetlands Delineation Manual*, Tech. Rep 4-87-11987 United States Department of the Army Corps of Engineers (USACE).

USACE, 2012. *Western Mountains, Valleys and Coast Final Draft Ratings*. United States Department of the Army Corp of Engineers, Cold Regions Research and Engineering Laboratory (CRREL).

USACE, 2013. *Waters of the United States and Geographic Extent*. United States Department of the Army Corps of Engineers (USACE). http://www.nwp.usace.army.mil/Missions/Regulatory/Jurisdiction.aspx

USFWS, 1987. *National Wetlands Inventory, Eureka Quad.* U.S. Fish and Wildlife Service (USFWS). Portland, OR.

Stephanie Morrissette (September 29, 2012

by MRB delineation (October 12, 2011

6.1 Scope and limitations

This report: has been prepared by GHD for The Wildlands Conservancy & California Trout, Inc. and *may only be used and relied on by The Wildlands Conservancy & California Trout, Inc. for the purpose agreed between GHD and the The Wildlands Conservancy & California Trout, Inc. . GHD otherwise disclaims responsibility to any person other than The Wildlands Conservancy & California Trout, Inc. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report does not authorize individuals to develop, fill or alter the wetlands delineated. Verification of the delineation by jurisdictional agencies is necessary prior to the use of this report for planning and site development purposes. Permits to affect wetlands must be obtained from the involved agencies. If permits are obtained to develop the delineated wetlands after agency review, and with written verification, the delineation is given a 5-year expiration period.

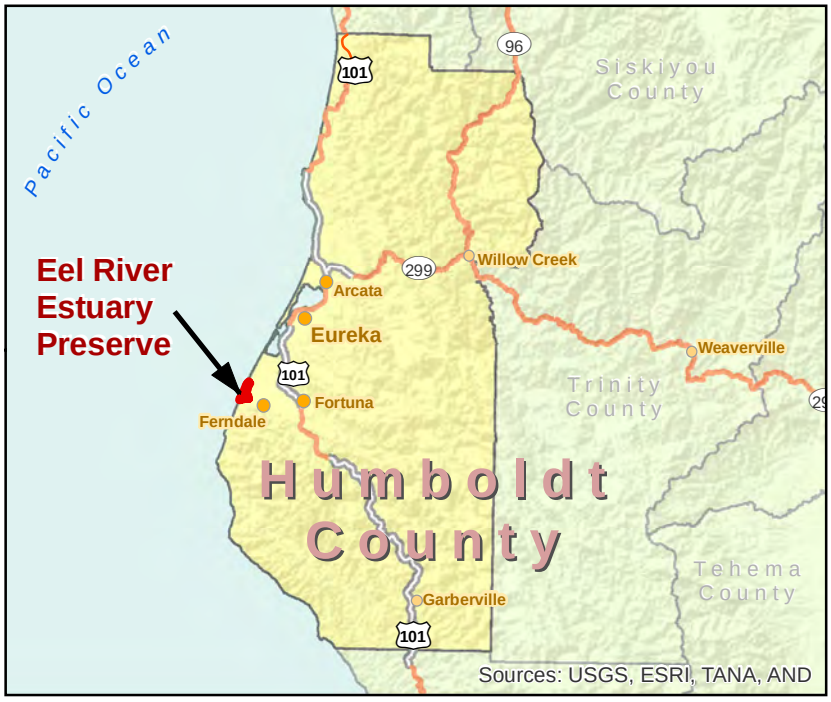
Appendices

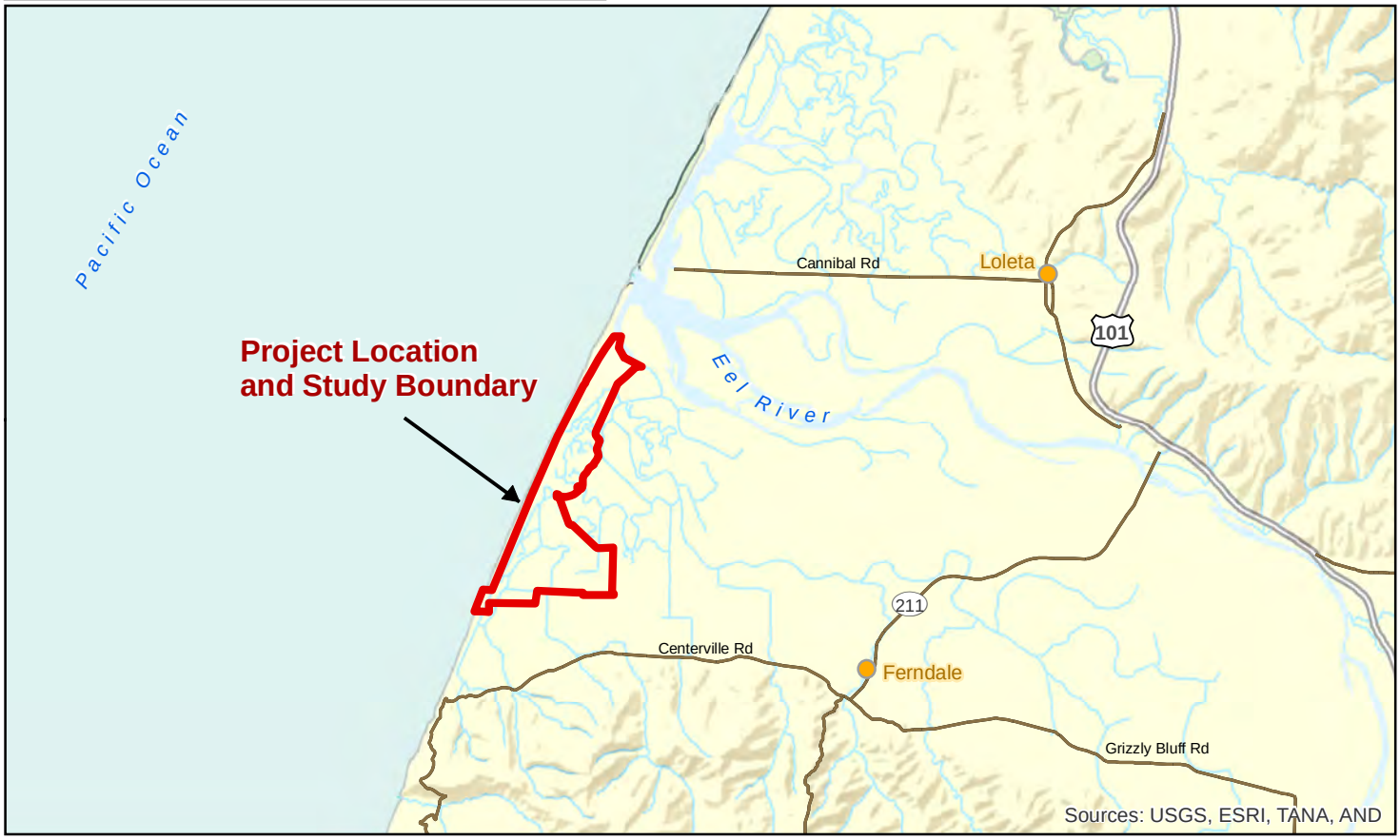
Appendix A - (Figures)

Figure 1 – Vicinity and Location

Figure 2 – Upland Mapping Figure Key

Figure 3 – Upland Mapping





- Eel River Estuary Preserve
- Humboldt County
- Counties
- Freeway
- Highway
- Roadway
- Streams

Paper Size ANSI A

0 0.5 1 2 3

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number	8410882
Revision	1
Date	27 Jan 2014

Vicinity and Location

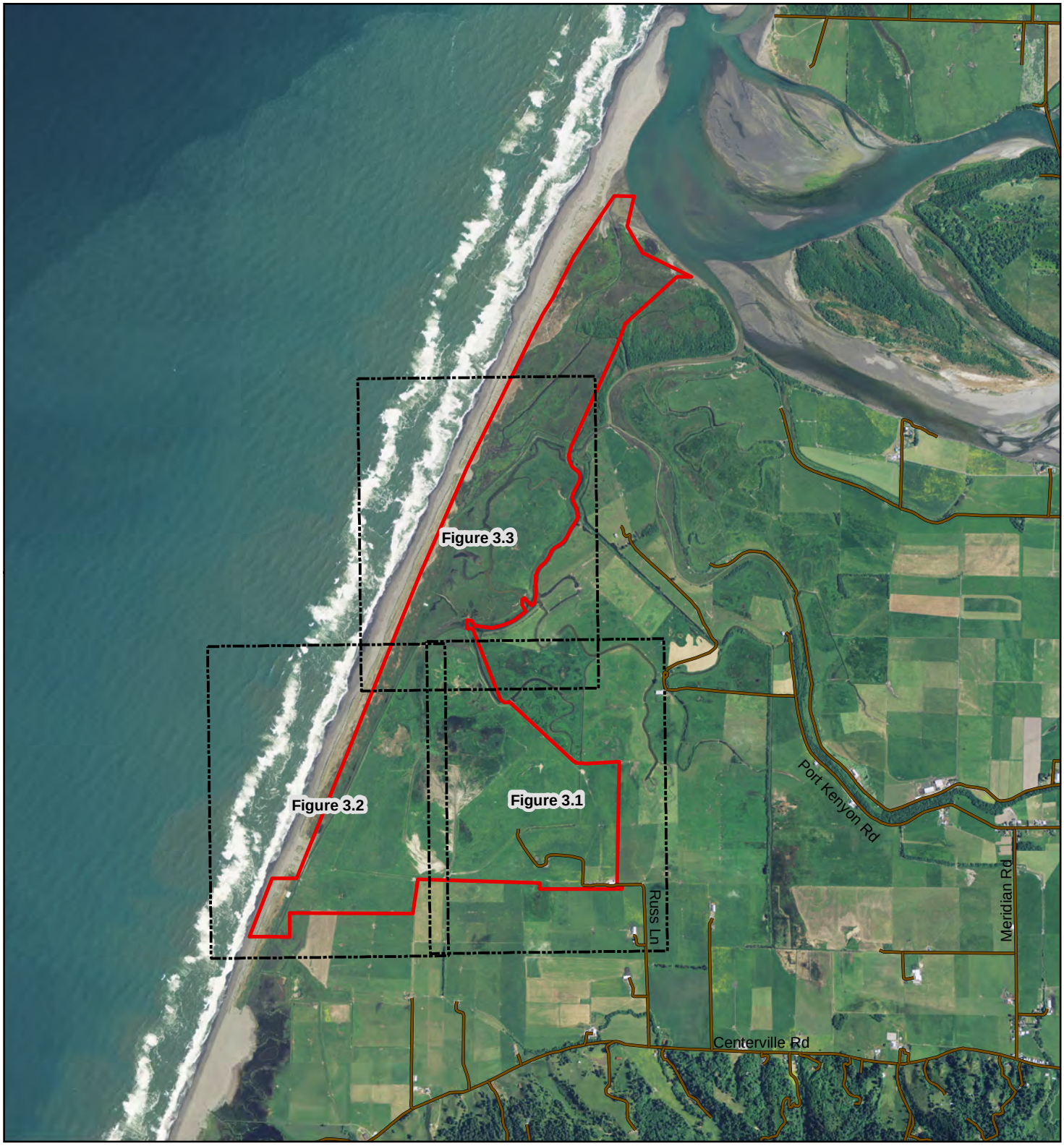
Figure 1

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Wetlands\F1_Vicinity.mxd

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, and County of Del Norte make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:amshows



Roadway
Figure Key
Study Boundary

Paper Size 8.5" x 11" (ANSI A)
0 1,000 2,000 3,000 4,000 5,000
Feet
Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 10N

N

CalTrout
EREP Ecosystem Enhancement Project

Eel River Estuary Preserve
Upland Mapping Figure Key

Job Number	8410882
Revision	A
Date	27 Jan 2014

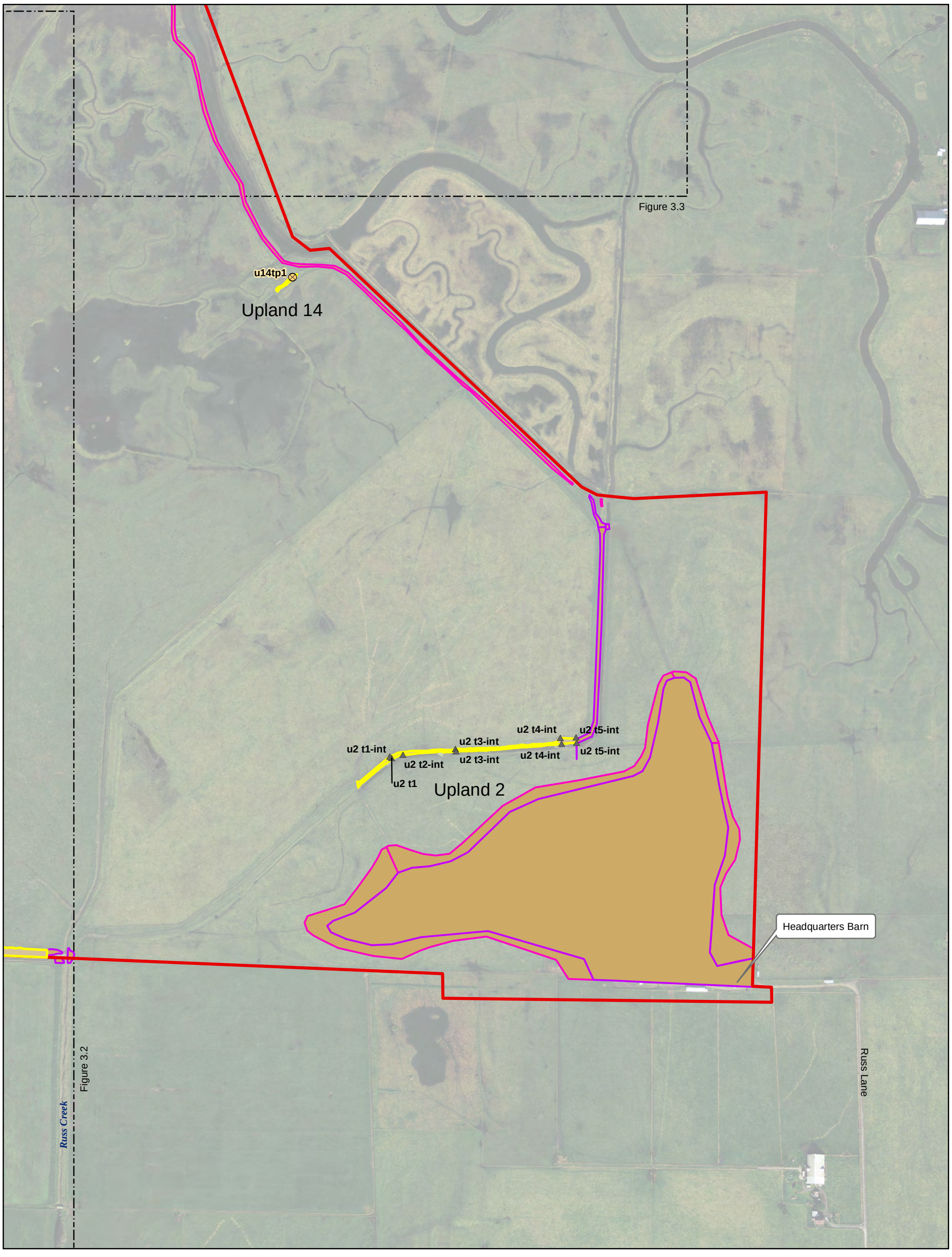
Figure 2

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Wetlands\F2_WetlandMBKey.mxd

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Aerial, 2012 USDA NAIP, 1m; Roads, County of Humboldt, 2008. Created by:amshows



GHD Data Colection (2013)

- Study Boundary
- Map Match Lines
- Test Pit (Wetland)
- Test Pit (Upland)
- Transect (Upland-Wetland Boundary)
- Upland
- 2-parameter Upland (Soils and Hydrology)

Previous Wetland/Upland Mapping Efforts

Mad River Biologists (2011)

- Upland
- 1 Parameter Wetland

Paper Size 11" x 17" (ANSI B)

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 09 Jul 2014

Eel River Estuary Preserve Upland Mapping

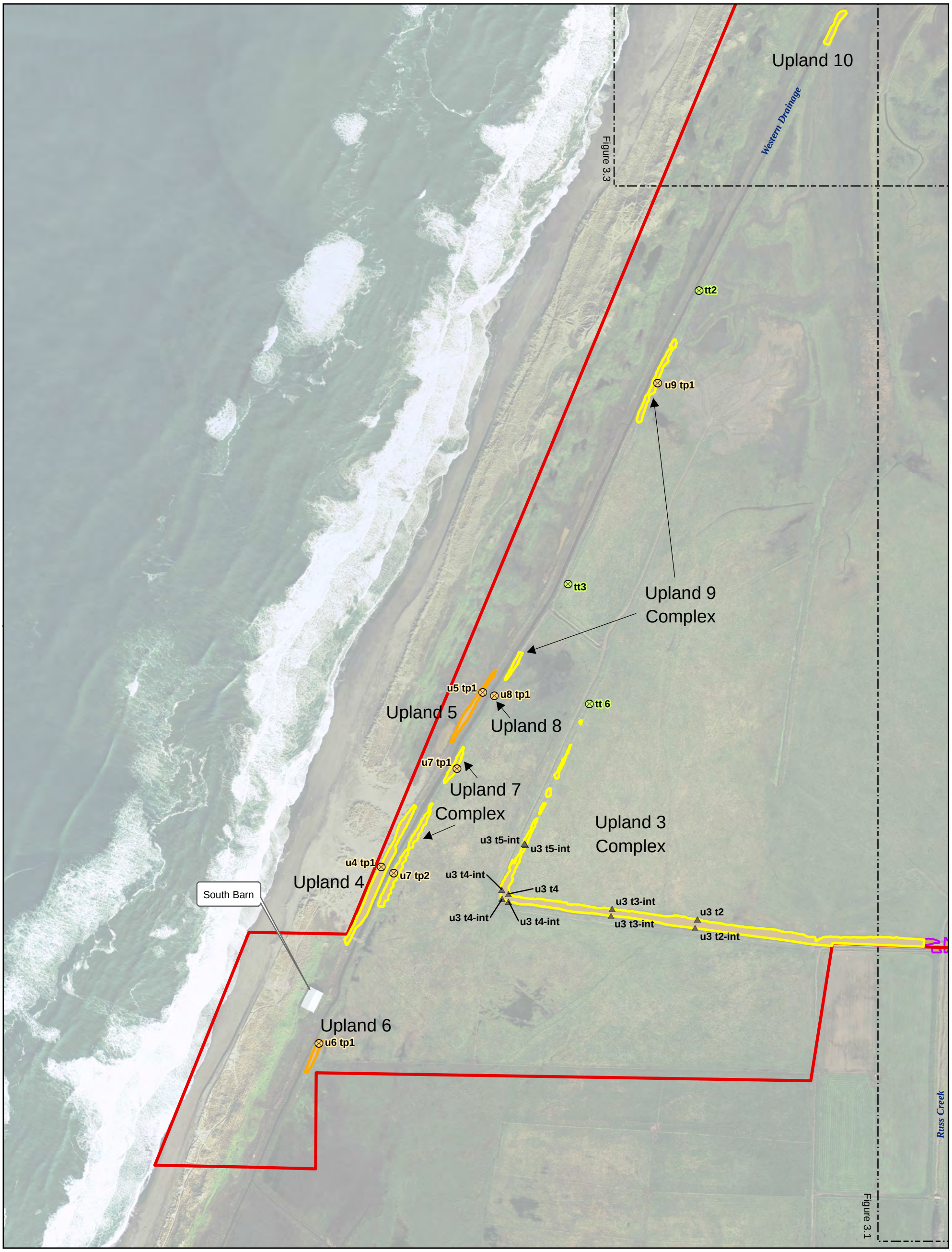
Figure 3.1

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Wetlands\F3_WetlandMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Wetland Mapping, GHD, 2013, and Mad River Biologists, 2011; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows



GHD Data Colection (2013)

- Study Boundary
- Map Match Lines
- Test Pit (Wetland)
- Test Pit (Upland)
- Transect (Upland-Wetland Boundary)
- Upland
- 2-parameter Upland (Soils and Hydrology)

Previous Wetland/Upland Mapping Efforts

Mad River Biologists (2011)

- Upland
- 1 Parameter Wetland

Paper Size 11" x 17" (ANSI B)

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882
Revision A
Date 09 Jul 2014

Eel River Estuary Preserve Upland Mapping

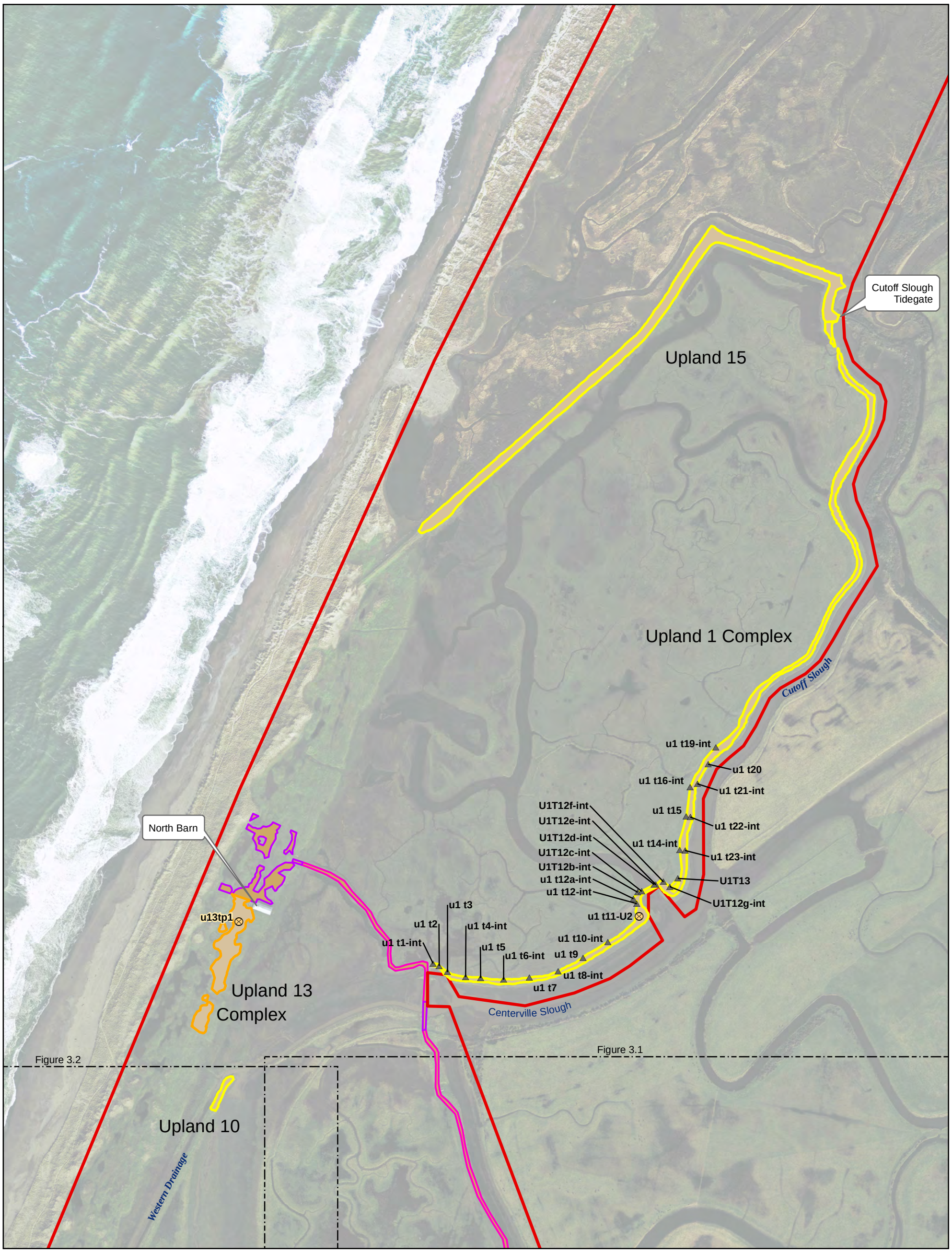
Figure 3.2

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Wetlands\F3_WetlandMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Wetland Mapping, GHD, 2013, and Mad River Biologists, 2011; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows



GHD Data Colection (2013)

- Study Boundary
- Map Match Lines
- Test Pit (Wetland)
- Test Pit (Upland)
- Transect (Upland-Wetland Boundary)
- Upland
- 2-parameter Upland (Soils and Hydrology)

Previous Wetland/Upland Mapping Efforts

Mad River Biologists (2011)

- Upland
- 1 Parameter Wetland

Paper Size 11" x 17" (ANSI B)

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Eel River Estuary Preserve
Upland Mapping

Job Number	8410882
Revision	A
Date	09 Jul 2014

Figure 3.3

G:\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Wetlands\F3_WetlandMB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Wetland Mapping, GHD, 2013, and Mad River Biologists, 2011; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:amshows

Appendix B - (Data Sheets)

Wetland Determination Data Forms – Western Mountains, Valleys, and Coast Region

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 10/15/13

Applicant/Owner: TNC State: CA Sampling Point: U/T2-U

Investigator(s): CS/AG Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee/road Local relief (concave, convex, none): linear/linear Slope (%): 10

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. Anthoxanthum St.	35	✓	FAC
2. Distichlis sp.	30	✓	FACW
3. Lotus co.	10	N	FAC
4. Salicornia sp.	20	✓	OBL
5. Aster ch.	5	N	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	30	x 2 = 60
FAC species	50	x 3 = 150
FACU species	0	x 4 = Ø
UPL species	0	x 5 = Ø
Column Totals:	100 (A)	230 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
*veg not growing as hydrophyte due to high position topographically on levee road, high chroma soils (does not meet indicators)

SOIL

Sampling Point: U1T2-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/3	98	2.5Y 4/4	2	C	M	silt loam	(1)
3-9	2.5Y 3/3	100	—	—	—	—	"	~~*~~ (2)
9-18	2.5Y 3/3	100	—	—	—	—	"	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
(1) chroma too high to meet indicators, and redox only in surface does not meet thickness
(2) anamolies in matrix color due to source material from level building, some areas of mixed color. Wood chips observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 2/2
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): >18"

Water Table Present? Yes ___ No X Depth (inches): "

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): "

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Humboldt Sampling Date: 10/15/13

Applicant/Owner: TWC State: CA Sampling Point: U/T2-W

Investigator(s): Consultant Section, Township, Range: _____

Landform (hillslope, terrace, etc.): mixed wetland/floodplain Local relief (concave, convex, none): concave/linear Slope (%): 5%

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. Distichlis sp.	30	✓	FACW
2. Salicornia pa.	10	✓	OBL
3. Atriplex st.	20	✓	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 40

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	10	x 1 = 10
FACW species	30	x 2 = 60
FAC species	20	x 3 = 60
FACU species	Ø	x 4 = Ø
UPL species	Ø	x 5 = Ø
Column Totals:	60 (A)	130 (B)

Prevalence Index = B/A = 2.16

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: UT2-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 3/2	85	2.5Y 4/4	15	C	M	silt loam	firm/compacted

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 2/2
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): >18"

Water Table Present? Yes ___ No X Depth (inches): "

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): "

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: CONNICK RANCH City/County: FERNDALE / ~~HUMBOLDT~~ HUMBOLDT Sampling Date: 10/15/13

Applicant/Owner: TNC State: CA Sampling Point: U1T3-U

Investigator(s): C SCOTT / A. GOWER Section, Township, Range: _____

Landform (hillslope, terrace, etc.): ~~FLOOD PLAIN~~ LEVEE / ROAD Local relief (concave, convex, none): ~~CONCAVE~~ CONCAVE / LINEAR Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ~~X~~	No ~~X~~	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: *veg not growing as hydrophytes

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Polygonum pa.	5	N	UPL
2. Salicornia pa.	20	Y	OBL
3. Achillea mi.	10	N	FACW
4. Lolus corni.	20	Y	FAC
5. Ambrosia sp.	35	Y	FAC
6. Distichlis sp.	25	Y	FACW
7.			
8.			
9.			
10.			
11.			
	_____ = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	25	x 2 = 50
FAC species	55	x 3 = 165
FACU species	10 10	x 4 = 40
UPL species	5	x 5 = 25 (25)
Column Totals:	100 (A)	300 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ~~X~~

Remarks: TP = 3' from wet boundary
*veg not growing as hydrophytes, elevated on levee/road and does not meet soil or hydrology indicators

SOIL

Sampling Point: U1T3-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/3	100	–	0	–	–	silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:
anomalies in matrix color in clumps due to material source in levee building. wood chips present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 2/2
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): >14"

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
top of man made levee topographically (high point)

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 10/16/13
Applicant/Owner: TNC State: CA Sampling Point: U1T3-W
Investigator(s): LW/AG Section, Township, Range: _____
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave/linear Slope (%): 1
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis st. ✓	45	Y	FAC
2. Salicornia pa. ✓	20	Y	OBL
3. Cirsium vu.	5	N	FACU
4. Achillea mi.	5		FACU
5. Hypochaeris ra.	10		FACU
6. Rumex cr. ✓	5		FAC
7. Plantago la.	10		FACU
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		
% Bare Ground in Herb Stratum Ø			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	Ø	x 2 = Ø
FAC species	50	x 3 = 150
FACU species	30	x 4 = 120
UPL species	Ø	x 5 = Ø
Column Totals:	100 (A)	290 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: UIT3-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	90	10YR 4/4	10	C	M	SILT LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: Redox concentration observed from surface to depth. F6 = Redox in dark surface (matrix value = 3; chroma value = 2) Redox concentration at approx 4" and ~~at 10-18~~ extended to depth

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 1/1
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Assume wet season hydro due to strong redox in flat pasture on fringe of obvious wetland

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 10/15/13

Applicant/Owner: TWC State: CA Sampling Point: U1TS-U

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee/road Local relief (concave, convex, none): linear/linear Slope (%): 15

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: * Vege does not pass PI

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		

Herb Stratum (Plot size: _____)			
1. Polygonum hydropiperoides	45	Y	FAC
2. Agrostis stolonifera	35	Y	FAC
3. Plantago lanceolata	15	N	FACU
4. Rumex OCC	5	N	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	5	x 2 = 10
FAC species	80	x 3 = 240
FACU species	15	x 4 = 60
UPL species	Ø	x 5 = Ø
Column Totals:	100 (A)	310 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: * Vegetation dominated by FAC species w/only 1 subdominant FACW species present at low percent (5%). Vege not growing as hydrophytes corroborated by absence of hydric soils or hydrology and higher topographic position [TP = 4' from wet boundary]

SOIL

Sampling Point: UITS-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/3	100	—	0	—	—	Si L loam	
12-18	10YR 3/2	100	—	0	—	—	" "	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks: Wood chips + anomalies in matrix color in clumps due to material source used to construct berm

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): >18"

Water Table Present? Yes _____ No ↓ Depth (inches): ↓

Saturation Present? (includes capillary fringe) Yes _____ No ↓ Depth (inches): ↓

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

UIT5-W

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: ~~UIT5-W~~

Applicant/Owner: TWC State: CA Sampling Point: 10/15/2013

Investigator(s): A. Gomez / C. Scott Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): Concave/linear Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: Ø

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		

Herb Stratum (Plot size: _____)			
1. Holcus lanatus	40	Y	FAC
2. Achillea mille	15	N	FACU
3. Plantago lanc	15	N	FACU
4. Agrostis stolon	25	Y	FAC
5. Rumex cr.	5	N	FACW
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	5	x 2 = 10
FAC species	165	x 3 = 195
FACU species	30	x 4 = 120
UPL species	Ø	x 5 = Ø
Column Totals:	100 (A)	325 (B)

Prevalence Index = B/A = 3.25

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:
~~Vegetation dominated by facultative species with only 1 subdominant FACW species present. Vegetation not showing as hydrophytes corroborated with absence of hydric soils, hydro and topographic position~~
TP = 1' from wet boundary

SOIL

Sampling Point: UITS-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	85	2.5Y4/4	15	C	M	Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- NO Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches) >18"

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* Assume hydro in winter due to strong/consistent redox through out soil horizon

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 10/15/13

Applicant/Owner: TNC State: CA Sampling Point: U1T7-U

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee/road Local relief (concave, convex, none): linear/linear Slope (%): 15

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: X does not pass PI for vege

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Holcus lanatus	45	Y	FAC
2. Plantago lanc.	15	N	FACU
3. Lolium dom.	10	N	FAC
4. Agrostis stol.	30	Y	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	_____ = Total Cover		

Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	85	x 3 = 255
FACU species	15	x 4 = 60
UPL species	0	x 5 = 0
Column Totals:	100 (A)	315 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

- __ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: X Vegetation dominated by FAC species not growing as hydrophytes (higher topographic position, absence of wetland soil indicators). Does not pass PI
TP = 5' from wet boundary

SOIL

Sampling Point: UT7-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/3	100	–	0	–	–	silt loam	firm
>12	too compacted							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No X

Remarks: wood chips + anomalies present in matrix color but in clumps (not consistent), due to source (historic) material to build berm

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-12

Water Table Present? Yes ___ No X Depth (inches): ↓

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ↓

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: UIT 7-W

Applicant/Owner: TWC State: CA Sampling Point: 10/15/2013

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave/linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No X	

Remarks: * Vege does not pass PI, because along levee, elevation was used to draw boundary, this plot technically 2 parameter wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Agrostis stol.	80	Y	FAC
2. Plantago lanc.	15	N	FACU
3. Rumex cr.	5	N	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	85	x 3 =	255
FACU species	15	x 4 =	60
UPL species		x 5 =	
Column Totals:	100 (A)		315 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: TP = 1' from wet boundary * Vege does not pass PI

SOIL

Sampling Point: U/T7-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	90	2.5Y 4/4	10	C	M	silt loam	firm

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ND FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): > 18"

Water Table Present? Yes ___ No ↓ Depth (inches): ↓

Saturation Present? (includes capillary fringe) Yes ___ No ↓ Depth (inches): ↓

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* Assume winter hydro based on topographic position, strong wetland indicators in soil and soil is relatively undisturbed.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 01-19-0

Applicant/Owner: TWC State: CA Sampling Point: 10/15/13

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee/road Local relief (concave, convex, none): linear/linear Slope (%): 15

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: TP = 2' from wet boundary on abrupt levee
veg does not pass PI

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Holcus lanatus	65	Y	FAC
2. Agrostis stol.	15	N	FAC
3. Trifolium cro	5	N	FAC
4. Plantago lanc	10	N	FACU
5. Taraxacum off.	5	N	FACU
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100* (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	85	x 3 = 255
FACU species	15	x 4 = 60
UPL species	Ø	x 5 = Ø
Column Totals:	100 (A)	315 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

NO 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ 5 - Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No *

Remarks: * Holcus is only dominant species (FAC), not strongly hydrophytic and not growing as hydrophyte. Area is on side of levee and lacks hydro or soils indicators. Soil Chroma is clearly 3/2 w/ Ø redox.
TP = 2' from wet boundary

SOIL

Sampling Point: UT9-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 4/3	98	2.5Y 4/4	2	C	M	silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- NO Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
Does not meet wetland soil indicators as matrix chroma not reduced (>2). Variegation in soil color may be due to imported materials during levee construction

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 7 18"

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: CONNICK RANCH City/County: FERNDALE, HUMBOLDT Sampling Date: 10/15/2013

Applicant/Owner: TWC State: CA Sampling Point: U1T9-W

Investigator(s): A. GOWER & C. SCOTT Section, Township, Range: _____

Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE/LINEAR Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation NO, Soil NO, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation NO, Soil NO, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ~~X~~	No X	**Is the Sampled Area within a Wetland?** Yes X No ___
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes X	No ___	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: ___)			
1. Agrostis st.	65	Y	FAC
2. Plantago la.	10	N	FACU
3. Holcus la.	20	Y	FAC
4. Rumex cr.	5	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	90	x 3 = 270
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	100 (A)	310 (B)

Prevalence Index = B/A = 3.10

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:
TP = 5' from wet boundary

* does not meet PI

SOIL

Sampling Point: UIT9-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	85	2.5Y4/4	15	C	M	silt loam	firm, roots present in top 2"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11) NO
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): >18"

Water Table Present? Yes ___ No ↓ Depth (inches): 1'

Saturation Present? (includes capillary fringe) Yes ___ No ↓ Depth (inches): 11

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* Assume winter hydro based on topo, strong redox + soil indicators in relatively undisturbed location

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: CONNICK RANCH City/County: FERNDALE / HUMBOLDT Sampling Date: 10/10/13

Applicant/Owner: TNC State: CA Sampling Point: VITI-U

Investigator(s): A. GOWER & L. WEBB Section, Township, Range: _____

Landform (hillslope, terrace, etc.): LEVEE / ROW Local relief (concave, convex, none): CONCAVE / LINEAR Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Rumex cr.	10	N	FAC
2. Holcus la.	65	Y	FAC
3. Plantago la.	5	N	FACU
4. Taraxacum of.	5	N	FACU
5. Centaura pu	15	N	NL
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	75	x 3 = 225
FACU species	10	x 4 = 40
UPL species	15	x 5 = 75
Column Totals:	100 (A)	340 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

- __ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

TP = 13' from wet boundary, dug multiple holes on low < slope PI > 3

SOIL

Sampling Point: UTU-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/3	100	–	0	–	–	silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/6
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): >18"

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / Humboldt Sampling Date: 10/15/2013

Applicant/Owner: TWC State: _____ Sampling Point: VIT 11-W2

Investigator(s): A. Gower & C. Scott / LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none) Concave / linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ~~X~~	No ~~X~~	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes ~~X~~	No ~~X~~	
Wetland Hydrology Present?	Yes ~~X~~	No X	

Remarks: Assumed wetland hydro

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis st.	75	Y	FAC
2. Holcus la.	20	Y	FAC
3. Plantago la	5	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 = Ø
FACW species	Ø	x 2 = Ø
FAC species	95	x 3 = 285
FACU species	5	x 4 = 20
UPL species	0	x 5 = 0
Column Totals:	100 (A)	305 (B)

Prevalence Index = B/A = 3.05

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- N 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ~~X~~ No ~~X~~

Remarks: TP = 6' from wet boundary (low angle slope)

SOIL

Sampling Point: UTU-U2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	90	10YR3/3	10	C	M	silt loam	faint redox does not meet F6

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ✓ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): >18"

Water Table Present? Yes ___ No ✓ Depth (inches): ↓

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ↓

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/Humboldt Sampling Date: 10/16/13

Applicant/Owner: TNC State: CA Sampling Point: UIT13-U

Investigator(s): KG/LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain/levee road Local relief (concave, convex, none): Concave linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Holcus la.	80	Y	FAC
2. Rumex cr	5	N	FAC
3. Cirsium vu.	15	N	FACU
4. Agrostis st.	5	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	90	x 3 = 270
FACU species	15	x 4 = 60
UPL species	0	x 5 = 0
Column Totals:	105 (A)	330 (B)

Prevalence Index = B/A = 3.14

Hydrophytic Vegetation Indicators:

- __ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ☆

Remarks:
☆ located at toe of levee road, on small bench. Above obvious break in topo + vege in lower lying wetland area. Vege not growing as hydrophytes b/c dominated by 1 FAC species PI >3.0
TP = 4' from wetland boundary

SOIL

Sampling Point: UIT13-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/2	100	—	—	—	—	Silt loam	
10-18	10YR 3/2	95	10YR 4/4	5	C	M	Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): 0-18"

Water Table Present? Yes _____ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / Humboldt Sampling Date: 10/16/13

Applicant/Owner: TNC State: CA Sampling Point: WIT13-W

Investigator(s): AG / LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave / linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Holcus la	65	Y	FAC
2. Agrostis st	20	Y	FAC
3. Plantago la	5	N	FACU
4. Grass ufo	10	N	unknown
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	_____	x 3 = _____
FACU species	_____	x 4 = _____
UPL species	_____	x 5 = _____
Column Totals:	_____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: TP N 4' from wetland boundary

SOIL

Sampling Point: UT13-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	100					SILT LOAM	
8-18	10YR 3/2	90	10YR 4/4	10	C	M	SILT LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: Redox concentrations observed in soil matrix if munsell value=3 & chroma=2 @ approx 10% from 8" to depth=fu.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Assume wetland hydrology due to geomorphic location and strong soil indicators.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick City/County: Fortuna/Humboldt Sampling Date: 10/16/13

Applicant/Owner: TWC State: CA Sampling Point: UITS-4

Investigator(s): LW/AG Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee/road Local relief (concave, convex, none): concave/linear Slope (%): 10

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Holcus la.	75	Y	FAC
2. Agrostis st.	5	N	FAC
3. Plantago la.	10	N	FACU
4. Rumex cr.	10	N	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	80	x 3 = 240
FACU species	20	x 4 = 80
UPL species	0	x 5 = 0
Column Totals:	100 (A)	320 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
Veg not growing as hydrophytes, dominated by single FAC species on sideslope of levee/road. Corroborated by absence of soil hydric indicators. Hydrophytic Veg. Index >3.0
(2' from wetland boundary)

SOIL

Sampling Point: U1T15-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/2	100	—	—	—	—	SILT LOAM	
10-18	10YR 3/2	98	10YR 4/4	2	C	M	SILT LOAM	distinct redox yet does not meet thickness/depth for F6

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): 0-18"

Water Table Present? Yes _____ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connicks City/County: Ferndale/Humboldt Sampling Date: 10/16/13

Applicant/Owner: TWC State: CA Sampling Point: U1T15-W

Investigator(s): LW/AG Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): CONCAVE/LINEAR Slope (%): 1

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ☆	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: ☆ does not pass PI

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis sti.	98	Y	FAC
2. Plantago la.	2	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	98	x 3 = 294
FACU species	2	x 4 = 8
UPL species	0	x 5 = 0
Column Totals:	100 (A)	302 (B)

Prevalence Index = B/A = 3.02

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- No 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: TP is 2' from wet boundary veg does not pass PI

SOIL

Sampling Point: U1T15-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	100	—	—	—	—	SILT LOAM	
8-18	10YR 3/2	90	10YR 4/4	10	C	M	SILT LOAM	distinct redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

- Redox concentrations starting at 8" bgs and extending to depth of pit. Four inches occur w/i upper 12 inches, therefore F6. Matrix value - mineral 3; chroma - 2.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

+ Assumed winter hydrology due to geomorphic position and strong soil indicators.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale Sampling Date: 10-17-13

Applicant/Owner: TWC State: _____ Sampling Point: U1T20-U

Investigator(s): LW/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee road edge Local relief (concave, convex, none): convex/linear Slope (%): 10

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis st.	30	Y	FAC
2. Holcus la.	30	Y	FAC
3. Cirsium vu.	10	N	FACU
4. Plantago la	5	N	FACU
5. Achillea mi.	10	N	FACU
6. Rumex cr.	5	N	FACW
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 =
FACW species	5	x 2 = 10
FAC species	60	x 3 = 180
FACU species	25	x 4 = 100
UPL species	Ø	x 5 =
Column Totals:	90 (A)	290 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

NO 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ 5 - Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: Dominant species are all FAC species. Does not pass P.I. FACW are represented at 5% of the total species present

TP = 0.5' from wet boundary

SOIL

Sampling Point: UIT20-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-13	2.5Y 3/2	100	—	—	—	—	siltloam	
13-18	2.5Y 4/2		10YR 3/4	5	C	M/PL	siltloam	oxidized channels

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch. City/County: Fernbdale Humboldt Sampling Date: 10-17-13

Applicant/Owner: TWC State: CA Sampling Point: U1T20-W

Investigator(s): LW/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): slough terrace Local relief (concave, convex, none): Edge/level Slope (%): 1-2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis st.	30	Y	FAC
2. Holcus la	30	Y	FAC
3. Cirsium vu	10	N	FACU
4. Plantago la	5	N	FACU
5. Acnillta mi.	10	N	FACU
6. Rumex cr	5	N	FACW
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	Ø	x 1 =
FACW species	5	x 2 = 10
FAC species	60	x 3 = 180
FACU species	25	x 4 = 100
UPL species	Ø	x 5 =
Column Totals:	100 (A)	290 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: Dominant species

TP = 3' from wetland boundary

SOIL

Sampling Point: U1T20-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	2.5Y 3/2	100	–	–	–	–	silt loam	
7-18	10YR 3/2	95	10YR 3/4	5	C	M	"	(small pockets fine sandy loam) Redox distinct

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ND FAC-Neutral Test (D5) %
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* Assume wetland winter hydrology based on vertical + horizontal ~~dis~~ proximity to slough channel

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / HUM Sampling Date: 10-2-13

Applicant/Owner: TWC State: CA Sampling Point: U2 T1-U

Investigator(s): LW / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Festuca pe.	30	Y	FAC
2. Cirsium vu.	10		FACU
3. Taenathrum ca.	25	Y	UPL
4. Trifolium fr	15		FACU
5. Argentina ans.	10		OBL
6. Phalaris m.	5		UPL
7. Rumex c.	5		FAC
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	10	x 1 = 10
FACW species	0	x 2 = 0
FAC species	35	x 3 = 105
FACU species	25	x 4 = 100
UPL species	30	x 5 = 150
Column Totals:	100 (A)	365 (B)

Prevalence Index = B/A = 3.65

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

TP = 3' from wetland boundary PI > 3.0 @ 3.65

SOIL

Sampling Point: U2T1-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y4/2	97	10YR3/4	2	C	M	silt	1% 2.5Y4/1
4-12	2.5Y4/2	100	—	—	—	—	silt	— —
12-20	2.5Y4/2	95	—	—	—	—	silt	pockets of mixed soil w/ redox C+D similar to surface

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks:
soil is mixed due to alterations from channel maintenance (historic). May meet F3 but surface redox due to compaction + altered surface conditions

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): _____

Water Table Present? Yes ____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Topographic high point above channel

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/HUM Sampling Date: 10-25-13
Applicant/Owner: TWC State: CA Sampling Point: D2T1-W
Investigator(s): LW/CS Section, Township, Range: _____
Landform (hillslope, terrace, etc.): Slough side slope Local relief (concave, convex, none): _____ Slope (%): 5
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		

Herb Stratum (Plot size: _____)			
1. Argentina an.	25	Y	OBL
2. Trifolium en.	20	Y	FAC
3. Agrostis st.	25	Y	FAC
4. Rumex cr.	5		FAC
5. Trifolium re.	5		FAC
6. Cirsium vu.	5		FACU
7. Festuca ar	10		FAC
8. Holcus la	5		FAC
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
__ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
✓ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:
TP = 4' from wetland boundary

SOIL

Sampling Point: U2T1-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR3/2	100	—	—	—	—	silt	
3-7	2.5Y3/3	98	10YR3/4	2				
7-20	2.5Y3/2	95	10YR3/4	5	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 1/1
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Fendak / HUM Sampling Date: 10-18-15

Applicant/Owner: TWC State: _____ Sampling Point: U3T2-U

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): tree edge/ramp Local relief (concave, convex, none) convex/linear Slope (%): Ø

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Polygonum ar.	30	Y	NL
2. Cirsium ar.	10		FAC
3. Rumex cr.	15		FAC
4. Festuca pe.	30	Y	FAC
5. Hypochoeris ra.	5		FACU
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 10%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	55	x 3 = 165
FACU species	5	x 4 = 20
UPL species	30	x 5 = 150
Column Totals:	90 (A)	335 (B)

Prevalence Index = B/A = 3.72

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- NO 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: TP = 12' from boundary. Formerly TT11

SOIL

Sampling Point: U3TT2-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	98	7.5Y 4/6	2	C	M	Sandy loam	0-5" does not meet indicators
5-18	2.5Y 3/2	70	see note	=	–	–	Sand.	30% clumps from surface mixed in (10YR 3/2 w/ 2% 7.5Y 4/6) (does not meet indicators)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No X

Remarks:

2% of Redox concentrations in matrix of soil. Value of 3 w/ a chroma of 2 from surface to 5.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 3-15"

Water Table Present? Yes ___ No X Depth (inches): 3-15

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 3-15"

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / Hum Sampling Date: 10-19-13

Applicant/Owner: TWC State: CA Sampling Point: U3TRW

Investigator(s): LW / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain/Terrace Local relief (concave, convex, none): linear / linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Argentina an	35	Y	OBL
2. Agrostis st.	25	Y	FAC
3. Rumex co.	10		FAC
4. Festuca pe.	10		FAC
5. Holcus la.	20	Y	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: TP = 12' from boundary

SOIL

Sampling Point: U3T2-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR2/2	100	—	0	—	—	silt loam	
2-18	2.5Y4/1	90	10YR3/4	10	C	M	silt	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* hydro assumed

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / HUM Sampling Date: 10-18-13

Applicant/Owner: TWC State: CA Sampling Point: U3T4-U

Investigator(s): AG/CS/LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee Local relief (concave, convex, none): linear/linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Polygonum ar.	20	Y	NL.
2. Festuca pr.	35	Y	FAC
3. Trifolium er.	10		FAC
4. Cirsium ar.	5		FAC
5. Rumex cr.	10		FAC
6. Lotus co.	15		FAC
7. Trifolium re.	2.5		FAC
8. Cirsium ar.	2.5		FAC
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	80	x 3 = 240
FACU species	0	x 4 = 0
UPL species	20	x 5 = 100
Column Totals:	100 (A)	340 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

PI > 3.0 @ 3.4

Formerly TT9

SOIL

Sampling Point: 1/3T4-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y 3/2	95	10YR 3/6	5	C	M	sand	very compacted
8-18	2.5Y 3/2	100	—	0	—	—	sand	looser than surface

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:
X meets S5 but only in surface, likely due to surface compacting +/or source material (located on top of levee). Remnant redox.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/HUM Sampling Date: 10-28-
Applicant/Owner: TWC State: CA Sampling Point: U3 T4-W
Investigator(s): LW/CS Section, Township, Range: _____
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): <5%
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Argentina ar.	50	Y	OBL
2. Rumex c.	5		FACW
3. Agrostis st.	20	Y	FAC
4. Holcus la.	10		FAC
5. Festuca ar.	15		FAC
6.			
7.			
8.			
9.			
10.			
11.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		
% Bare Ground in Herb Stratum _____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

TP = 3 feet from wetland boundary

SOIL

Sampling Point: U3T4-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR3/2	90	7.5YR4/6	10	C	M	silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 1/1
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / HUM Sampling Date: 10-31-03

Applicant/Owner: TWC State: CA Sampling Point: U4 TP1

Investigator(s): LW / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): dredge spoils Local relief (concave, convex, none): convex Slope (%): 30%

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No X

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Distichlis sp.	25	Y	FACW
2. Ammophila ar	15	Y	FACU
3. Calystegia so.	10	Y	NL
4. Cumissonia ch.	5		NL
5. Rumex cr.	5		FAC
6. Festuca pe	5		FAC
7. Ambrosia ch.	10	Y	NL
8.			
9.			
10.			
11.			
	75 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 25

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- __ 1 - Rapid Test for Hydrophytic Vegetation
- __ 2 - Dominance Test is >50%
- __ 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL

Sampling Point: U4TP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	2.5Y3/1	100	—	0	—	—	sand	mixed w/ spoils
1-18	2.5Y4/2	90	10YR3/6	10			silty clay loam	(mixed w/ sand)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks: Appearance of relict redox features are remnant in material sourced from slough channel

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) **(LRR A)**
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) **(LRR A)**
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): _____

Water Table Present? Yes ____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: near 11/11/11 test pit C2 by JBL reclassify as upland, all the way to edge of slough (see JBL grey polygon)

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/HUM Sampling Date: 10-31-13

Applicant/Owner: TWC State: _____ Sampling Point: US TP1

Investigator(s): LW/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): dredge spoils Local relief (concave, convex, none): convex Slope (%): <5

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: PEM1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: vege not growing as hydrophytes — 1/2 parameter upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		

Herb Stratum (Plot size: _____)			
1. Sarcocornia pa	70	Y	OBL
2. Atriplex pr.	15	N	FAC
3. Rumex cr.	5	N	FAC
4. Distichlis sp.	10	N	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	10	x 2 =	20
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		150 (B)

Prevalence Index = B/A = 1.5

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: USTP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR3/2	100	—	0	—	—	clay loam	
3-8	10YR4/3	70	10YR4/6	10	C	M	"	highly mixed (20%)
8-18+	10YR3/2	100	—	0	—	—	"	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
wood mixed throughout 3-8"
variation in soil does not meet hydric indicator b/c chroma high, and sourced from slough/mixed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 1/1
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
near 11/2/11 NG JBL (Dec 13, 2011)
topographic high on historic dredge spoils

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/HUM Sampling Date: 10-31-13

Applicant/Owner: TWC State: CA Sampling Point: U6 TP1

Investigator(s): LW / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): historic spoils from dredging Local relief (concave, convex, none): convex Slope (%): 1%

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: 2 parameter upland

2 parameter upland

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Festuca pe.	20	Y	FAC
2. Plantago sp.	2.5		FACW
3. Rumex cr.	2.5		FAC
4. Hordeum ma.	15		FAC
5. Agrostis st.	25	Y	FAC
6. Distichlis sp.	20	Y	FACW
7. Hypochaeris ra.	2.5		FACU
8. Cirsium vu.	2.5		FACU
9. Lotus co.	10		FAC
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	22.5	x 2 = 45
FAC species	72.5	x 3 = 217.5
FACU species	5	x 4 = 20
UPL species		x 5 =
Column Totals:	100 (A)	282.5 (B)

Prevalence Index = B/A = 2.825

Hydrophytic Vegetation Indicators:

- __ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- __ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ 5 - Wetland Non-Vascular Plants[1]
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: U6TP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y 3/2	70	2.5Y 4/4	10	C	M	silty clayloam	20% mixed of other material + varigated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

X Historic dredge spoils, topographic high, soil redox apparent are remnant from source from slough

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5) 1/1
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale/HUM Sampling Date: 10-31-13
Applicant/Owner: TWC State: CA Sampling Point: U7TP2
Investigator(s): LW/CS Section, Township, Range: _____
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Convex Slope (%): <5%
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Festuca pe.	20	Y	FAC
2. Arctotheca ca.	15	Y	NL
3. Distichlis sp.	10		FACW
4. Spergularia ma.	15	Y	FAC
5. Rumex cr.	10		FAC
6. Cirsium vu.	5		FACU
7. Plantago sp.	5		FACW
8.			
9.			
10.			
11.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 20

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	15	x 2 = 30
FAC species	45	x 3 = 135
FACU species	5	x 4 = 20
UPL species	15	x 5 = 75
Column Totals:	80 (A)	260 (B)

Prevalence Index = B/A = 3.25

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
FAC species not acting as hydrophyte PI > 3.0 @ 3.25

SOIL

Sampling Point: U7TP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y3/2	100	—	0	—	—	Sandy loam	
4-8	5Y4/2	70	10YR4/6	10	C	M	silt clay loam w/20% sand in profile	
4-20	5Y3/2	100	—	0	—	—	loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
X Does not meet hydric indicators because redox in 4-8" layer is mixed soil w/ 20% sand from dredge deposits. Does not meet S6 b/c matrix value too high, X meets F3 but not formed in situ, redox relic from source material from slough channel. X Also, redox not continuous throughout 4-8" layer

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
near JBL (12/13/2011) C3

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Fendale/HUM Sampling Date: 10-31-13
Applicant/Owner: TWC State: CA Sampling Point: U8 TP1
Investigator(s): LW/CS Section, Township, Range: _____
Landform (hillslope, terrace, etc.): slough Local relief (concave, convex, none): none Slope (%): Ø
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		

Herb Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Festuca pe	25	Y	FAC
2. Rumex cr.	15	Y	FAC
3. Hypochaeris ra	15	Y	FACU
4. Lotus co.	15	Y	FAC
5. Polygonum ar	10		NL
6. Phalaris ar	5		FACW
7. Argentina ar	5		OBL
8.			
9.			
10.			
11.			
	90 = Total Cover		

Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	5	x 1 = 5
FACW species	5	x 2 = 10
FAC species	55	x 3 = 165
FACU species	15	x 4 = 60
UPL species	10	x 5 = 50
Column Totals:	90 (A)	290 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No *

Remarks:
*= based on P.I > 3.0 and upland topography

SOIL

Sampling Point: U8TP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR3/2	100	—	0	—	—	silt loam	
1-12	2.5Y4/1	55	10YR3/3	45	C	M	"	highly mixed +
12-18	2.5Y3/2	100	—	0	—	—	silt	variegated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet indicators because < 60% is reduced matrix. Material placed from historic dredging of slough (possibly)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
location near N7 by JBL (12/13/11)

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / Hum Sampling Date: 10-18-13

Applicant/Owner: TNC State: CA Sampling Point: U9 TP1

Investigator(s): AG / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee edge Local relief (concave, convex, none): linear/linear Slope (%): Ø

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: * soil features remnant from source material

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Agrostis st.	30	Y	FAC
2. Galium vu.	20	Y	FACU
3. Trifolium re	10		FAC
4. Festuca pe.	25	Y	FAC
5. Rumex cr.	5		FAC
6. Lotus co.	10		FAC
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	80	x 3 = 240
FACU species	20	x 4 = 80
UPL species	0	x 5 = 0
Column Totals:	100 (A)	320 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: Formerly TT1 does not pass P.I.

SOIL

Sampling Point: U9TP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.) (U9TP1)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	5Y 5/1	95	7.5YR 4/6	5	C	M	SILT LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: DEPLETED MATRIX VALUE OF MUNSELL 5 & CHROMA OF 1 FROM SURFACE TO BOTTOM OF PIT = F3, but likely remnant from source material based on topo + contour/elevation + absence of strongly hydrophytic veg

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- NO FAC-Neutral Test (D5) 0/0
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: higher topo position

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale, Humboldt Sampling Date: 11/1/13

Applicant/Owner: TWC State: CA Sampling Point: U13TP1

Investigator(s): SK, LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: Vegetation not growing as hydrophytes & mapped as 2 parameter upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1. —			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Juncus breweri	40	✓	FACW
2. Distichlis spicata	20	✓	FACW
3. Holcus lanatus	10		FAC
4. Plantago lanceolata	10		FACU
5. Rumex crispus	10		FACW
6. Agrostis stolonifera	5		FAC
7. Cynosurus	5		—
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1. —			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	~~70~~	x 2 =	140
FAC species	~~10~~ 15	x 3 =	45
FACU species	10	x 4 =	40
UPL species	5	x 5 =	25
Column Totals:	100 (A)		250 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

SOIL

Sampling Point: U13TP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR2/2	100	—	0	—	—	loam	
4-11	10YR3/2	100	—	0	—	—	sandy loam	
11-18	2.5Y3/2	100	—	0	—	—	sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ELEP City/County: Ferndale, Humboldt Sampling Date: 11/1/13

Applicant/Owner: TWC State: CA Sampling Point: W14TP1

Investigator(s): SE, LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee Local relief (concave, convex, none): Convex Slope (%): 10%

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Festuca Perenne	15~~40~~	N	FAC
2. Trifolium repens	10	N	FAC
3. Agrostis Stolonifera	~~40~~5	N	FAC
4. Cirsium vulgare	20	Y	FACU
5. Holcus lanatus	30	Y	FAC
6. Plantago lanceolata	15~~20~~	~~Y~~N	FACU
7. Hypochaeris radiata	5	N	
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	60	x 3 = 180
FACU species	35	x 4 = 140
UPL species	5	x 5 = 25
Column Totals:	100 (A)	345 (B)

Prevalence Index = B/A = 3.45

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ND 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
FAC species not acting as hydrophyte DI > 3.0 @ 3.45 topographically higher

SOIL

Sampling Point: U14TP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5Y 3/2	99	10YR 3/4	1	C	M	Silty clay loam	
6-18	2.5Y 4/1	55	10YR 3/3	45	C	M	"	does not meet depth/thickness

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet F3 b/c redox would need thickness/depth of 6" w/in 10" of surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
topographic high point ~2-3' above surrounding pasture (on levee)

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale, HUM Sampling Date: 10-18-13

Applicant/Owner: TWC State: _____ Sampling Point: TT2

Investigator(s): AG/CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): Ø

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Cirsium vu.	10		FACU
2. Festuca pr	15	Y	FAC
3. Agrostis st.	30	Y	FAC
4. Potentilla an.	20	Y	OBL
5. Lotus co.	15	Y	FAC
6. Plantago la.	2.5		FACU
7. Hypochaeris ra.	2.5		FACU
8. Rumex cr.	2.5		FAC
9. Trifolium rc.	2.5		FAC
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		
% Bare Ground in Herb Stratum Ø			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	20	x 1 = 20
FACW species	0	x 2 = 0
FAC species	65	x 3 = 195
FACU species	15	x 4 = 60
UPL species	0	x 5 = 0
Column Totals:	100 (A)	275 (B)

Prevalence Index = B/A = 2.75

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No *

Remarks: * Argentina anserina (OBL) present in a small amts.

SOIL

Sampling Point: TT-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y 4/1	90	7.5YR 4/6	10	C	M	SILT LOAM	FIRM SILT

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

DEPLETED MATRIX → SOIL VALUE = MUNSELL 4 w/ A CHROMA OF 1 FROM SURFACE TO BOTTOM OF PIT = F3

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

STRONG REDOX CONCENTRATIONS, TOPOGRAPHIC POSITION AND LAND OWNER INFORMATION SUGGESTS AREA MEETS WETLAND HYDROLOGY IN THE WINTER.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / HUM Sampling Date: 10-18-13

Applicant/Owner: TWC State: CA Sampling Point: TT3

Investigator(s): AG / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave / linear Slope (%): 5

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1.			
2. Rumex cr.	10		FAC
3. Cirsium vu.	2.5		FACU
4. Lotus co.	10		FAC
5. Trifolium re.	15		FAC
6. Festuca pe.	10		FAC
7. Agrostis st.	30	Y	FAC
8. Argentina an.	2.5		OBL
9. ~~Ar[illegible]~~			
10. Distichlis sp.	20	Y	FACW
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2.5	x 1 =	2.5
FACW species	20	x 2 =	40
FAC species	75	x 3 =	225
FACU species	2.5	x 4 =	10
UPL species	0	x 5 =	0
Column Totals:	100 (A)		277.5 (B)

Prevalence Index = B/A = 2.775

Hydrophytic Vegetation Indicators:

- ✓ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: * = small amounts of Argentina anserina Pacific cinquefoil present on edge of levee.

SOIL

Sampling Point: TT-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y 4/1	92	7.5YR 4/6	8	C	M	SILT LOAM	prominent redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:
DEPLETED MATRIX → SOIL VALUE = MUNSELL 4 w/ A CHROMA OF 1 FROM SURFACE (BELOW ROOTS) TO DEPTH OF PIT = F3

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
* STRONG REDOX CONCENTRATIONS, TOPOGRAPHIC POSITION AND LAND OWNER INFORMATION SUGGESTS AREA MEETS WETLAND HYDROLOGY IN WINTER.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Connick Ranch City/County: Ferndale / HUM Sampling Date: 10-18-13

Applicant/Owner: TWC State: CA Sampling Point: TT-6

Investigator(s): AG / CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): berm next to slough Local relief (concave, convex, none): none Slope (%): Ø

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca pr	35	Y	FAC
2. Argentina an.	15		OBL
3. Trifolium cro.	2.5		FAC
4. Agrostis st.	20	Y	FAC
5. Lotus co.	15		FAC
6. Ranunculus rc.	5		FAC
7. Cirsium vu.	2.5		FACU
8. Holcus la.	5		FAC
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	Ø = Total Cover		
% Bare Ground in Herb Stratum Ø			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	15	x 1 = 15
FACW species	0	x 2 = 0
FAC species	82.5	x 3 = 247.5
FACU species	2.5	x 4 = 10
UPL species	0	x 5 = 0
Column Totals:	100 (A)	272.5 (B)

Prevalence Index = B/A = 2.725

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: TT-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	5Y 5/1	90	7.5YR 4/6	10	C	M	SILT LOAM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: DEPLETED MATRIX: MATRIX ~~VALUE~~ VALUE = MUNSELL 5; CHROMA = 1 FROM SURFACE TO DEPTH.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): 0-18"

Water Table Present? Yes ___ No X Depth (inches): 0-18"

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): 0-18"

Wetland Hydrology Present? Yes X* No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: * STRONG REDOX CONCENTRATIONS, TOPOGRAPHIC LOCATIONS AND LAND OWNER PROVIDED INFORMATION SUGGEST WETLAND HYDROLOGY IN THE WINTER.

www.ghd.com

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

Memorandum

October 10, 2014

To	The Wildlands Conservancy (TWC) and Cal Trout		
Copy to	Ken Mierzwa (GHD Senior Biologist)		
From	Cara Scott (GHD Botanist), Lia Webb (GHD Ecologist)	Tel	707.443.8326
Subject	Special-Status Species Evaluation and Special-Status Plant and Animal Surveys for Eel River Estuary Preserve (EREP), Ferndale, California	Job no.	84/10882/01

1 Introduction

On April 2 and June 9, 2014 special-status plant surveys and mapping were conducted at the Eel River Estuary Preserve (EREP) in Humboldt County, California for the proposed project. Additionally, during multiple site visits conducted in 2013-2014, the site was evaluated for potential habitat for special-status animal species. The plant surveys were intended to document the presence, location, and extent of special status plant species. The animal species evaluations were not protocol level and were intended to identify potential species and habitat that could be present at the project site during project implementation. The results of these field efforts will provide a basis to avoid, minimize, and/or mitigate potential impacts associated with project activities and guide future management goals and decisions. In some cases, additional pre-construction surveys may be recommended prior to ground disturbance.

1.1 Location

The EREP is located west of Ferndale, California, and north of Centerville Beach (Figure 1). The site is accessed via Centerville Road. The Pacific Ocean is located directly west of the site. The confluence of Salt River and Eel River is located approximately two miles northwest of The Wildlands Conservancy (TWS) onsite headquarters. Prominent water features include Russ Creek, remnant Centerville Slough, Cutoff Slough, and the Western Drainage as well as smaller (seasonal) slough channels and drainage ditches. The northern portion of the site borders the mouth of the Eel River while the southern area is bordered by dairy pastures. The site corresponds to portions of Sections 20, 29, 30, 31 and 32, Township 2-3 North, Range 2 West on the USGS 7.5 Minute Ferndale quadrangle. The coordinates for the Centerville Road access route are 40.582063N and -124.312370W.

1.2 Environmental Setting

TWC owns the approximately 1,100-acre EREP property, which includes a patchwork of current and historic agricultural lands, tidal salt marsh, brackish marsh, riparian scrub, sloughs/open water channels, freshwater ponds and ditches, and nearshore dune ridges and swales. The climate is Mediterranean with precipitation

GHD Inc.
718 Third Street Eureka CA 95501 USA
T 1 707 443 8326 **F** 1 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

most abundant in the winter months, and the average annual rainfall is approximately 48.5 inches supporting various vegetation types including pickleweed mats (*Salicornia pacifica* Herbaceous Alliance), perennial rye grasslands (*Festuca perennis* Semi-Naturalized Herbaceous Alliance) and bent grass meadows (*Agrostis stolonifera* Semi-Natural Herbaceous Stands). Approximately two thirds of the year the site is influenced by coastal fog. EREP occurs within the Northwestern California Region (NW) and North Coast Subregion (NCo) (Baldwin et al. 2012).

The site consists of level to undulating areas influenced by surface and subsurface hydrology, salinity and past and current land use and modifications (Eicher 2013). Elevations on site range from < 2.5 feet in the sloughs of the inner marsh to above 10 feet in the back dunes near the North and South Barns. Historical land uses for the site include grazing for dairy through the use of diked levees on historic tidal lands. These wetland pastures are still actively used for grazing.

1.3 Regulatory Setting

Special-status plant species include those listed as endangered, threatened, or as candidate species by the U.S. Fish and Wildlife Service (USFWS) under the U.S. Endangered Species Act (ESA) or by the California Department of Fish and Wildlife (CDFW) under the California Endangered Species Act (CESA). Plant species on the California Native Plant Society's (CNPS) California Rare Plant Ranking (CRPR) lists 1A, 1B and 2 are considered eligible for state listing as Endangered or Threatened pursuant to the California Fish and Game Code, and CDFW has oversight of these special-status plant species as a trustee agency of CEQA. As part of the CEQA process, such species should be considered as they meet the definition of Threatened or Endangered under Sections 2062 and 2067 of the California Fish and Game Code (Andre et. al. 2010). CNPS List 3 and 4 plants do not have formal protection under CEQA. CDFW publishes and periodically updates lists of special plants which include, for the most part, the species listed as sensitive by CNPS.

Special-status animal species include those listed as of endangered (E), threatened (T), proposed (P), and candidate (C) species by U.S. Fish and Wildlife Service (USFWS) under the U.S. Endangered Species Act (ESA) or by the California Department of Fish and Wildlife (CDFW) under the California Endangered Species Act (CESA), as well the most recent CDFW special animals list (CDFG 2011).

2 Methods

2.1 Pre-Survey Review

Prior to initiating field work, database searches were conducted of the *California Natural Diversity Database* (CNDDB) [CDFW 2014], the CNPS *Inventory of Rare and Endangered Vascular Plants* (CNPS 2014), and U.S. Fish and Wildlife Service (USFWS) listed/proposed threatened and endangered species list in order to compile a list of potential special-status species that are known to occur in the project vicinity and/or have the potential to occur at the site. The USFWS lists include special-status aquatic species under the jurisdiction of NOAA National Marine Fisheries Service (NMFS). Relevant literature was also reviewed,

including recovery plans, status reports, published articles, species lists maintained by TWC staff, and previous regulatory review documents, when available. Topographic maps and aerial photography were also consulted prior to and during the survey to determine potential habitats for target sensitive species occurrence.

Prior to conducting botanical field surveys, a scoping list of CRPR plant species and habitats with recorded occurrences in the project vicinity was compiled by consulting the database results and existing project information. The CNDDB and Consortium of California Herbaria databases were consulted for site specific species cross reference of rare plant occurrences documented in the project vicinity. The scoping list includes special status plants that occur in habitat similar to the project area with documented occurrences on the site USGS quadrangle or adjacent quadrangles. The CDFW and the CNPS recommend project assessments include species with potential to occur on a minimum of nine USGS quadrangles with the project site located in the central quad(s). The scoping list should also contains other taxa that may occur in the project area whose habitat is suitable if the project is within or near the known range of the species. The scoping list included species with potential to occur on the USGS 7.5 Minute quadrangles in which the project is located (Ferndale), as well as adjacent six quads which did not include areas over the ocean to the west of the site (Capetown, Cape Mendocino, Fields Landing, Fortuna, Taylor Peak, and Cannibal Island). The CNPS Inventory was also queried for CRPR List 3 and 4 species known to occur within the county for informational purposes prior to conducting plant surveys, although those species are not presented herein. The queries yielded 31 special-status plant species previously documented in the assessment area. Of these taxa, 13 have a high to moderate probability of occurring within the study area (Appendix A).

2.2 Survey Methods

Surveys to determine the presence of special-status plant species (listed as rare, threatened, endangered, or candidate for rare, threatened, or endangered species listing under the State or Federal Endangered Species Acts, CNPS, or species of local importance) were conducted at the appropriate blooming or active period for each species. Field visits were by Cara Scott (GHD Botanist). U.S. Fish & Wildlife Service (USFWS) and/or other resources agencies and local experts were contacted to verify that botanical surveys were being conducted at an appropriate time of year to allow for climatic micro-variations and bloom period for specific species on a year-to-year basis. Additionally, reference site(s) were viewed if possible, where target plant species are known to occur in the project area to verify the species was visible and blooming at the time of surveys. It was determined that a minimum of two seasonally-appropriate focused botanical surveys should be conducted, one in the spring (April or May) as well as one visit in summer (June to mid-July).

The surveys were floristic in nature following *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* by the California Natural Resource Agency (CDFG 2009) and *General Rare Plant Survey Guidelines by the Endangered Species Recovery Program* (USFWS 2002). An intuitively controlled survey was conducted that sampled and identified potential habitat(s). Plants were identified to the lowest taxonomic level (genus or species) necessary for rare plant

identification. Nomenclature follows *The Jepson Manual* (Baldwin et al 2012). Species surveys were conducted by walking the site for target species and recording extent, approximate number, and percent cover of special status plant species observed. A total of 30.5 field person hours were spent surveying the study area. Annie Eicher, H.T.Harvey plant ecologist, and Cara Scott, GHD botanist, conducted the protocol level botanical surveys. Effort was focused within and near the inner marsh and in areas to the south where project-related impacts are possible under alternatives being considered; minimal time was spent north of the inner marsh because no project activities are anticipated there.

Sensitive plant species locations were recorded with a Trimble GPS with sub meter accuracy where not under tree canopy (Figure 2). Under canopies and with limited satellite signal, locations were recorded on a field map or if possible with a Tablet PC GPS (not sub meter accuracy). The location of individual plants was not recorded, rather a polygon was drawn to encompass the area of species presence and an estimate of individuals (to the nearest 100) present and approximate percent cover (using standard cover classes of 1-5%, 5-25%, 25-50%, 50-75%, and greater than 75%) at the time of survey was recorded.

Protocol level surveys were not conducted for special-status animal species. Site visits for review of potential habitat for special-status animal species were conducted based on results of database searches, in order to determine onsite areas of potential habitat for listed species, and to determine likelihood for species to occur at the site. The site was visited by Ken Mierzwa (GHD Senior Biologist) in January 2013 and January 2014 specifically to evaluate habitat, and on numerous other occasions as part of visits primarily conducted for other reasons. The site was traversed to assess the potential of suitable habitat for special status species. A particular focus was on identifying potential northern red legged frog (NRLF) breeding habitat. Additional NRLF information was provided by M. van Hattem (CDFW) based on 2011 site visits.

3 Results

On April 3 and June 9, 2014, the project study boundary was surveyed in an effort to identify if listed or special status plant species are present. The project area was evaluated by walking the EREP study area to evaluate for the presence of Federal, State and CNPS listed special status plants. During this evaluation, five special status plant species were observed and mapped during the protocol level survey, one of which is a federally and state listed species (Table 1, Figures 3.1 through 3.4).

Table 1 Special-status plant survey results

Scientific Name	Common Name	Listing Status	Approximate Number of Individuals	Approximate Absolute Coverage Range (%)
Angelica lucida	sea-watch	List 4.2	4	5-10%
Carex lyngbyei	Lyngbye's sedge	**List 2B.2**	> 5,000	50-75%

Castilleja ambigua ssp. *humboldtiensis*	Humboldt Bay's owl-clover	**List 1B.2**	3,000	15-20%
Gillia millefoliata	dark eyed gilia	**List 1B.2**	50	5-10%
Layia carnosa	beach layia	**FE/SE/ List 1B.1**	480	5-10%

Note: Plant species in bold have California Native Plant Society (CNPS) California Rare Plant Ranking (CRPR) lists 1A, 1B and 2 and are considered eligible for state listing as Endangered or Threatened pursuant to the California Fish and Game Code.

From the botanical survey efforts, 126 vascular taxa were identified within the study area: one fern, zero fern allies, zero gymnosperms, zero magnoliids, 86 eudicots, and 39 monocots. A little under half of the taxa (47%) are introduced species which is double that of the state average (Baldwin et al. 2012). These 60 non-native taxa range from rare to extremely abundant and widespread such as bent grass (*Agrostis stolonifera*) and velvet grass (*Holcus lanatus*). This has resulted in the establishment of several vegetation alliances that are semi-natural stands with introduced species as the dominants.

During the botanical survey, areas within the main slough channel were noted to have scattered bunches of eelgrass (*Zostera marina*) in patches of 0-5%, and 5-15% coverage, located behind the existing onsite tidegate, and as shown on Figure 5. These are as were generally mapped to show the range of coverages and extent, and trend where eel grass abundance decreases the further south from tidegate. This area was not extensively surveyed since at this point in time, project activities are uncertain within the slough. Follow up species-specific surveys would be conducted if deemed appropriate in preparation for proposed project.

Based on a CNDDB database review and local and extensive onsite field experience (from wetland delineation, habitat mapping, botanical surveys, wildlife species observations, and other site visits), GHD evaluated the potential presence of habitat for special-status animal species on the site. In January 2014, potential breeding habitat for northern red-legged frog (*Rana aurora*) was noted and is mapped and presented on Figures 4.1 and 4.2, combined with previous mapping results from portions of the site provided from CDFW. Some species present in the greater area were eliminated from further consideration because of an absence of suitable habitat, such as species associated with dense riparian and forested environments. Species with moderate to high potential to occur at the site either due to potential habitat presence or mobility of species where it is noted a species could fly over, traverse, or be present adjacent to the site, are described briefly below.

Raptors: Several species of raptors (osprey, red-shouldered hawk, red-tailed hawk, northern harrier, etc.) have potential to fly over the site, although specific observations have not been documented. Raptor nests were not noted on the project site, and large trees to support nests are absent from the site. Standard buffers can be established to avoid impacts if any nests are noted.

Other Avian Species: A detailed avian species list for the preserve was provided by TWC, based on several years of information provided by staff, researchers, and visitors. GHD also noted avian observations during site visits although no attempt was made to conduct detailed or standardized surveys at this time; rather the reliance was on the fairly extensive existing database. A list of avian species is included in Appendix D. Although several sensitive avian species are known to occur at least seasonally on the preserve, it should be possible to avoid impacts to these species through implementation of standard seasonal avoidance measures, construction surveys, and establishment of nest buffer areas where appropriate, similar to the measures recently implemented on the adjacent Salt River project.

Amphibians: GHD biologists noted the presence of northern red-legged frogs and breeding habitat (documented by presence of egg masses) on the site. It appears that most NRLF breeding area is associated with the artificially managed duck ponds (abundant) and a freshwater ditch in the southeast part of the site (abundant), with limited presence in the western drainage (one observation). Over 100 egg masses were observed in each of the former two locations during winter 2013 site visits. Documented breeding locations are shown in Figures 4.1 and 4.2, which includes data from CDFW (2011) and GHD (unpublished field notes, 2013).

Salmonids: Salmonids including coho, chinook, and steelhead are known or are assumed to occur in the tidal portions of the estuary and have potential to occur elsewhere on the site within limits imposed by the existing tide gate. One of the primary goals of the proposed project is to expand and enhance habitat for salmonids. Various methods including seasonal avoidance, block nets, and relocation are available to avoid and minimize impacts to salmonids. A biological assessment to be prepared for the project and will address salmonids, potential short-term impacts, and potential long-term benefits for salmonids.

Other Fish Species: The tidewater goby is known to occur within the preserve and will be addressed in detail in separate a separate memo and in the biological assessment. Gobies were captured during 2012 sampling within and adjacent to the inner marsh. As with salmonids, there may be short-term project impacts as well as longer-term benefits, the latter associated with restoration of Centerville Slough. Both potential impacts and potential benenfits will be in different locations than for salmonids, because of tidewater goby preference for brackish water. Other sensitive fish species including the state listed longfin smelt occur in the general project vicinity although presence within the preserve is not documented at this time.

Eel Grass: Additional pre-construction surveys are recommended if project activities are anticipated to change conditions within the slough areas mapped with scattered occurrences of eel grass; the most extensive eelgrass beds are north of the tidegate and are not expected to be affected by project activities. Eelgrass communities can be dynamic, and the draft California eelgrass guidance document (NMFS 2011) places limits on the length of time for which a survey is valid. Normally a survey is required in the same growing season that construction is scheduled to begin.

4 Conclusion

The purpose of botanical surveys was to identify and map federal, state and CNPS listed CRPR plants within the project boundary. This survey identified five special status plants present in the study area of which one plant is a federally and state listed plant species. The animal species evaluation identified presence or a high potential of presence for several sensitive avian species including several raptor species; documented breeding presence of one special-status amphibian, the northern red-legged frog; and known or potential presence of several listed or sensitive fish species including salmonids, tidewater goby, and longfin smelt. In most cases potential impacts can be avoided or minimized. Possible impacts to aquatic species including fish and frogs will require additional analysis in the context of project design.

5 References

Baldwin, B. D. 2012. *The Jepson Manual*, *Second Edition*. University of California Press. Berkeley, CA.

CNPS, 2013. Inventory of Rare and Endangered Plants (online edition, v8-01a). California Native Plant Society (CNPS). Sacramento, CA. Accessed: June, 2013:

California Department of Fish and Wildlife. 2011. GIS map of northern red-legged frog egg mass survey results, January 2011.

California Department of Fish and Wildlife. 2013. California Natural Diversity Database (CNDDB). Crescent City USGS 7.5 Minute Quadrangles. California Department of Fish and Game (CDFG). Sacramento, California. Accessed May, 2013: http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp

CDFG, 2009. *Guidelines for Assessing the Effects of Proposed Development on Rare, Threatened, and Endangered Plants and Plant Communities.* Sacramento, CA.

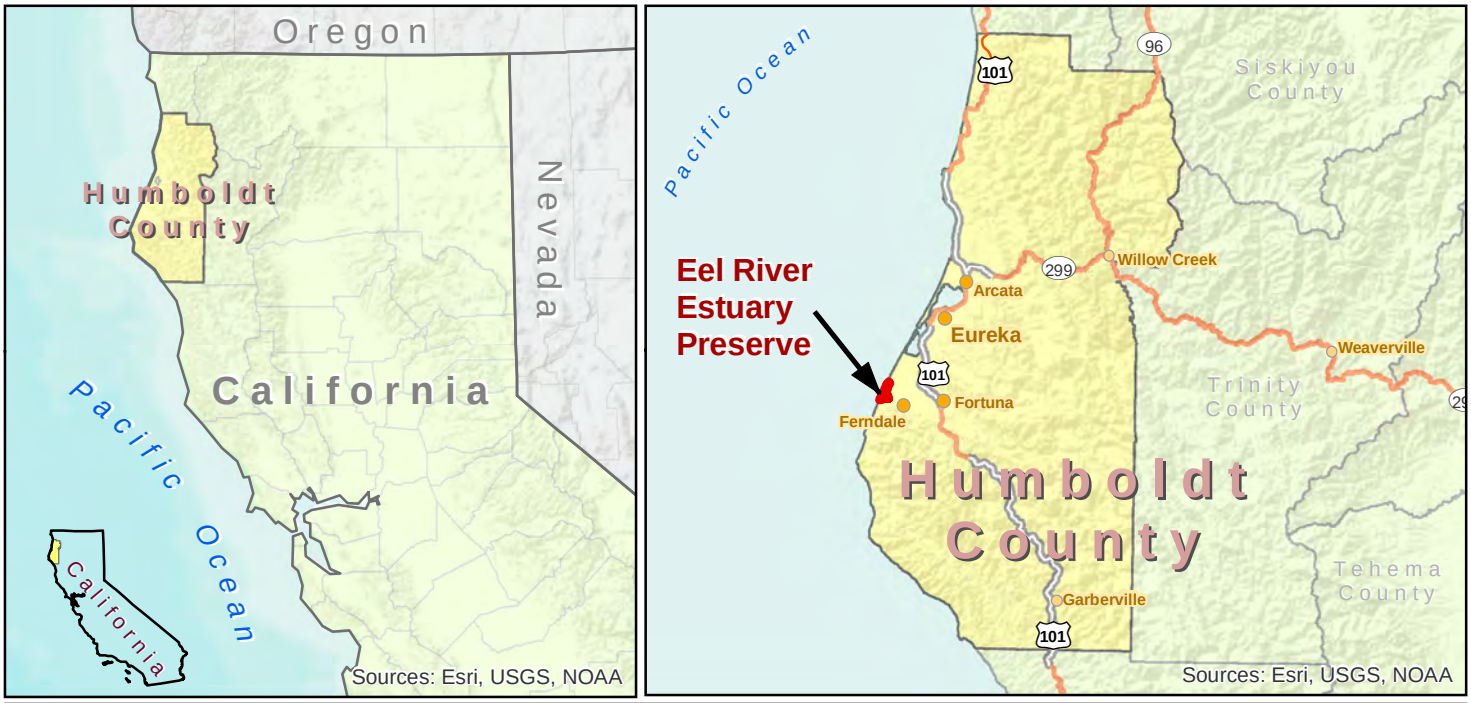
DFW, 2009. *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. California Department of Fish and Game, Sacramento, CA.

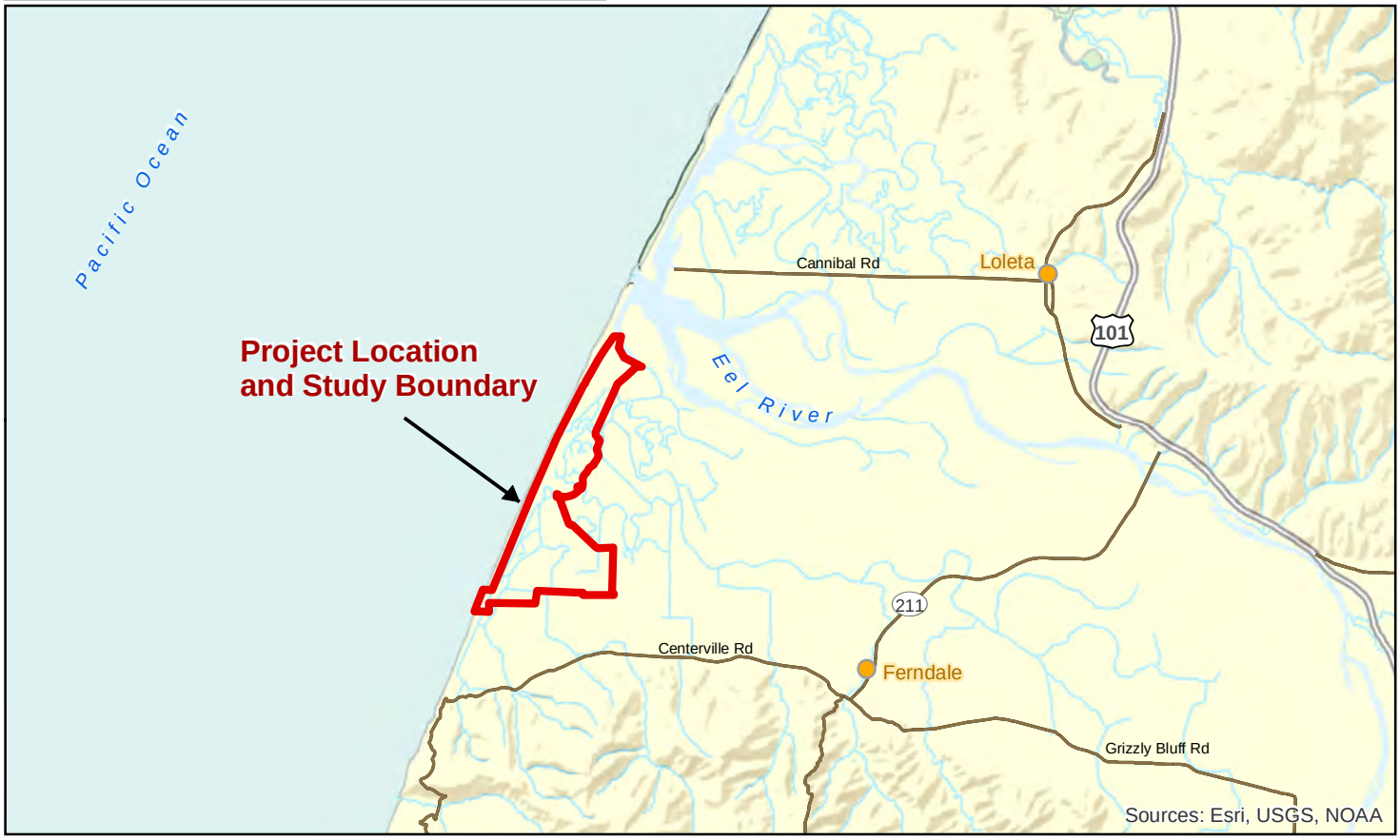
National Marine Fisheries Service. 2011. Draft eelgrass guidance.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evans. 2009. *A Manual of California Vegetation, 2nd Edition*. California Native Plant Society. Sacramento, CA.

USFWS, 2013. Listed/Proposed Threatened and Endangered Species for the Ferndale Quad. FWS Arcata Field Station, U. S. Fish and Wildlife Service (USFWS).Accessed May 2013: http://www.fws.gov/arcata/specieslist/search.asp.

Appendix A. Figures





- Eel River Estuary Preserve
- Humboldt County
- Counties
- Freeway
- Highway
- Roadway
- Streams

Paper Size ANSI A

0 0.5 1 2 3

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number	8410882.01
Revision	1
Date	02 Sep 2014

Vicinity and Location

Figure 1

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

N:\US\Eureka\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F1_Vicinity.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, and County of Del Norte make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:jrousseau

Roadway

Study Boundary

Paper Size ANSI B

0 1,000 2,000 3,000 4,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve Figure Set Key

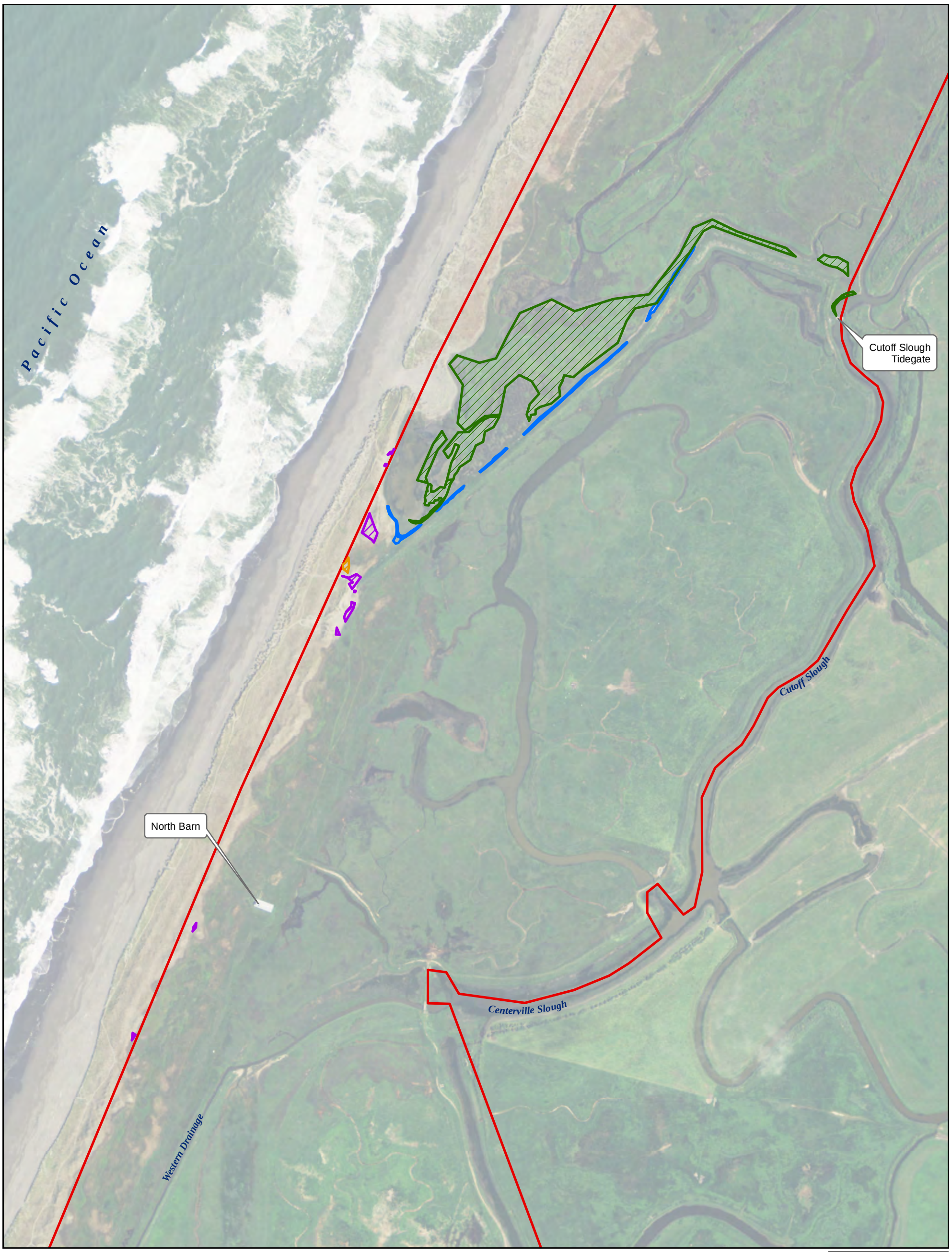
Figure 2

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F2_VegMBKey_1117.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau



Humboldt Bay's owl-clover (CRPR List 1B.2)
beach layia (FE, SE, CRPR List 1B.1)
dark eyed gilia (CRPR List 1B.2)
Lyngbye's sedge (CRPR List 2B.2)
Study Boundary

Paper Size 11" x 17" (ANSI B)
0 200 400 600 800
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve Special Status Plant Survey Results

Figure 3.1

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F3.1_BotanicalOverview.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau

Humboldt Bay's owl-clover (CRPR List 1B.2)
beach layia (FE, SE, CRPR List 1B.1)
dark eyed gilia (CRPR List 1B.2)
Lyngbye's sedge (CRPR List 2B.2)
Study Boundary

Paper Size ANSI B
0 10 20 40 60 80 100
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet
N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve Special Status Plant Survey Results

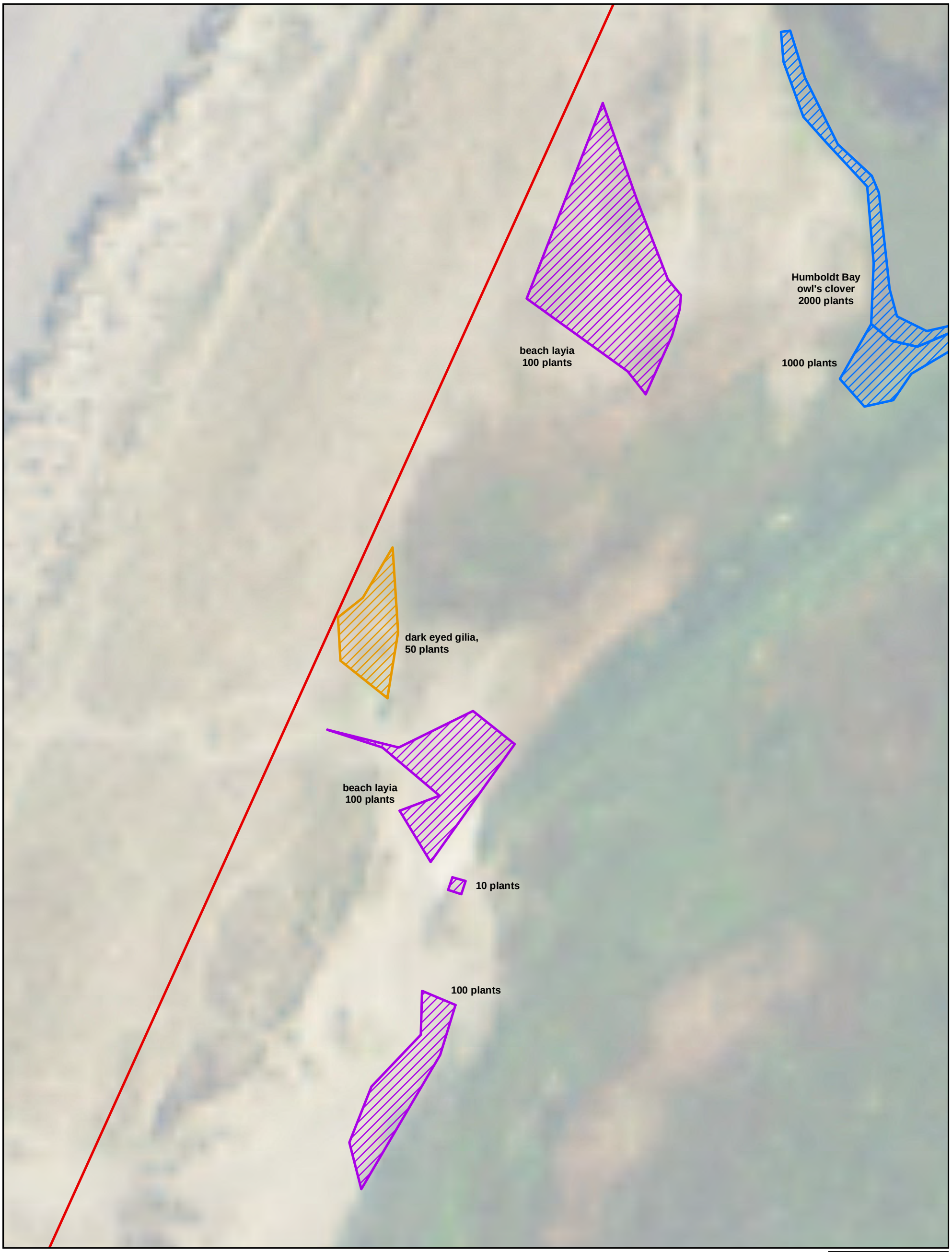
Figure 3.2

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F3.2-4_BotanicalFocuses.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau



Humboldt Bay's owl-clover (CRPR List 1B.2)
beach layia (FE, SE, CRPR List 1B.1)
dark eyed gilia (CRPR List 1B.2)
Lyngbye's sedge (CRPR List 2B.2)
Study Boundary

Paper Size ANSI B
0 10 20 40 60 80 100
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet
N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve
Special Status Plant Survey Results

Figure 3.3

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F3.2-4_BotanicalFocuses.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.
Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau

Humboldt Bay's owl-clover (CRPR List 1B.2)
beach layia (FE, SE, CRPR List 1B.1)
dark eyed gilia (CRPR List 1B.2)
Lyngbye's sedge (CRPR List 2B.2)
Study Boundary

Paper Size ANSI B
0 10 20 40 60 80 100
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve
Special Status Plant Survey Results

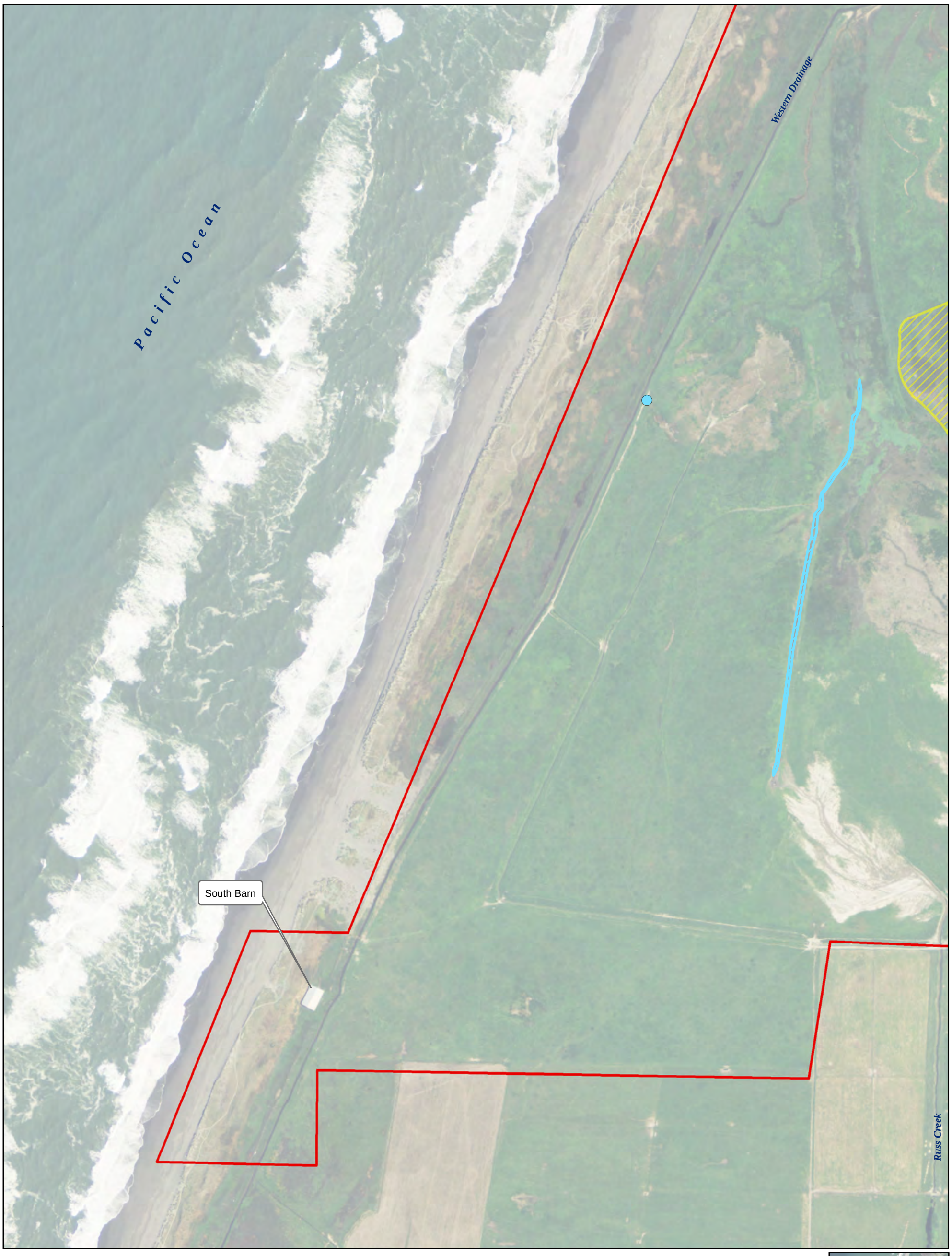
Figure 3.4

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F3.2-4_BotanicalFocuses.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau

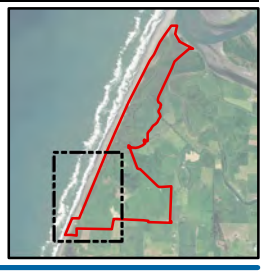


Breeding Habitat (CFWD, 2012)

Breeding Habitat (CFWD, 2012)

Breeding Habitat (TWC/GHD, January 2013)

Study Boundary



Paper Size 11" x 17" (ANSI B)

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve
Red-Legged Frog Breeding Habitat

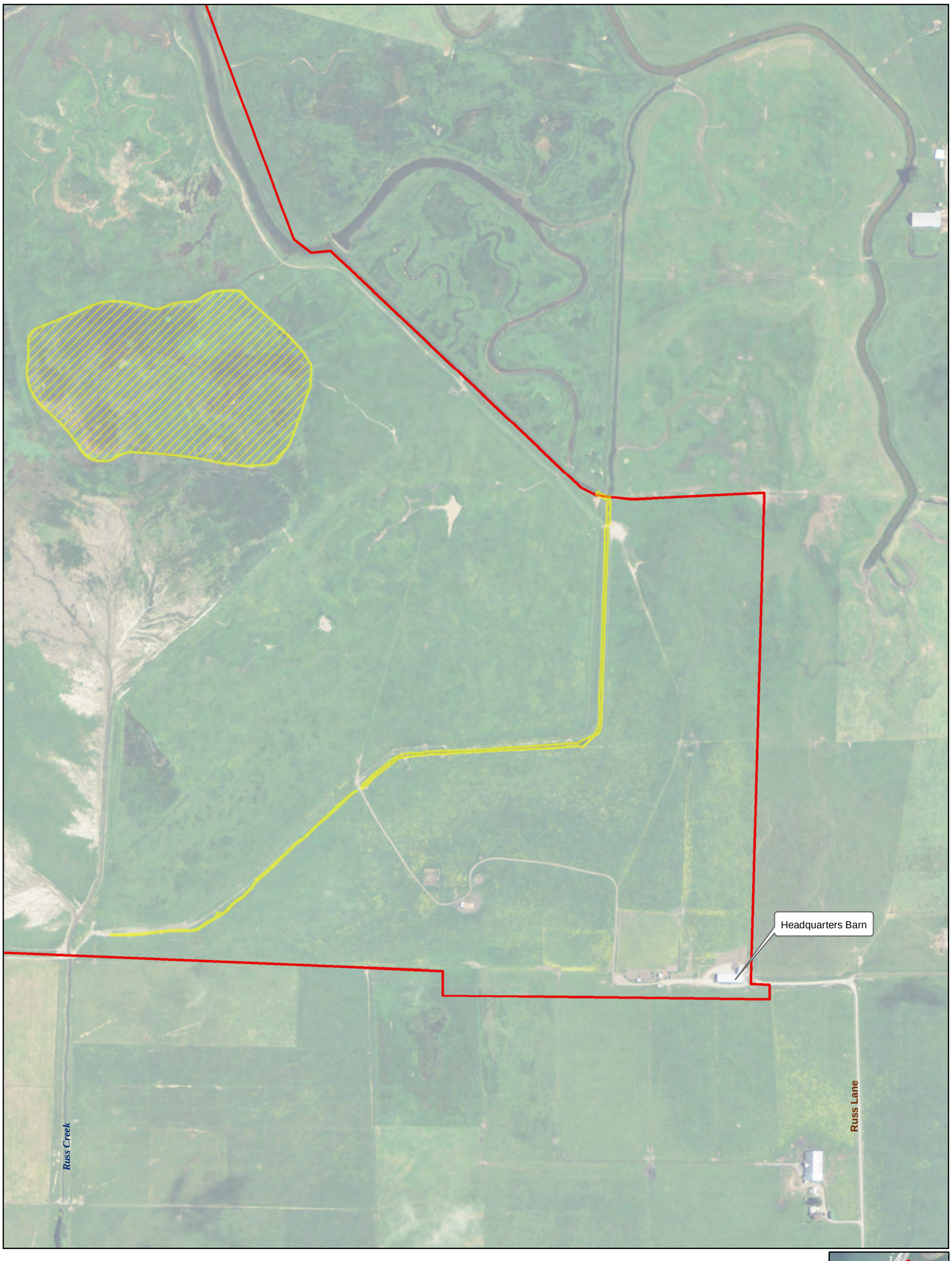
Figure 4.1

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F4.1_RedLeggedFrogs.mxd

718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau



Breeding Habitat (CFWD, 2012)

Breeding Habitat (CFWD, 2012)

Breeding Habitat (TWC/GHD, January 2013)

Study Boundary

Paper Size 11" x 17" (ANSI B)

0 200 400 600 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number 8410882.01
Revision A
Date 17 Sep 2014

Eel River Estuary Preserve
Red-Legged Frog Breeding Habitat

Figure 4.2

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F4.1_RedLeggedFrogs.mxd

718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Habitat Mapping, GHD, 2013, J.B. Lovelace & Associates, 2011, and Humboldt Bay Harbor District Preliminary Spartina Mapping, 2013; Parcel Lines, Humboldt County, v41, 2010; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau

Eel Grass Percent Cover

Dark = 15%, Light = 0 - 5% cover

Study Boundary

Paper Size ANSI A

0 150 300 450 600

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

CalTrout
EREP Ecosystem Enhancement Project

Job Number	8410882.01
Revision	A
Date	16 Sep 2014

Eel River Estuary Preserve
Approximate Extent of Eel Grass

Figure 5

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Biology Report\F5_Eelgrass.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason. Data source: Habitat Mapping, GHD, 2013; Aerial Imagery, 4 band 0.5ft resolution, NOAA, 2010. Created by:jrousseau

Appendix B. Special-Status Species Lists

Scientific Name	Common Name	Listing Status	Habitat Description	Bloom Period	Potential to Occur in Study Area
PLANTS					
Abronia umbellata var. *breviflora*	pink sand-verbena	List 1B.1	Coastal dunes	Jun-Oct	High
Anomobryum julaceum	slender silver moss	List 2B.2	Broadleafed upland forest, Lower montane coniferous forest, North Coast coniferous forest/damp rock and soil on outcrops, usually on roadcuts	NA	Low
Astragalus pycnostachyus var. *pycnostachyus*	coastal marsh milk-vetch	List 1B.2	Coastal dunes(mesic), Coastal scrub, Marshes and swamps(coastal salt, streamsides)	Apr-Oct	High
Carex leptalea	bristle-stalked sedge	List 2B.2	Bogs and fens, Meadows and seeps(mesic), Marshes and swamps	Mar-Jul	Moderate
Carex lyngbyei	**Lyngbye's sedge**	**List 2B.2**	**Marshes and swamps (brackish or freshwater)**	**Apr-Aug**	**Present**
Castilleja ambigua* var. *humboldtiensis	**Humboldt Bay owl's-clover**	**List 1B.2**	**Marshes and swamps (coastal salt)**	**Apr-Aug**	**Present**
Castilleja litoralis	Oregon coast paintbrush	List 2B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub/sandy	Jun	High
Chloropyron maritimum ssp. *palustre*	Point Reyes bird's-beak	List 1B.2	Marshes and swamps(coastal salt)	Jun-Oct	High
Clarkia amoena ssp. *whitneyi*	Whitney's farewell-to-spring	List 1B.1	Coastal bluff scrub, Coastal scrub	Jun-Aug	Low
Erysimum menziesii	Menzies' wallflower	FE/SE/ List 1B.1	Coastal dunes	Mar-Sep	High
Erythronium oregonum	giant fawn lily	List 2B.2	Cismontane woodland, Meadows and seeps/sometimes serpentinite, rocky, openings	Mar-Jun(Jul)	Low
Erythronium revolutum	coast fawn lily	List 2B.2	Bogs and fens, Broadleafed upland forest, North Coast coniferous forest/Mesic, streambanks	Mar-Jul(Aug)	Low

Scientific Name	Common Name	Listing Status	Habitat Description	Bloom Period	Potential to Occur in Study Area
Gilia capitata ssp. *pacifica*	Pacific gilia	List 1B.2	Coastal bluff scrub, Chaparral (openings), Coastal prairie, Valley and foothill grassland	Apr-Aug	Low
Gilia millefoliata	**dark-eyed gilia**	**List 1B.2**	**Coastal strand, dunes**	**June-Aug**	**Present**
Hesperevax sparsiflora var. *brevifolia*	short-leaved evax	List 1B.2	Coastal bluff scrub (sandy), Coastal dunes, Coastal prairie	Mar-Jun	Low
Hesperolinon adenophyllum	glandular western flax	List 1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland/usually serpentinite	May-Aug	Low
Lathyrus palustris	marsh pea	2B.2	Bog & fen, Coastal prairie, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, North coast coniferous forest, Wetland	Mar-Aug	Moderate
Layia carnosa	**beach layia**	**FE/SE/ List 1B.1**	**Coastal dunes, Coastal scrub(sandy)**	**Mar-Jul**	**Present**
Lilium occidentale	western lily	FE/SE/ List 1B.1	Bogs and fens, Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps(freshwater), North Coast coniferous forest(openings)	Jun-Jul	Moderate
Montia howellii	Howell's montia	List 2B.2	Meadows and seeps, North Coast coniferous forest, Vernal pools/vernally mesic, sometimes roadsides	Mar-May	Low
Oenothera wolfii	Wolf's evening-primrose	List 1B.1	Coastal bluff scrub, Coastal dunes, Coastal prairie, Lower montane coniferous forest/sandy, usually mesic	May-Oct	Low
Packera bolanderi var. *bolanderi*	seacoast ragwort	List 2B.2	Coastal scrub, North Coast coniferous forest/Sometimes roadsides	May-Jul(Aug)	Low
Polemonium carneum	Oregon polemonium	List 2B.2	Coastal prairie, Coastal scrub, Lower montane coniferous forest	Apr-Sep	Low
Puccinellia pumila	dwarf alkali grass	List 2B.2	Marshes and swamps(coastal salt)	Jul	High

Scientific Name	Common Name	Listing Status	Habitat Description	Bloom Period	Potential to Occur in Study Area
Romanzoffia tracyi	Tracy's romanzoffia	List 2B.3	Coastal bluff scrub, Coastal scrub/rocky	Mar-May	Low
Sidalcea malviflora ssp. *patula*	Siskiyou checkerbloom	List 1B.2	Coastal bluff scrub, Coastal prairie, North Coast coniferous forest/often roadcuts	May-Aug	Low
Sidalcea oregana ssp. *eximia*	coast checkerbloom	List 1B.2	Lower montane coniferous forest, Meadows and seeps, North Coast coniferous forest	Jun-Aug	Low
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	List 1B.1	Cismontane woodland(openings), Valley and foothill grassland	Jun	Low
Spergularia canadensis var. *occidentalis*	western sand-spurrey	List 2B.1	Marshes and swamps(coastal salt)	Jun-Aug	High
PLANT COMMUNITY					
Coastal Terrace Prairie	G2S2	Coastal prairie	Survey conducted	Absent	
Northern Coastal Salt Marsh	**G3S3**	**Estuarine emergent wetlands**	**Survey conducted**	**Present**	
Sitka Spruce Forest	G1S1	Forested	Survey conducted	Absent	

Table B2. Special-status animal species with potential to occur in the study area

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
			AMPHIBIANS		
Ascaphus truei	Pacific tailed frog	SSC - G4S2S3	Aquatic | Klamath/North coast flowing waters | Lower montane coniferous forest | North coast coniferous forest | Redwood | Riparian forest	Salmon Creek 3 mi N of Fortuna, 4 mi E of Loleta	Absent
Rana aurora	**northern red-legged frog**	**SSC – G4S2**	**Klamath/North coast flowing waters, Riparian forest, Riparian woodland**	**Egg masses in freshwater ponds, slough**	**Present**
Rana boylii	foothill yellow-legged frog	SSC – G3S2S3	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow & seep, Riparian forest & woodland	Shallow streams & riffles with a rocky substrate not present on site	Low
			BIRDS		
Accipiter cooperii	Cooper's hawk	None – G5S3	Cismontane woodland, Riparian forest & woodland, Upper montane, coniferous forest	Could fly over the site	Moderate
Accipiter striatus	Sharp-shinned hawk	None – G5S3	Cismontane woodland, Lower montane coniferous forest, Riparian forest & woodland.	Could fly over the site	Moderate
Agelaius tricolor	Tricolored blackbird	SSC	Colonial species in central valley & vicinity. Requires open water, protected nesting substrate, & foraging area with insect prey within a few km of the colony.	Low quality for species habitat requirements	Low
Ammodramus savannarum	Grasshopper sparrow	SSC	Open grasslands and prairies with patches of bare ground.	Nesting and foraging habitat on site	Low
Aquila chrysaetos	Golden eagle	SFP – G5S3	Rolling foothills, mountain areas, sage-juniper flats, & desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees	Habitat requirements not present	Moderate

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
			in open areas.		
Ardea alba	Great egret	None - G5S4	Rookery sites located near marshes, tide-flats, irrigated pastures, and margins of rivers and lakes.	Potential habitat nearby, likely to use the site for feeding	High
Ardea herodias	Great blue heron	None – G5S3	Colonial nester in tall trees, cliffsides, and sequestered spots on marshes. Rookery sites in close proximity to foraging areas: marshes, lake margins, tide-flats, rivers and streams, wet meadows.	Potential habitat nearby, likely to use the site for feeding	High
Asio flammeus	Short-eared owl	SSC	Open grasslands, shrub-stepped, agricultural fields	Nesting and foraging habitat on site	Moderate
Brachyramphus marmoratus	Marbled murrelet	FT	Rocky seastacks, nests in old growth redwoods	May briefly fly over site	Low
Chaetura vauxi	Vaux's swift	SSC	Nests in coniferous or mixed forest. Forages in forest openings, especially above streams.	Species could forage over site	Moderate
Charadrius alexandrinus nivosus	Western snowy plover	FT, SSC	Great Basin standing waters, Sand shore, Wetland	Dune habitat adjacent to site	Present
Circus cyaneus	Northern harrier	SSC	Wide-open habitats ranging from fields and marshes	Nesting and foraging habitat on site	Present
Coccyzus americanus	Western yellow-billed cuckoo	FPT, SE	Dense riparian, known from Cock Robin island on the Eel. Nearby Critical habitat designated.	Sparse riparian present but limited	Low
Egretta thula	Snowy egret	None - G5S4	Colonial nester, with nest sites situated in protected beds of dense tules. Rookery sites situated close to foraging areas: marshes, tidal-flats, streams, wet meadows, and borders of	Rookery sites not present, likely to use the site for feeding	High

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
			lakes.		
Elanus leucurus	white-tailed kite	SFP	Open country and farmland with scattered trees and grassland. Nests in tall trees; nesting known from adjacent lower Salt River	Forage habitat present, lacks trees	High
Empidonax traillii	Willow flycatcher	SE	Neotropical migrant, riparian; non-nesting presence within several miles	Low quality habitat	Low
Falco peregrinus anatum	American peregrine falcon	SFP	Forages in open areas. Nests on cliffs almost always near water, towers, bridges, and buildings.	Could fly over the site, forage	Moderate
Fratercula cirrhata	Tufted puffin	SSC	Open-ocean bird; nests along the coast on islands, islets, or (rarely) mainland cliffs. Requires sod or earth into which the birds can burrow, on island cliffs or grassy island slopes.	Low quality habitat	Low
Haliaeetus leucocephalus	Bald eagle	SE	Lower montane coniferous forest, Old growth	Conifer or old growth habitat absent on or near site, may fly over site	Moderate
Nycticorax nycticorax	Black-crowned night heron	None-G5S3	Colonial nester, usually in trees, occasionally in tule. Rookery sites located adjacent to foraging areas: lake margins, mud-bordered bays, marshy spots.	Rookery sites known within four miles.	High
Pandion haliaetus	Osprey	None-G5S3	Ocean shore, bays, fresh-water lakes, and larger streams. Large nests built in tree-tops within 15 miles of a good fish-producing body of water.	May fly over site, nest sites absent.	Moderate
Passerculus sandwichensis	Bryant's savannah sparrow	SSC	Grasslands with few trees, including meadows, pastures, grassy roadsides, sedge wetlands, and cultivated fields	Nesting and foraging habitat on site	High

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
Pelecanus occidentalis (=P. o. *occidentalis*)	Brown pelican (=California brown pelican)	SFP	Ocean and shore	Adjacent forage habitat	Moderate
Phalacrocorax auritus	Double-crested cormorant	None – G5S3	Colonial nester on coastal cliffs, offshore islands, & along lake margins in the interior of the state. Nests along coast on islets, usually on ground with sloping surface, or in tall trees along lake margins.	May fly over site, cliffs and islets absent.	Moderate
Phoebastris albatrus	Short-tailed albatross	FE	Open ocean	Unlikely to fly over site	Low
Progne subis	Purple martin	SSC	Forest and woodlands	Site is absent forest, yet species could forage over site	Moderate
Riparia riparia	Bank swallow	ST	Riparian scrub & riparian woodland	Only sparse riparian present	Low
Setophaga petechia	Yellow warbler	SSC	Thickets and other disturbed or regrowing habitats, particularly along streams and wetlands	Potential nesting in thickets and shrubs	Moderate
Strix occidentalis caurina	Northern spotted owl	FT	Mature forest	Forested habitat not present in close proximity	Absent
Synthliboramphus hypoleucas	Xantus's murrelet	FC	Offshore ocean waters, breeds on rocky islands	Unlikely to fly over site	Low
FISH					
Acipenser medirostris	green sturgeon	FT, SSC	Aquatic, North coast flowing waters	Potential habitat nearby	Low
Eucyclogobius newberryi	tidewater goby	FE, SSC	Aquatic, North coast flowing waters and backwater	Potential habitat onsite	Present
Oncorhynchus clarkii clarkii	coast cutthroat trout	None - G4T4S3	Small low gradient coastal streams and estuaries from the eel river to the Oregon border.	Potential habitat	Moderate

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
Oncorhynchus kisutch	coho salmon - southern Oregon / northern California ESU	FT	Aquatic, North coast flowing waters	Potential habitat	High
Oncorhynchus mykiss	N. CA steelhead	FT	Anadromous, breeds in rivers and streams	Potential habitat	Probable
Oncorhynchus tshawytscha	CA coastal Chinook salmon	FT	Anadromous, breeds in rivers and streams	Potential habitat	Probable
Spirinchus thaleichthys	longfin smelt	FC, ST	Aquatic, Estuary	Potential habitat nearby	Moderate
Thaleichthys pacificus	eulachon	FT, SSC	Aquatic, Klamath/North coast flowing waters	Flowing water not observed	Low
INVERTEBRATES					
Haliotis cracherodii	black abalone	FT (NMFS)	Marine	Marine area not present	Absent
MAMMALS					
Antrozous pallidus	pallid bat	SSC	Deserts, grasslands, shrublands, woodlands & forests. Most common in open, dry habitats with rocky areas for roosting.	Habitat not present	Low
Arborimus pomo	Sonoma tree vole	SSC	North coast coniferous forest | Old growth | Redwood	Forested habitat not present	Low
Baleanoptera borealis	Sei wha	FE	Marine, offshore	Habitat not present	Absent
Baleanoptera musculus	Blue whale	FE	Marine, offshore	Habitat not present	Absent
Baleanoptera physalus	Fin whale	FE	Marine, offshore	Habitat not present	Absent
Eumetopias jubatus	Steller (northern) sea lion	FT	Marine offshore. Haul outs on beaches, ledges, or rocky reefs in the North Pacific	Habitat nearby/ adjacent	Low

Scientific Name	Common Name	Listing Status	Habitat Description	Presence On or Near Site	Potential to Occur in Study Area
Lasiurus cinereus	hoary bat	None – G5S4	Open habitats or mosaics, with access to trees for cover & open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths. Requires water.	Habitat mosaic not present.	Low
Megoptera novaengliae	Humpback whale	FE	Marine, offshore	Habitat not present	Absent
Orcinus orca	Killer whale, S. resident	FE	Marine, offshore	Habitat not present	Absent
Pekania pennanti	fisher - West Coast DPS	FC, SCT	Intermediate to large-tree stages of coniferous forests & deciduous-riparian areas with high percent canopy closure.	Only sparse riparian present.	Low
Physeter macrocephalus	Sperm whale	FE	Marine, offshore	Habitat not present	Absent
			REPTILES		
Caretta caretta	Loggerhead sea turtle	FT	Marine, offshore	Habitat not present	Absent
Chelonia mydas (incl. agassizi)	Green sea turtle	FT	Marine, offshore	Habitat not present	Absent
Emys marmorata	Western pond turtle	SSC	Aquatic, artificial flowing waters, coast flowing waters, coast standing waters, marsh & swamp, wetland	Habitat present but species not observed; possibly not warm enough	Low
Dermochelys coriacea	Leatherback sea turtle	FE	Marine, offshore	Habitat not present	Absent
Lepidochelys olivacea	Olive (Pacific) ridley sea turtle	FT	Marine, offshore	Habitat not present	Absent

Status:
Federal Endangered (FE); Federal Threatened (FT); Federal Proposed (FP, FPE, FPT); Federal Candidate (FC), Federal Species of Concern (FSC), Federal Delisted (FD); State Endangered (SE); State Threatened (ST); State Fully Protected (SFP); State Rare (SR); State Species of Special Concern (SSC)

Appendix C. Vascular Plant Species Observed

Taxon	Common Name
Trees:	
Alnus rubra	red alder
Salix hookeriana	coastal willow
Shrubs:	
Baccharis pilularis ssp. *consanguinea*	coyote brush
Herbs:	
Abronia latifolia	sand-verbena
Achillea millefolium	yarrow
Acmispon parviflorus	lotus
Agrostis stolonifera	creeping bent
Aira caryophyllea	silver hair grass
Alopecurus aequalis var. *aequalis*	short-awn foxtail
Alopecurus saccatus	foxtail
Ambrosia chamissonis	beach bur-sage
Ammophila arenaria	European beach grass
Anagallis arvensis	scarlet pimpernel
Anaphalis margaritacea	pearly everlasting
***Angelica lucida* (CRPR 4.2)**	**sea watch**
Anthemis cotula	mayweed or dog fennel
Arctotheca calendula	cape weed
Artemisia pycnocephala	coastal sagewort
Atriplex prostrata	fat-hen
Avena sativa	cultivated oat
Bellis perennis	English daisy
Bolboschoenus maritimus ssp. *paludosus*	saltmarsh bulrush
Bromus diandrus	ripgut grass
Bromus hordeaceus	soft chess
Cakile maritima	sea rocket
Calandrinia ciliata	red maids
Callitriche heterophylla	water-starwort
Calystegia soldanella	beach morning-glory

Taxon	Common Name
Camissoniopsis cheiranthifolia ssp. *cheiranthifolia*	beach evening-primrose
Cardamine oligosperma	bitter cress
Cardionema ramosissimum	sandmat
***Carex lyngbyei* (CRPR 2B.2)**	**Lyngbye's sedge**
Carex obnupta	slough sedge
Carex pansa	sanddune sedge
***Castilleja ambigua* ssp. *humboldtiensis* (CRPR 1B.2)**	Humboldt Bay owl's-clover
Cerastium fontanum ssp. *vulgare*	mouse-ear chickweed
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Claytonia perfoliata ssp. *perfoliata*	miner's lettuce
Claytonia rubra ssp. *depressa*	claytonia
Conium maculatum	poison hemlock
Cotula coronopifolia	brass-buttons
Cuscuta salina	dodder
Cynosurus echinatus	bristly dogtail grass
Cyperus eragrostis	tall flatsedge
Dactylis glomerata	orchard grass
Daucus carota	Queen Anne's lace
Daucus pusillus	American wild carrot
Deschampsia cespitosa	tufted hair grass
Distichlis spicata	salt grass
Echinochloa crus-pavonis var. *crus-pavonis*	barnyard grass
Eleocharis macrostachya	spikerush
Equisetum telmateia ssp.. *braunii*	giant horsetail
Erigeron glaucus	seaside daisy
Eriogonum latifolium	seaside wild buckwheat
Erodium cicutarium	redstem filaree
Festuca arundinacea	tall fescue
Festuca myuros	sixweek rattail fescue
Festuca perennis	rye grass

Taxon	Common Name
Festuca rubra	red fescue
Foeniculum vulgare	fennel
Fragaria chiloensis	beach strawberry
Fragaria vesca	wood strawberry
Geranium dissectum	cranesbill
Geranium molle	cut-leaved geranium
***Gilia millefoliata* (CRPR 1B.2)**	dark-eyed gilia
***Glehnia littoralis* ssp. *leiocarpa* (CRPR 4.2)**	American glehnia
Grindelia stricta var. *platyphylla*	gumplant
Grindelia stricta var. *stricta*	Oregon gumweed
Helminthotheca echioides	bristly ox-tongue
Heracleum maximum	cow parsnip
Hirschfeldia incana	short pod mustard
Holcus lanatus	common velvet grass
Hordeum brachyantherum ssp. *brachyantherum*	barley
Hordeum marinum ssp. *gussoneanum*	barley
Hordeum murinum	mouse barley
Hydrocotyle ranunculoides	marsh pennywort
Hypochaeris radicata	rough cat's-ear
Isolepis cernua	low bulrush
Jaumea carnosa	jaumea
Juncus bolanderi	Bolander's rush
Juncus breweri	Brewer's rush
Juncus bufonius var. *bufonius*	toad rush
Juncus effusus ssp. pacificus	soft rush
Juncus hesperius	coast rush
Juncus lescurii	San Francisco rush
Juncus patens	rush
Lathyrus littoralis	beach pea
***Layia carnosa* (FE, SE, CRPR 1B.1)**	**beach layia**
Lemna sp.	duckweed
Lepidium virginicum ssp. *menziesii*	peppergrass

Taxon	Common Name
Limonium californicum	marsh rosemary
Lotus corniculatus	birdfoot trefoil
Lupinus littoralis	lupine
Lupinus rivularis x *arboreus*	hybrid lupine
Lythrum hyssopifolia	hyssop loosestrife
Madia sativa	coast tarweed
Malva nicaeensis	bull mallow
Matricaria discoidea	pineapple weed
Medicago lupulina	black medick
Medicago polymorpha	California burclover
Mentha pulegium	pennyroyal
Mimulus guttatus	monkeyflower
Nasturtium officinale	watercress
Nuttallanthus texanus	blue toadflax
Oenanthe sarmentosa	water parsley
Parapholis incurva	sickle grass
Phalaris aquatica	Harding grass
Plantago lanceolata	English plantain
Plantago major	common plantain
Plantago maritima	goose tongue
Plantago subnuda	plantain
Poa annua	annual bluegrass
Polygonum aviculare ssp. *depressum*	knotweed
Polygonum paronychia	beach knotweed
Polypogon maritimus	Mediterranean beard grass
Polypogon monspeliensis	rabbitsfoot grass
Polystichum munitum	sword fern
Portulaca oleracea	purslane
Potentilla anserina ssp. *pacifica*	Pacific silverweed
Pseudognaphalium stramineum	cudweed
Ranunculus muricatus	buttercup
Ranunculus repens	buttercup

Taxon	Common Name
Raphanus sativus	wild radish
Rubus ursinus	California blackberry
Rumex acetosella	sheep sorrel
Rumex conglomeratus	dock
Rumex crispus	curly dock
Ruppia maritima	ditch-grass
Salicornia pacifica	pickleweed
Schoenoplectus pungens var. *longispicatus*	common three-square bulrush
Scirpus microcarpus	small-fruited bulrush
Senecio glomeratus	fireweed
Senecio sylvaticus	woodland ragwort
Silene gallica	catchfly
Silybum marianum	milk thistle
Solidago spathulata	Dune goldenrod
Sonchus asper ssp. *asper*	prickly sow thistle
Spartina densiflora	dense-flower cord grass
Spergularia macrotheca var. *macrotheca*	sticky sand spurry
Spergularia marina	salt marsh sand spurry
Spergularia rubra	red sand-spurrey
Stellaria crispa	chickweed
Stellaria nitens	shining chickweed
Symphyotrichum chilense	Pacific aster
Tanacetum bipinnatum	dune tansy
Taraxacum officinale	common dandelion
Trifolium dubium	clover
Trifolium fragiferum	strawberry clover
Trifolium pratense	red clover
Trifolium repens	white clover
Trifolium wormskioldii	cows clover
Triglochin maritima	common arrow-grass
Triglochin striata	three-ribbed arrow-grass
Typha latifolia	broad-leaved cattail

Taxon	Common Name
Urtica dioica	stinging nettle
Veronica americana	American brookline
Vicia villosa ssp. villosa	hairy vetch
Vicia sativa	common vetch
Zostera marina	**eel-grass**

Memorandum

August 6, 2015

To	Russ Ranch and Timber (Jay Russ)		
From	Cara Scott (GHD Botanist)	Tel	707.443.8326
Reviewed:	Ken Mierzwa (GHD Senior Project Manager) and Jeremy Svehla (GHD Project Manager)		
Subject	Special-Status Plant Survey for Russ Ranch and Timber component of the Eel River Estuary Preserve Ecosystem Enhancement Project, Ferndale, California	Job no.	84/10882/07

1 Introduction

On May 22, June 3, and June 12, 2015, special-status plant surveys and mapping were conducted at the Russ Ranch and Timber property in Humboldt County, California. The plant surveys were intended to document the presence, location, and extent of special-status plant species. The results of these field efforts will provide a basis to avoid, minimize, and/or mitigate potential impacts associated with project-related activities and guide future management goals and decisions.

1.1 Location

The Russ Ranch and Timber (RR&T) site is located west of Ferndale, California, and north of Centerville Beach (Figure 1-2, Attachment 1). The site is accessed via Centerville Road. The Pacific Ocean is located directly west of the site. The confluence of Salt River and Eel River is located approximately 3.7 miles north of the project site. Prominent water features include Russ Creek, Shaw Creek, and the southern portion of the Western Drainage as well as smaller (seasonal) slough channels and drainage ditches. The northern portion of the site borders The Wildlands Conservancy while the southern area is bordered by private property. The site corresponds to portions of Sections 5, 6, 31 and 32, Township 2-3 North, Range 2 West on the USGS 7.5 Minute Ferndale quadrangle. The coordinates for the Centerville Road access route are 40.576407N and -124.333866W.

1.2 Environmental Setting

The RR&T project study boundary encompasses approximately 460 acres, which includes a patchwork of current and historic agricultural lands, tidal salt marsh, brackish marsh, sloughs/open water channels, freshwater ponds and ditches, and nearshore dune ridges and swales. The climate is Mediterranean with precipitation most abundant in the winter months, and the average annual rainfall is approximately 48.5 inches supporting various vegetation types including pickleweed mats (*Sarcocornia pacifica* Herbaceous Alliance), perennial rye grasslands (*Festuca perennis* Semi-Naturalized Herbaceous Alliance) and bent grass meadows (*Agrostis stolonifera* Semi-Natural Herbaceous Stands). Approximately two thirds of the year the site is influenced by coastal fog. The RR&T site occurs within the Northwestern California Region (NW)

GHD Inc.
718 Third Street Eureka CA 95501 USA
T 1 707 443 8326 **F** 1 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

and North Coast Subregion (NCo) (Baldwin et al. 2012).

The site consists of level to undulating areas influenced by surface and subsurface hydrology, salinity and past and current land use and modifications. Elevations on site range from < 2.5 feet in the sloughs of the inner marsh to above 10 feet in the back dunes. Historical land use for the site includes grazing for dairy through the use of diked levees on historic tidal lands. These wetland pastures are still actively used for grazing.

1.3 Regulatory Setting

Special-status plant species include those listed as endangered, threatened, or as candidate species by the U.S. Fish and Wildlife Service (USFWS) under the U.S. Endangered Species Act (ESA) or by the California Department of Fish and Wildlife (CDFW) under the California Endangered Species Act (CESA). Plant species on the California Native Plant Society's (CNPS) California Rare Plant Ranking (CRPR) lists 1A, 1B and 2 are considered eligible for state listing as Endangered or Threatened pursuant to the California Fish and Game Code, and CDFW has oversight of these special-status plant species as a trustee agency of CEQA. As part of the CEQA process, such species should be considered as they meet the definition of Threatened or Endangered under Sections 2062 and 2067 of the California Fish and Game Code (Andre et. al. 2010). CRPR List 3 and 4 plants do not have formal protection under CEQA. CDFW publishes and periodically updates lists of special plants which include, for the most part, the species listed as sensitive by CNPS.

2 Methods

2.1 Pre-Survey Review

Prior to initiating field work, database searches were conducted of the *California Natural Diversity Database* (CNDDB) [CDFW 2015], the CNPS *Inventory of Rare and Endangered Vascular Plants* (CNPS 2015), and U.S. Fish and Wildlife Service (USFWS) listed/proposed threatened and endangered species list in order to compile a list of potential special-status species that are known to occur in the project vicinity and/or have the potential to occur at the site. Relevant literature was also reviewed, including status reports, published articles, species lists maintained by The Wildlands Conservancy staff, and previous regulatory review documents, when available. Topographic maps and aerial photography were also consulted prior to and during the survey to determine potential habitats for target sensitive species occurrence.

Prior to conducting botanical field surveys, a scoping list of CRPR plant species and habitats with recorded occurrences in the project vicinity was compiled by consulting the database results and existing project information. The CNDDB and Consortium of California Herbaria databases were consulted for site specific species cross reference of rare plant occurrences documented in the project vicinity. The scoping list includes special status plants that occur in habitat similar to the project area with documented occurrences on the site USGS quadrangle or adjacent quadrangles. The CDFW and the CNPS recommend project assessments include species with potential to occur on a minimum of nine USGS quadrangles with the project site located in the central quad(s). The scoping list should also contain other taxa that may occur in the project area whose habitat is suitable if the project is within or near the known range of the species. The scoping list developed for this project, included species with potential to occur on the USGS 7.5 Minute quadrangles in which the project is located (Ferndale), as well as adjacent quadrangles (Capetown, Cape Mendocino, Fields Landing, Fortuna, Taylor Peak, and Cannibal Island). The CNPS Inventory was also

queried for CRPR List 3 and 4 species known to occur within the vicinity for informational purposes prior to conducting plant surveys, although those species are not presented herein. The queries yielded 29 special-status plant species previously documented in the assessment area. Of these taxa, 15 have a high to moderate probability of occurring within the study area (Attachment 2).

2.2 Survey Methods

Surveys to determine the presence of special-status plant species (listed as rare, threatened, endangered, or candidate for rare, threatened, or endangered species listing under the State or Federal Endangered Species Acts, CNPS, or species of local importance) were conducted at the appropriate blooming or active period for each species. The protocol-level botanical surveys were conducted by Cara Scott (GHD Botanist). USFWS and/or other resources agencies and local experts were contacted to verify that botanical surveys were being conducted at an appropriate time of year to allow for climatic micro-variations and bloom period for specific species on a year-to-year basis. Additionally, reference site(s) were viewed if possible, where target plant species are known to occur in the project vicinity to verify the species was visible and blooming at the time of surveys. It was determined that a minimum of two seasonally-appropriate focused botanical surveys should be conducted, one in the spring (April or May) as well as one visit in summer (June to mid-July).

The surveys were floristic in nature following *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* by the California Natural Resource Agency (CDFG 2009) and *General Rare Plant Survey Guidelines by the Endangered Species Recovery Program* (USFWS 2002). An intuitively controlled survey was conducted that sampled and identified potential habitat(s). Plants were identified to the lowest taxonomic level (genus or species) necessary for rare plant identification. Nomenclature follows *The Jepson Manual* (Baldwin et al 2012). Species surveys were conducted by walking the site for target species and recording extent, approximate number, and percent cover of special status plant species observed. A total of 30.5 field person hours were spent surveying the study area. Effort was focused within and near the tidal salt marsh and in upland areas where project-related impacts are possible. Minimal time was spent surveying grazed pastures as project activities are not proposed in these areas.

3 Results

On May 22, June 3, and June 12, 2015, the project study boundary was surveyed by walking the Russ Ranch and Timber study area to evaluate for the presence of Federal, State and CNPS listed special-status plants. During this evaluation, no special status plant species were observed.

From the botanical survey efforts, 115 vascular taxa were identified within the study area: one fern, one fern ally, 79 eudicots, and 36 monocots (Attachment 3). A little under half of the taxa (46 percent), are introduced species which is double that of the state average ((Baldwin et al. 2012). These 53 non-native taxa range from rare to extremely abundant and widespread such as bent grass (*Agrostis stolonifera*) and velvet grass (*Holcus lanatus*). This has resulted in the establishment of several vegetation alliances that are semi-natural stands with introduced species as the dominants such as *Agrostis stolonifera* Semi-Natural Herbaceous Alliance and *Lolium perenne* (now *Festuca perennis*)Semi-Natural Herbaceous Stand (Sawyer 2009).

4 Conclusion

The purpose of botanical surveys was to identify and map federal, state and CNPS listed CRPR plants within the project boundary. This survey did not identify any special-status plants present in the study area.

5 References

Baldwin, B. D. 2012. *The Jepson Manual*, *Second Edition*. University of California Press. Berkeley, CA.

CNPS, 2015. Inventory of Rare and Endangered Plants (online edition, v8-01a). California Native Plant Society (CNPS). Sacramento, CA.

California Department of Fish and Wildlife. 2015. California Natural Diversity Database (CNDDB). Ferndale and adjacent USGS 7.5 Minute Quadrangles. California Department of Fish and Wildlife (CDFW). Sacramento, California.

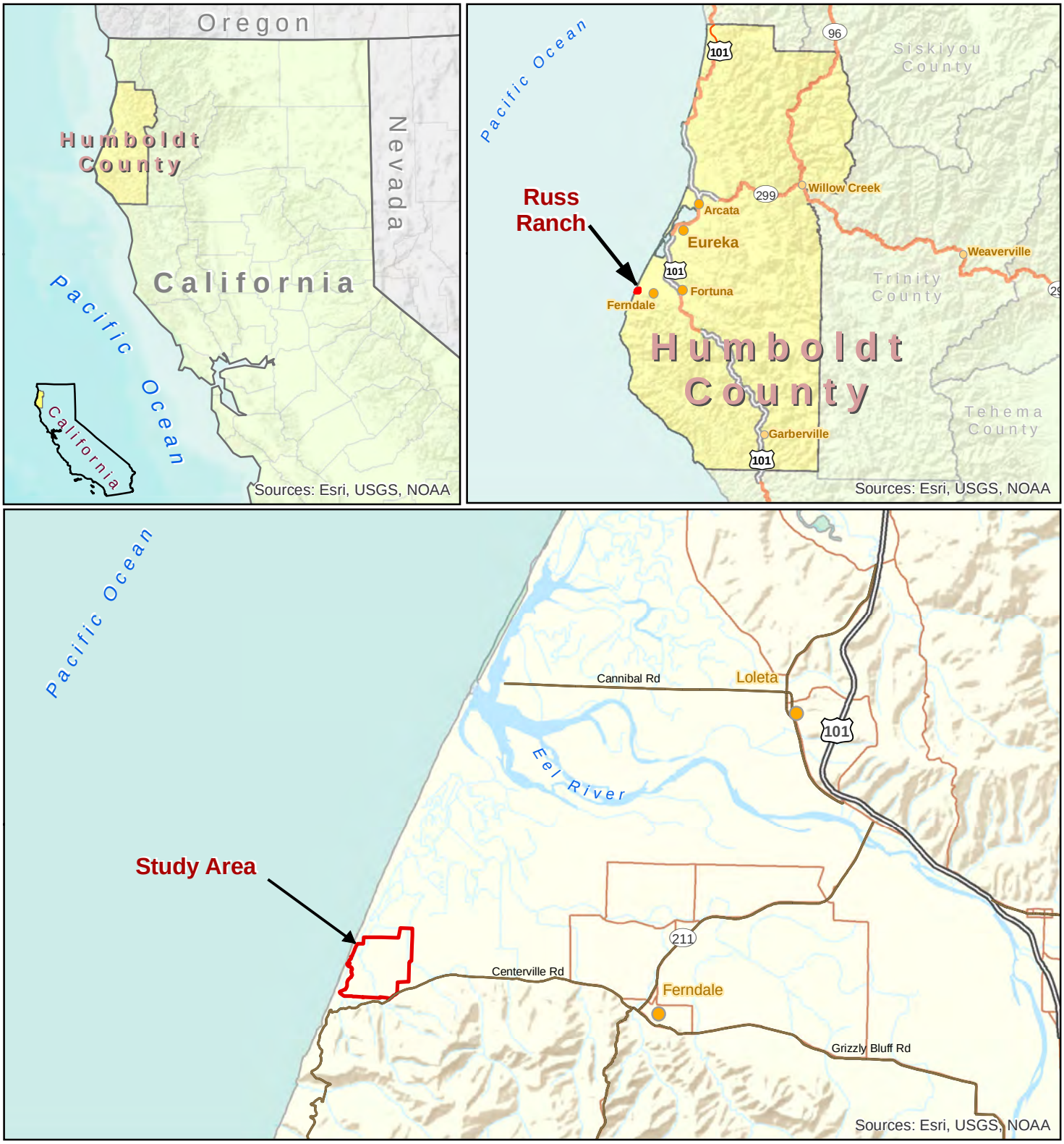
CDFG, 2009. *Guidelines for Assessing the Effects of Proposed Development on Rare, Threatened, and Endangered Plants and Plant Communities.* Sacramento, CA.

CDFG, 2009. *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. California Department of Fish and Game (CDFG), Sacramento, CA.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evans. 2009. *A Manual of California Vegetation, Second Edition*. California Native Plant Society. Sacramento, CA.

USFWS, 2015. Listed/Proposed Threatened and Endangered Species for the Ferndale Quad. Document Number: 727907158-191457. USFWS Arcata Field Station, U. S. Fish and Wildlife Service (USFWS).

Attachment 1. Figures



Study Area
Humboldt County
Counties
Freeway
Highway
Roadway
Streams

Paper Size ANSI A
0 0.5 1 2 3
Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Russ Ranch
Rare Plant Survey

Job Number	8410882.07
Revision	1
Date	16 Sep 2015

Project Vicinity and Location

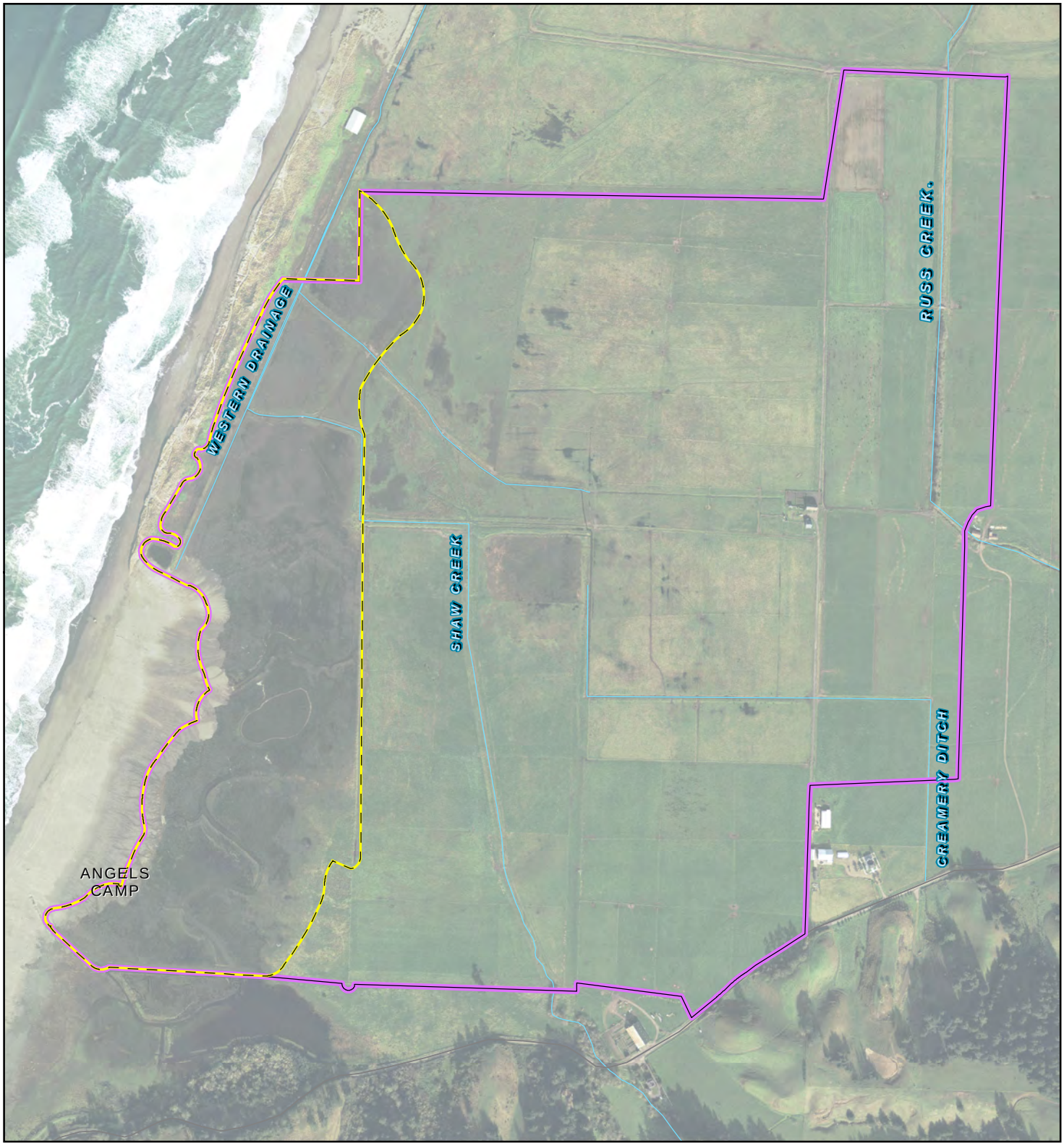
Figure 1

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_RarePlantSurvey\F1_Vicinity.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:porogers



Rare Plant Survey Boundary

Existing Drainage

Vegetation Survey Boundary

Paper Size ANSI A

0 250 500 1,000 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Russ Ranch
Rare Plant Survey

Job Number	84-10882-07
Revision	A
Date	16 Sep 2015

Study Boundaries

Figure 2

718 Third Street Eureka CA 95501 USA T 1 707 443 8326 F 1 707 444 8330 W www.ghd.com

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_RarePlantSurvey\F2_StudyArea.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers

Attachment 2. Special-Status Plant Species Lists

Scientific Name	Common Name	Listing Status	Habitat Description	Bloom Period	Potential to Occur in Study Area
Abronia umbellata var. *breviflora*	pink sand-verbena	List 1B.1	Coastal dunes	Jun-Oct	High
Astragalus pycnostachyus var. *pycnostachyus*	coastal marsh milk-vetch	List 1B.2	Coastal dunes(mesic), Coastal scrub, Marshes and swamps(coastal salt, streamsides)	Apr-Oct	High
Carex leptalea	bristle-stalked sedge	List 2B.2	Bogs and fens, Meadows and seeps(mesic), Marshes and swamps	Mar-Jul	Moderate
Carex lyngbyei	Lyngbye's sedge	List 2B.2	Marshes and swamps (brackish or freshwater)	Apr-Aug	High
Castilleja ambigua var. *humboldtiensis*	Humboldt Bay owl's-clover	List 1B.2	Marshes and swamps (coastal salt)	Apr-Aug	High
Castilleja litoralis	Oregon coast paintbrush	List 2B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub/sandy	Jun	High
Chloropyron maritimum ssp. *palustre*	Point Reyes bird's-beak	List 1B.2	Marshes and swamps(coastal salt)	Jun-Oct	High
Clarkia amoena ssp. *whitneyi*	Whitney's farewell-to-spring	List 1B.1	Coastal bluff scrub, Coastal scrub	Jun-Aug	Low
Erysimum menziesii	Menzies' wallflower	FE/SE/ List 1B.1	Coastal dunes	Mar-Sep	High
Erythronium oregonum	giant fawn lily	List 2B.2	Cismontane woodland, Meadows and seeps/sometimes serpentinite, rocky, openings	Mar-Jun(Jul)	Low
Erythronium revolutum	coast fawn lily	List 2B.2	Bogs and fens, Broadleafed upland forest, North Coast coniferous forest/Mesic, streambanks	Mar-Jul(Aug)	Low
Gilia capitata ssp. *pacifica*	Pacific gilia	List 1B.2	Coastal bluff scrub, Chaparral (openings), Coastal prairie, Valley and foothill grassland	Apr-Aug	Low
Gilia millefoliata	dark-eyed gilia	List 1B.2	Coastal strand, dunes	June-Aug	High
Hesperevax sparsiflora var. *brevifolia*	short-leaved evax	List 1B.2	Coastal bluff scrub (sandy), Coastal dunes, Coastal prairie	Mar-Jun	Low
Hesperolinon adenophyllum	glandular western flax	List 1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland/usually serpentinite	May-Aug	Low

GHD Inc.
718 Third Street Eureka CA 95501 USA
T 1 707 443 8326 **F** 1 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Scientific Name	Common Name	Listing Status	Habitat Description	Bloom Period	Potential to Occur in Study Area
Lathyrus palustris	marsh pea	2B.2	Bog & fen, Coastal prairie, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, North coast coniferous forest, Wetland	Mar-Aug	Moderate
Layia carnosa	beach layia	FE/SE/ List 1B.1	Coastal dunes, Coastal scrub(sandy)	Mar-Jul	High
Lilium occidentale	western lily	FE/SE/ List 1B.1	Bogs and fens, Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps(freshwater), North Coast coniferous forest(openings)	Jun-Jul	Moderate
Montia howellii	Howell's montia	List 2B.2	Meadows and seeps, North Coast coniferous forest, Vernal pools/vernally mesic, sometimes roadsides	Mar-May	Low
Oenothera wolfii	Wolf's evening-primrose	List 1B.1	Coastal bluff scrub, Coastal dunes, Coastal prairie, Lower montane coniferous forest/sandy, usually mesic	May-Oct	Low
Packera bolanderi var. *bolanderi*	seacoast ragwort	List 2B.2	Coastal scrub, North Coast coniferous forest/Sometimes roadsides	May-Jul(Aug)	Low
Polemonium carneum	Oregon polemonium	List 2B.2	Coastal prairie, Coastal scrub, Lower montane coniferous forest	Apr-Sep	Low
Puccinellia pumila	dwarf alkali grass	List 2B.2	Marshes and swamps(coastal salt)	Jul	High
Romanzoffia tracyi	Tracy's romanzoffia	List 2B.3	Coastal bluff scrub, Coastal scrub/rocky	Mar-May	Low
Sidalcea malviflora ssp. *patula*	Siskiyou checkerbloom	List 1B.2	Coastal bluff scrub, Coastal prairie, North Coast coniferous forest/often roadcuts	May-Aug	Low
Sidalcea oregana ssp. *eximia*	coast checkerbloom	List 1B.2	Lower montane coniferous forest, Meadows and seeps, North Coast coniferous forest	Jun-Aug	Low
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	List 1B.1	Cismontane woodland(openings), Valley and foothill grassland	Jun	Low
Spergularia canadensis var. *occidentalis*	western sand-spurrey	List 2B.1	Marshes and swamps(coastal salt)	Jun-Aug	High

Attachment 3. Vascular Plant Species Observed

Taxon	Common Name
Trees:	
Alnus rubra	red alder
Salix hookeriana	coastal willow
Shrubs:	
Baccharis pilularis ssp. *consanguinea*	coyote brush
Herbs:	
Achillea millefolium	yarrow
Acmispon parviflorus	lotus
Agrostis stolonifera	creeping bent
Aira caryophyllea	silver hair grass
Alopecurus saccatus	foxtail
Ambrosia chamissonis	beach bur-sage
Ammophila arenaria	European beach grass
Anagallis arvensis	scarlet pimpernel
Anaphalis margaritacea	pearly everlasting
Arctotheca calendula	cape weed
Artemisia pycnocephala	coastal sagewort
Atriplex prostrata	fat-hen
Avena sativa	cultivated oat
Bellis perennis	English daisy
Bolboschoenus maritimus ssp. *paludosus*	saltmarsh bulrush
Briza minor	small quaking grass
Bromus diandrus	ripgut grass
Bromus hordeaceus	soft chess
Cakile maritima	sea rocket
Calandrinia ciliata	red maids
Calystegia soldanella	beach morning-glory
Camissoniopsis cheiranthifolia ssp. *cheiranthifolia*	beach evening-primrose
Carex obnupta	slough sedge
Carex pansa	sanddune sedge
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Claytonia perfoliata ssp. *perfoliata*	miner's lettuce
Cotula coronopifolia	brass-buttons
Cuscuta salina	dodder

GHD Inc.
718 Third Street Eureka CA 95501 USA
T 1 707 443 8326 **F** 1 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Taxon	Common Name
Cynosurus echinatus	bristly dogtail grass
Cyperus eragrostis	tall flatsedge
Dactylis glomerata	orchard grass
Daucus carota	Queen Anne's lace
Distichlis spicata	salt grass
Eleocharis macrostachya	spikerush
Equisetum telmateia ssp.. *braunii*	giant horsetail
Erigeron glaucus	seaside daisy
Eriogonum latifolium	seaside wild buckwheat
Erodium cicutarium	redstem filaree
Festuca arundinacea	tall fescue
Festuca microstachys	rye grass
Festuca perennis	rye grass
Festuca rubra	red fescue
Foeniculum vulgare	fennel
Fragaria chiloensis	beach strawberry
Geranium dissectum	cranesbill
Geranium molle	cut-leaved geranium
Helminthotheca echioides	bristly ox-tongue
Holcus lanatus	common velvet grass
Hordeum brachyantherum ssp. *brachyantherum*	barley
Hordeum marinum ssp. *gussoneanum*	barley
Hydrocotyle ranunculoides	marsh pennywort
Hypochaeris radicata	rough cat's-ear
Isolepis cernua	low bulrush
Jaumea carnosa	jaumea
Juncus bolanderi	Bolander's rush
Juncus breweri	Brewer's rush
Juncus bufonius var. *bufonius*	toad rush
Juncus effusus ssp. pacificus	soft rush
Juncus lescurii	San Francisco rush
Juncus patens	rush
Lemna sp.	duckweed
Linum bienne	flax
Lotus corniculatus	birdfoot trefoil
Lupinus littoralis	lupine

Taxon	Common Name
Lythrum hyssopifolia	hyssop loosestrife
Madia sativa	coast tarweed
Malva nicaeensis	bull mallow
Matricaria discoidea	pineapple weed
Medicago lupulina	black medick
Medicago polymorpha	California burclover
Mentha pulegium	pennyroyal
Nasturtium officinale	watercress
Oenanthe sarmentosa	water parsley
Phalaris aquatica	Harding grass
Plantago lanceolata	English plantain
Plantago subnuda	plantain
Poa annua	annual bluegrass
Poa compressa	
Polygonum aviculare ssp. *depressum*	knotweed
Polygonum paronychia	beach knotweed
Polypogon monspeliensis	rabbitsfoot grass
Polystichum munitum	sword fern
Potentilla anserina ssp. *pacifica*	Pacific silverweed
Ranunculus muricatus	buttercup
Ranunculus repens	buttercup
Raphanus sativus	wild radish
Rubus ursinus	California blackberry
Rumex acetosella	sheep sorrel
Rumex conglomeratus	dock
Rumex transitorius	dock
Ruppia maritima	ditch-grass
Salicornia pacifica	pickleweed
Schoenoplectus pungens var. *longispicatus*	common three-square bulrush
Scirpus microcarpus	small-fruited bulrush
Silene gallica	catchfly
Silybum marianum	milk thistle
Solidago spathulata	Dune goldenrod
Sonchus asper ssp. *asper*	prickly sow thistle
Spergularia rubra	red sand-spurrey
Symphyotrichum chilense	Pacific aster

Taxon	Common Name
Tanacetum bipinnatum	dune tansy
Taraxacum officinale	common dandelion
Trifolium fragiferum	strawberry clover
Trifolium pratense	red clover
Trifolium repens	white clover
Trifolium wormskioldii	cows clover
Triglochin maritima	common arrow-grass
Triglochin striata	three-ribbed arrow-grass
Typha latifolia	broad-leaved cattail
Veronica americana	American brookline
Vicia sativa	common vetch

Russ Ranch and Timber

Delineation of Uplands

September 2015

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

Table of Contents

1. Introduction 1
2. Methodology 1
   - 2.1 Project Study Boundary (PSB) 2
   - 2.2 Botanical Methodology 3
   - 2.3 Soils Methodology 3
   - 2.4 Hydrology Methodology 4
   - 2.5 Wetland Determination 4
3. Results 6
   - 3.1 Vegetation 7
   - 3.2 Soil 8
   - 3.3 Hydrology 8
4. Conclusions 8
5. Special Terms and Conditions 9
6. References 9
   - 6.1 Scope and limitations 11

Table Index

Table 1. Summary of Wetland Results

Appendices

Appendix A: Figures
Appendix B: Data Sheets

1. Introduction

On June 2-4 and September 17, 2015, GHD Inc. (GHD) staff conducted a delineation of uplands on portions of Russ Ranch and Timber Properties adjacent to the Eel River Estuary Preserve (EREP). The project site is located northwest of the City of Ferndale, Humboldt County, California and is in the Coastal Zone (Figures 1 and 2, Appendix A). The Pacific Ocean is located directly west of the site while the confluence of Salt River and Eel River is located approximately 3.7 miles north of the project site. Prominent water features include Russ Creek, Shaw Creek, and the southern portion of the Western Drainage as well as smaller (seasonal) slough channels and drainage ditches. The northern portion of the site borders The Wildlands Conservancy property while the southern area is bordered by private property.

The upland delineation procedure was completed pursuant to the U.S. Army Corps of Engineers (USACE) 1987 Manual; the *Regional Supplement to the USACE Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Regions* (2010); and California Coastal Commission (Commission) guidance for wetland delineations. Current and historic land use practices in the vicinity of the project area consist of active agricultural management. The area is further complicated due to the seasonal nature of surface and/or groundwater and the observed absence of hydrology within 12 inches of the soil surface in the summer months. In addition, many uplands area consist of hisotric spoil which demonstrate relic redoximorphic features.

This delineation report includes a discussion of site conditions, sampling methodology, sampling results, and conclusions as well as maps delineating proposed upland and wetland boundaries within the study area (Figures 3.1-3.3, Appendix A). The area of investigation consists of evaluation of land owned by the Russ Family that is being considered for use as part of a habitat enhancement project proposed at the adjacent EREP. A jurisdictional determination (JD) from the USACE (and Commission, if deemed appropriate) should be requested to seek concurrence with results reported herein in preparation for anticipated permitting requirements of the proposed project.

2. Methodology

The delineation of uplands and wetlands were conducted by GHD field team consisting of two qualified technical staff, made up of combinations of the following GHD staff members: GHD soil scientist/wetland scientist (Lia Webb or Misha Schwarz) GHD botanist (Cara Scott or Jordan Mayor). The delineation was conducted in June and September 2015.

The GHD field effort focused on delineation of extent of uplands and the predominant matrix of seasonal agricultural wetlands present in the project area due to low gradient topography and close proximity to Russ Creek and Salt River. The areas not mapped as uplands, but within the study boundary, by default, may fall under jurisdiction of the U.S. Army Corp of Engineers (USACE) based on the three parameter wetland definition and/or Waters of the U.S., as well as under the jurisdiction of the California Coastal Commission (Commission). This phase of delineation efforts required a streamlined approach to delineation that targeted larger upland areas that could be considered for use for project features such as wetland establishment/enhancement, staging, soils reuse, and/or access. Due to micro-topography, it is noted that smaller upland areas could be present within the wetland and transitional matrix that dominates the site. Further, without winter wetland hydrology present at the time of delineation coupled with the low gradient topography,

upland areas were challenging to discern at the time field work was conducted. The substantial upland dune complex on the western edge of the site was not evaluated.

The wetland delineation approach is to determine one single wetland/upland boundary line that meets multi-jurisdictional requirements of both the Commission and USACE. However, due to a gradual ecotone and a low topographical gradient at this site, the field evaluation determined several areas that meet the USACE upland definition, but could be considered jurisdictional by the Commission based on presence of one or two-parameters.

The delineation followed the USACE criteria three-parameter approach from the most current USACE wetland delineation manual for the area, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coastal Regions (Version 2.0)* (USACE 2010), and per California Coastal Commission wetland definition which relies on a one parameter approach. Wetland determination data sheets from the most current version of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast* were used to document existing conditions for the field effort (USACE 2010) and are provided in Appendix B.

Vegetation, soil, and hydrology data were collected at sampling plots to typify areas with similar conditions of topography and vegetation communities in order to delineate the wetland/upland boundary. The defined upland boundaries are presented in figures provided in Appendix A. Upland confirmation points are provided as U#T# naming convention where the test pits/plots are not paired in relation to a transect across wetland/upland boundary, yet were installed for confirmation of site conditions. Additional intermediate/confirmation pits/plots were installed in multiple presumed upland areas for verification of wetland/upland boundary and to confirm extrapolation of delineation boundaries based on previous test pits/plots, but are not recorded on data sheets in order to keep delineation efforts efficient (indicated with “-int” naming convention on maps).

Test pit/plots were evaluated at representative positions to allow onsite identification of upland areas. The surfaces of the area were transected on foot to ensure no undetected changes in wetland/upland conditions existed. Areas appearing to meet the criteria for wetlands were evaluated and individually determined for wetland characteristics. When possible upland areas were identified, a boundary was designated from the known wetland plot to the presumed edge of the upland. Typically, shifts in topography, soil, and/or vegetation were used to locate the wetland/upland boundary. In some places, a complex mosaic of wetlands and uplands were encountered and topographic elevation was utilized in conjunction with plot observations in order to extrapolate the upland/wetland boundary from test pit locations around topographic features.

2.1 Project Study Boundary (PSB)

Prior to conducting field work, the PSB was discussed and determined in conjunction with the project manager, project engineer, and project ecologist/biologist. The PSB was established to focus delineation efforts on areas of the site where project features such as site modifications, project alternatives, mitigation, staging, and access could be considered. The delineation effort targeted areas that were topographically higher and thus might be confirmed/documented as uplands (in particular historic levees, roads, and visually higher and sloped areas) in order to identify possible mitigation opportunities, spoils disposal options, and temporary staging and stockpile areas for proposed various restoration activities. The delineation did not focus on evaluation/mapping of upland dune complex along the western portion of the parcel.

2.2 Botanical Methodology

Botanical/vegetation data collection consisted of listing the dominant species at each plot in each stratum layer. Species observed within a radius of three feet were listed in either the shrub or herb stratum. The percent of absolute cover for each species was recorded along with their indicator status. Indicator status relied on using the standard reference for plant wetlands indicators, *Western Mountains, Valleys and Coasts Region-National Wetland Plant List Final Draft Ratings* (Lichvar 2013). This document classifies plants based on the probability of occurring within a wetland. Plants are given classifications ranging from the following:

Code	Wetland Indicator Category	Estimated Probability of Occurrence in Wetlands
OBL	Obligate Wetland	> 99 percent of the time
FACW	Facultative Wetland	67 percent to 99 percent of the time
FAC	Facultative	34 percent to 66 percent of the time
FACU	Facultative Upland	one percent to 33 percent of the time
UPL	Obligate Upland	less than one percent of the time
NI	Non-Indicators	Not assigned a rating of wetland condition and are also included in the UPL category

(USFWS 1988, Tiner 1999, Lichvar 2013)

The PSB is dominated by facultative (FAC) species in many areas and/or FAC or FACW species that are not growing as hydrophytes where present in the absence of hydric soil and wetland hydrology indicators. GHD scientists deemed it appropriate to additionally utilize the descriptive prevalence index (PI) to further evaluate areas where greater than 50 percent of plant species were facultative or wetter based on the dominance test. This result was contrary to observed upland soils and/or hydrology parameters, and/or the majority of plant species were facultative (FAC) meaning they are just as likely to be present in wetlands as uplands. The PI was utilized in these situations to convey that in the absence of hydric soils and hydrology indicators, and where the plant composition passed the PI as an upland (greater than 3.0), that these areas are considered three parameter uplands. Where the PI was calculated with scores greater than 3.0, this was used as an indication that corroborates that the vegetation is not growing as hydrophytes. However, in some plots the predominance of facultative species (and presence of FAC or wetter species growing in upland topographic positions and absensce of hydric soil and wetland hydrology) present in the coastal plain resulted in PI of near or less than 3.0, and these areas were evaluated in context of upland soils and hydrology conditions to have vegetation not growing as hydrophytes.

2.3 Soils Methodology

The definition of a hydric soil is “a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” The USACE 1987 Manual procedures were combined with the Natural Resources Conservation Service’s (NRCS) definition of hydric soils presented in *Changes in Hydric Soils of the United States* and *Field Indicators of Hydric Soils in the United States* (United States Department of Agriculture [U.S.D.A.], 1995 and 2006, respectively), as well as the most recent wetland guidance document

Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (USACE 2010). The regional supplement provides detailed descriptions of primary and secondary indicators that help determine if wetland hydrology is present at a site. Soil data was recorded on data sheets from the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast* (USACE 2010) provided in Appendix B of this report.

To evaluate the soil matrix and qualitatively describe the presence or absence of redoximorphic features, reductions and concentrations, soil pits were dug to an approximate depth of 14-18 inches. Data on soil color, texture and redoximorphic features were collected. Care was taken to observe mottling (iron concentrations), distinguish between chromas of 1 and 2, and determine the percentage of redoximorphic features in the soil. Redoximorphic features at 2 percent and 5 percent are important thresholds for identification of hydric soils for both USACE and CCC delineation purposes.

Colors were described for the entire depth of the test pit. Colors were determined on moist ped surfaces which had not been crushed. To determine the soil matrix colors, mottle colors and mottle abundance, the *Munsell Color Chart* (Munsell Color 2000) was used. Soils with low chromas were verified as being hydric or upland using indicators for Depleted Matrix (F3) and Redox Dark Surface (F6) for fine grained soils (USACE 2010).

2.4 Hydrology Methodology

One primary indicator or two secondary indicators are required to identify the presence of wetland hydrology. Direct evidence of ground water (soil saturation, standing water, etc.) was not present in wetland soil pits that delineate the upland boundary due to low rainfall conditions and implementation of field work to meet the schedule required by the project. Primary wetland hydrology indicators used to determine whether hydrology was present include: oxidized rhizospheres along Living Roots (C3) and Depleted Matrix (F3).

2.5 Wetland Determination

2.5.1 Corps of Engineers Jurisdictional Wetland Determination

The USACE wetland determination utilized the three parameters (soils, hydrology, and vegetation) but was limited mostly to soils as the vegetation was relatively uniform throughout the site (except where described in Section IV – Results of Wetland Delineation). An area was determined to be USACE and Commission uplands when all three wetland parameters were absent (hydric soils, wetland hydrology, and hydrophytes). If one of the three wetland parameters was not present, then the area was mapped as a USACE upland, yet identified as two parameter (likely considered by Coastal Commission to be a wetland). This property is considered a “Problematic Area” as the wetlands are considered seasonal (USACE 1987 Manual, page 91).

In addition, the USACE does note in the wetland delineation manual that “on a sub-regional basis, questions of indicator status of FAC species may use the following opinion: When FAC species occur as dominants along with other dominants that are not FAC (either wetter or drier than FAC), the FAC species can be considered neutral, and the vegetation decision can be based on the number of dominant species wetter than FAC as compared to the number of species drier than FAC. When a tie occurs or all the dominant species are FAC, the non-dominant species should be considered. The area has hydrophytic vegetation when more than 50 percent of all considered species are wetter than FAC. When either all species are FAC or the number of species wetter than

FAC equals the number of species drier than FAC, the wetland determination will be based on the soil and hydrology parameters" (USACE 1987 Manual, page 18).

2.5.2 California Coastal Commission Jurisdictional Wetland Determination

Section 30121 of the California Coastal Act (1976) has a broad definition for a wetland:

> "Wetland means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, or fens."

However, the CCC Administrative Regulations (Title 14 CCR Section 13577 (b)) provides a more explicit definition:

> "Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitat."

<u>1994 California Coastal Commission Procedural Guidance</u>

The 1994 CCC Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone provides the following information regarding wetland classification system:

Although the U.S. Fish and Wildlife Service (USFWS) classification system is complex, it does provide an objective method for identifying virtually most wetland landscapes. Relative to the USACE, the USFWS definition is generally regarded as being more inclusive in the classification and subsequent delineation of a wetland. This is because the USFWS classification system defines a wetland by the presence "of the proper hydrology and either the presence of hydric soils or hydrophytic vegetation, except in non-soil areas, such as rocky intertidal areas, where only the presence of proper hydrology is required."

<u>Cowardin Wetland Definition</u>

According to Cowardin 1979, the definition of a wetland is as follows:

"In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil.

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of the classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season each year."

Based on the above definitions as well as the 1994 guidance, the Commission relies on a one-parameter approach for the determination of a wetland and utilizes the 1979 Cowardin wetland

definition/classification. If an area is determined to have one of the three wetland parameters (hydric soils, wetland hydrology, or the predominance of hydrophytes), it can be determined a Commission wetland. However, at this project site, vegetation is not a strong indicator of the wetland/upland boundary as the vegetation present on most of the site has been managed by continued farming and disking for agricultural purposes and is heavily influenced by the maritime climate. The site includes soils with high available water (silts) and has soils with a near iso-mesic temperature regime. Agricultural management of the vegetation present on this land is the dominating factor influencing the dominant vegetation type at this site (not strongly correlated with the natural community and/or environmental selection). In addition, many of the upland areas consist of historically placed dredge/ditch excavation that contain seeds and plant material that are FAC/FACW, but are clearly in an upland topographic position that lack hydric, saturated soils, wetland hydrology, and salt conditions that persist in the excavated soils for favor of halophytes.

Some listed FAC species, such as perennial ryegrass (*Festuca perennis*), have been seeded on the property; and therefore, are not growing as hydrophytes in all cases. Vegetation classified as OBL, FACW, FAC, FACU, or UP can lose strong predictive power at managed or disturbed sites. It is likely that the continued intensive management at this site promotes FAC plant species to be dominant, yet not necessarily growing in hydric conditions (not functioning as hydrophytes), in which case these species are existing as phreatophytes. A hydrophyte is defined as “a plant that grows partly or totally submerged in water.”

From a statistical perspective, when facultative wetland plants dominate an area, they are just as likely to occur in uplands or wetlands (34-66 percent chance) and therefore lose their predictive value. Field inspection to determine the presence of hydric soil conditions and/or wetland hydrology can alleviate potential technical misinterpretation as to actual hydric/wetland conditions. If the FAC plant species are not growing as hydrophytes (and no other parameters are present, i.e. hydric soil and/or hydrology), then the area should therefore not be considered a wetland based on various descriptive verbage/definitions of wetlands, including language originating from the CCC and USACE.

3. Results

Table 1 quantifies a summary of upland areas mapped at the project site to date.

Table 1 Summary of Upland Results

Category	Acres
USACE/CCC Uplands	
Upland 1	3.28
Upland 2	0.70
Upland 3	0.46
Upland 4	0.23
Upland 5	0.34
Upland Total	**5.01**

The USACE jurisdiction defines a wetland based on the presence of all three wetland parameters, when the study area has normal circumstances and not significantly disturbed. The Commission defines a wetland based on the presence of one of the three wetland parameters. The method used

to identify USACE uplands (non USACE jurisdictional) on the project site are when at least one wetland characteristic of soil, hydrology, or vegetation are not present.

Current and historic land use practices in the vicinity of the site have consisted of active agricultural management primarily for cow/calf operations, and some areas have been disced and planted with agricultural pasture species with many portions of the project area being altered from a natural state. Cattle currently being grazed on the site may complicate identification of some plant species, can alter the vegetation composition, and often results in surface soil compaction (hoof punch) that can in turn create ephemeral surface ponding (from episaturation) that is not related to groundwater conditions (endosaturation). The wetland/upland determination is further complicated due to the seasonal nature of surface and/or groundwater and absence of hydrology within 12 inches of the soil surface in the fall months. Historically, in average winter rainfall, portions of the site have been reported as being temporarily flooded after storm events, particularly in lower lying portions of the site, yet hydrology parameters were not observed in many locations during the fall delineation efforts due to flashy nature of hydrology and active use of the site.

Wetlands observed at the site are palustrine emergent seasonal wetlands (NWI code PEM1Cd, National Wetlands Inventory 1987; Cowardin 1979) and USACE upland areas that are potentially considered jurisdictional (degraded/seasonal) according to Coastal Commission definitions. The upland areas are predominantly perennial grassland series within the open agricultural bottoms. The upland areas observed at the site consist predominantly of ruderal non-native vegetation (*Agrostis stolonifera-Festuca arundinacea* Semi-Natural Herbaceous Stands and *Holcus lanatus-Anthoxanthum odoratum* Semi-Natural Herbaceous Stands). The upland/wetland delineation field results are presented within Figure Set 3 (Appendix A). General descriptions of vegetation, soils, and hydrology site conditions observed are presented below, followed by more specific description of the upland areas mapped at the site.

3.1 Vegetation

Within the PSB, slightly lower elevation areas were presumed to be wetlands based on predominance of greater than 50 percent hydrophytic vegetation within the coastal zone consist of the following dominant species: buttercup (*Ranunculus repens,* FAC), Pacific silverweed (*Potentilla anserina* ssp. *pacifica*, OBL), perennial ryegrass (*Festuca perennis,* FAC), white clover (*Trifolium repens*, FAC), velvet grass (*Holcus lanatus*, FAC), dock (*Rumex transitorius*, FAC), soft chess (*Bromus hordeaceus*, FACU), and orchard grass (*Dactylis glomerata*, FACU). However, many of these plant species are also present in upland plots yet in conjunction with other species in most cases. Overall. few FACW or OBL plant species were present in the wetland plots.

Upland areas included many dominant FAC species listed above as observed in the wetland, as well as presence of some dominant upland species (UP and NL) which were used to define the wetland/upland boundary, including bull thistle (*Cirsium vulgare*, FACU), capeweed (*Arctotheca calendula*, NL), and prickly sow thistle (*Sonchus asper* ssp. *asper*, FACU). As previously mentioned, upland sample plots also included some dominant herbaceous species that are FAC or wetter such as dock (*Rumex transitorius*, FACW), velvet grass (*Holcus lanatus*, FAC)*,* buttercup (*Ranunculus repens*, FAC), and white clover (*Trifolium repens,* FAC).

The absence of wetland soil and wetland hydrology in upland areas corroborates the assumption that plants within some portions of the property that are listed as FAC are not actually growing as hydrophytes. This assumption is based on the definition that plants identified as FAC are just as likely to be found in both wetland and upland areas. The upland areas that did not have hydric soil or hydrology; yet with vegetation that fell on the cusp are an example of this condition (U1T2). From

a statistical perspective, when facultative wetland plants dominate an area, they are just as likely to occur in uplands or wetlands (34-66 percent chance) and therefore lose their predictive value. Field inspection to determine the presence of hydric soil conditions and wetland hydrology can alleviate potential technical misinterpretation as to actual hydric/wetland conditions. If the FAC plant species are not growing as hydrophytes (as no other wetland parameters are present, i.e. hydric soil nor wetland hydrology), then the area would therefore not be considered a wetland based on various descriptive verbage/definitions of wetlands, including language originating from the Commission and USACE.

3.2 Soil

In general, upland soils associated with transects did not meet hydric soil indicators due to either high matrix chroma ranging from 1-2 with some plots containing chroma of 3. Any redoximorphic features located in upland soils did not indicate a presence of hydric soils as there is not persistent moisture regime in these topographic, upland areas nor do they exhibit wetland hydrology.

The high chroma soils often had mixed color soil due to source material from levee construction and historic drainage and slough modifications at the site. Where redoximorphic features were observed, in some cases the contrast was faint and therefore did not meet wetland indicators, and/or the layer was not thick enough or close enough to the surface to meet hydric soil indicators. In some cases, redoximorphic features consisted of a thin band originating at the surface and therefore can be attributed to surface compaction.

Wetlands soils that did exhibit redoximorphic features were associated with having a Depleted Matrix (F3) and/or Redox Dark Surface (F6). Redox features consisted of 10-20 percent moisture color 7.5 yr 4/6.

3.3 Hydrology

The field work was conducted in the summer during an unusually dry period prior to onset of wet season conditions. Primary indicators that might be utilized as indicators of seasonal wetland hydrology during a normal year include Oxidized Rhizospheres along Living Roots (C3) and Depleted Matrix (F3). Only one secondary wetland hydrology indicator, (FAC-Neutral Test (D5)), was observed. On occasion, hydrology was assumed due to strong soil redox at 6-18 inches bgs and topographic position, particularly where conditions were observed in conjunction with predominance of FAC or wetter vegetation based on the predominance test and/or prevalence index.

The absence of wetland hydrology indicators and hydric soil confirmed the assumption that plants within some portions of the property that are listed as FAC are not actually growing as hydrophytes if the area lacks wetland hydrology and hydric soils. This assumption is based on the fact that plants identified as FAC are just as likely to be found in both wetland and upland areas.

4. Conclusions

Based on GHD 2015 upland/ wetland evaluation conducted in at the site, 5.01 acres of three-parameter uplands were mapped that meet USACE and Coastal Commission definitions and are non-jurisdictional. The identified upland areas are within a matrix of predominantly palustrine agricultural wetlands, ruderal transitional areas, brackish marsh, and slough channels. Additional upland areas exist on the site that were not mapped as part of the current effort, including the large

upland dune complex to the west and likely some additional upland micro-topographic areas within the predominant wetland and transitional matrix.

5. Special Terms and Conditions

To achieve the delineation objectives stated in this report, conclusions are based on the information available during the period of the investigation, June and September, 2015. This report does not authorize individuals to develop, fill or alter the wetlands delineated. Verification of the delineation by jurisdictional agencies, including the USACE and the California Coastal Commission may be necessary prior to the use of this report for site development purposes. Permits to affect wetlands must be obtained from the involved government agencies. If permits are obtained to develop the delineated wetlands after agency review, and with written verification, the delineation is given a five-year expiration period. If filling is used under permitted authority, care should be given to maintain a sufficient quantity of fill to prevent a reestablishment of wetlands. Land use practices and regulations can change thereby affecting current conditions and delineation results.

This report was prepared for the exclusive use of Russ Ranch and Timber. GHD is not liable for any action arising out of the reliance of any third party on the information contained within this report.

6. References

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors, 2012. *The Jepson Manual: Vascular Plants of California*, *Second Edition*. University of California Press, Berkeley

California Coastal Act, 1976. http://www.coastal.ca.gov/coastact.pdf.

California Coastal Commission, 1994. *Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone*. http://www.coastal.ca.gov/wetrev/wettitle.html.

Cowardin/United States Fish and Wildlife Service, 1979*. Classification of Wetlands and Deepwater Habitats of the United States*, FWS/OBS 79/31.

Gretag Macbeth, 2000. *Munsell Soil Color Charts.*

Lichvar, R.W, 2013. *The National Wetland Plant List: 2013 Wetland Ratings*. United States Department of the Army Corp of Engineers (USACE), Cold Regions Research and Engineering Laboratory (CRREL).Phytoneuron 2013-49: 1-241.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evans, 2009. *A Manual of California Vegetation, 2nd Edition*. California Native Plant Society. Sacramento, CA.

Soil Survey Staff,1992. *Keys to Soil Taxonomy*, 5th Edition, SMSS Technical Monograph No. 19, Blacksburg, Virginia.

U.C. Davis, 1965. *Soils of Western Humboldt County*. University of California at Davis, Department of Soils and Plant Nutrition, in Cooperation with County of Humboldt, California.

USACE, 2010*. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region.* J. S. Wakeley, R. W. Lichvar, and C. V. Noble, eds. Army Engineer Research and Development Center, U.S. Army Corps of Engineers (USACE).

USACE, 1987. *Wetlands Delineation Manual*, Tech. Rep 4-87-11987 United States Department of the Army Corps of Engineers (USACE).

USACE, 2013. *Waters of the United States and Geographic Extent*. United States Department of the Army Corps of Engineers (USACE). http://www.nwp.usace.army.mil/Missions/Regulatory/Jurisdiction.aspx

USFWS, 1987. *National Wetlands Inventory, Eureka Quad.* U.S. Fish and Wildlife Service (USFWS). Portland, OR.

6.1 Scope and limitations

This report: has been prepared by GHD for Russ Ranch and Timber and *may only be used and relied on by Russ Ranch and Timber for the purpose agreed between GHD and the Russ Ranch and Timber. GHD otherwise disclaims responsibility to any person other than Russ Ranch and Timber arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report does not authorize individuals to develop, fill or alter the wetlands delineated. Verification of the delineation by jurisdictional agencies is necessary prior to the use of this report for planning and site development purposes. Permits to affect wetlands must be obtained from the involved agencies. If permits are obtained to develop the delineated wetlands after agency review, and with written verification, the delineation is given a five-year expiration period.

Appendices

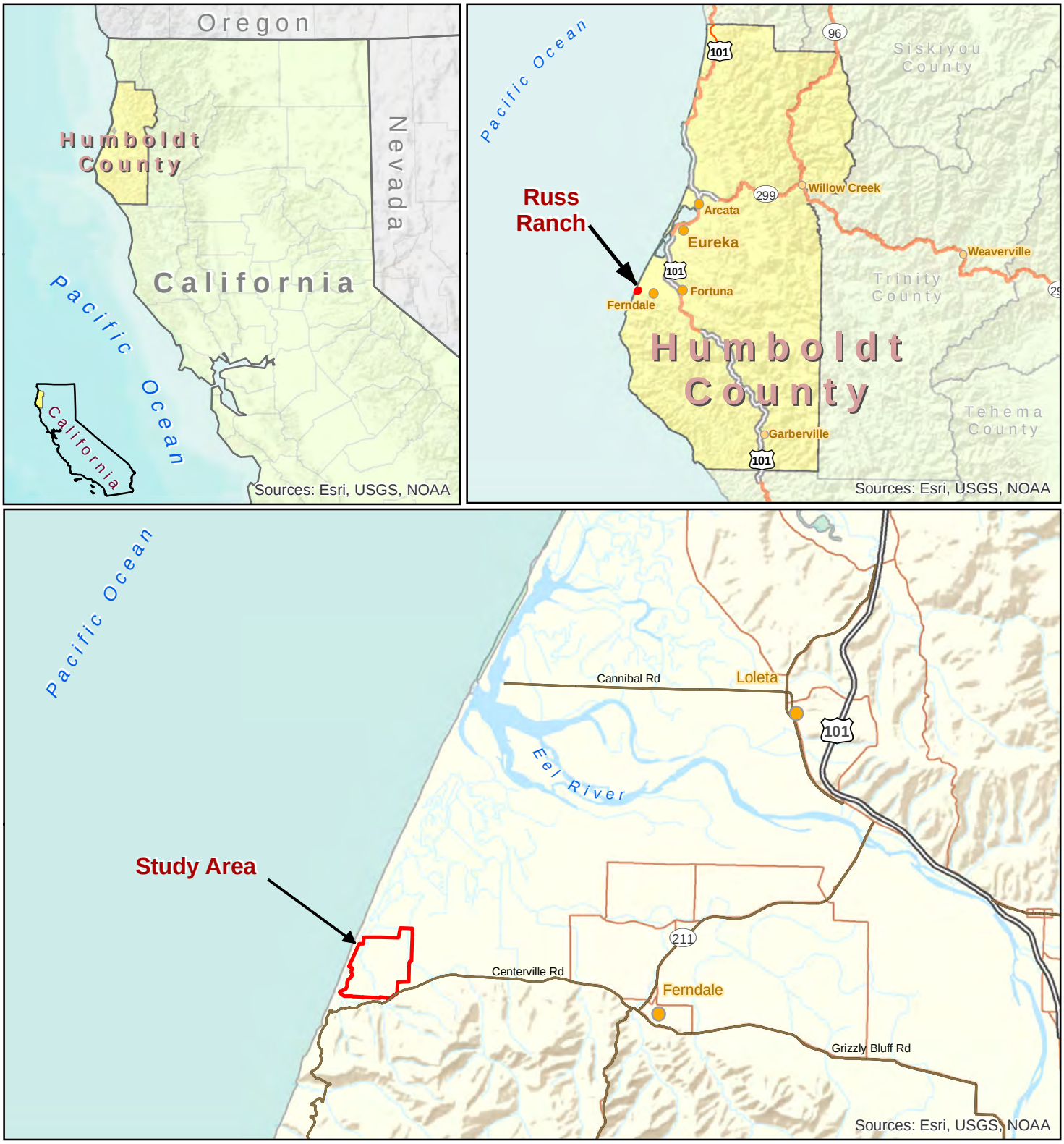
Appendix A - (Figures)

Figure 1. Project Vicinity and Location

Figure 2. Upland Delineation Overview

Figure 3.1. Upland Delineation Results Key Map

Figure 3.2 – 3.3. Upland Delineation Results



Study Area
Humboldt County
Counties
Freeway
Highway
Roadway
Streams

Paper Size ANSI A
0 0.5 1 2 3
Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Russ Ranch
Vegetation/Habitat Mapping

Job Number	84-10882-07
Revision	1
Date	16 Sep 2015

Project Vicinity and Location

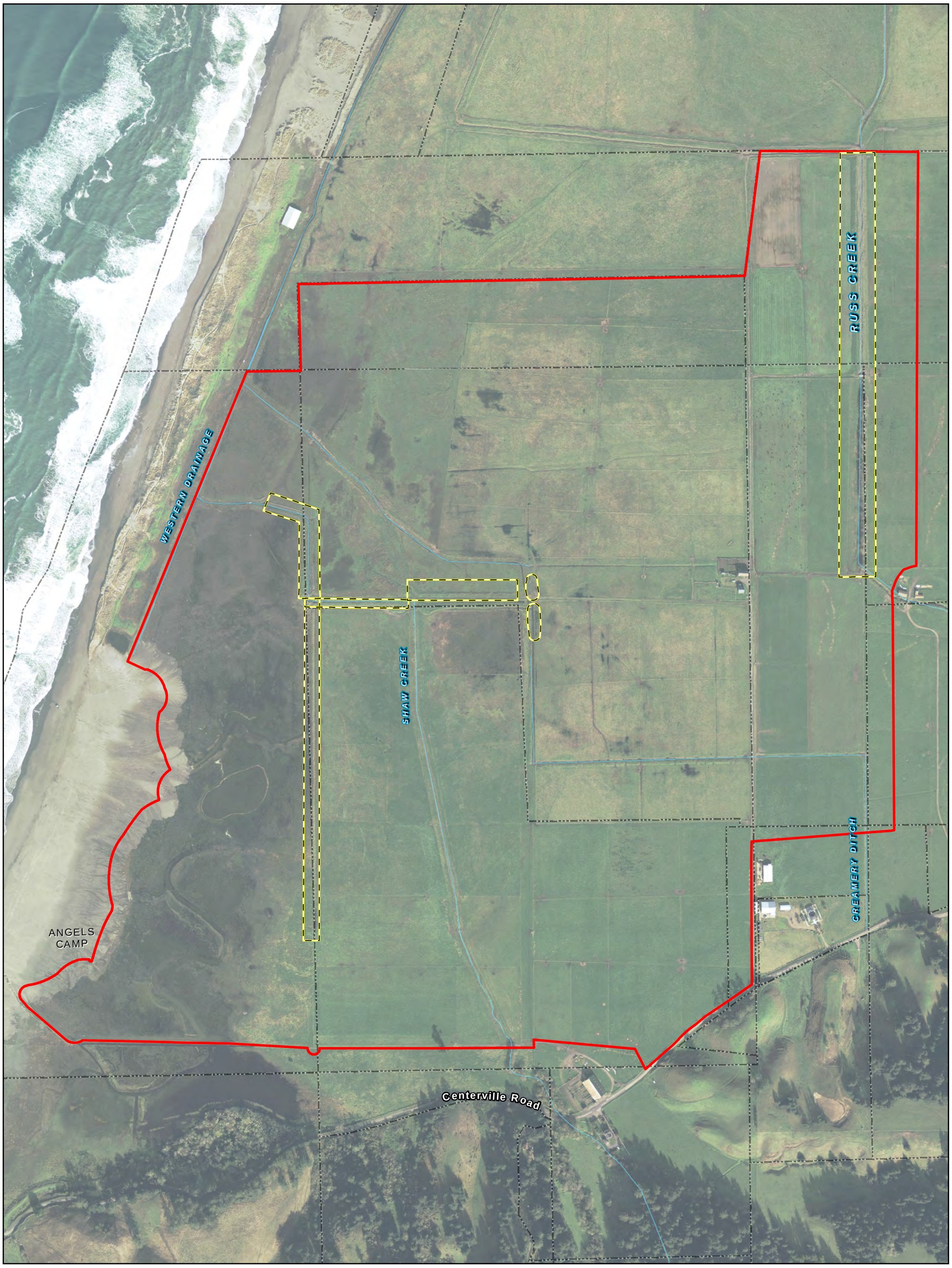
Figure 1

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F1_Vicinity.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:porogers



Upland Delineation Study Area

Upland Survey Boundary

Property Boundary (Reference: Humboldt County Parcel Data)

Paper Size 11" x 17" (ANSI B)

0 100 200 400 600 800 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-07
Revision	A
Date	18 Sep 2015

Upland Delineation Overview

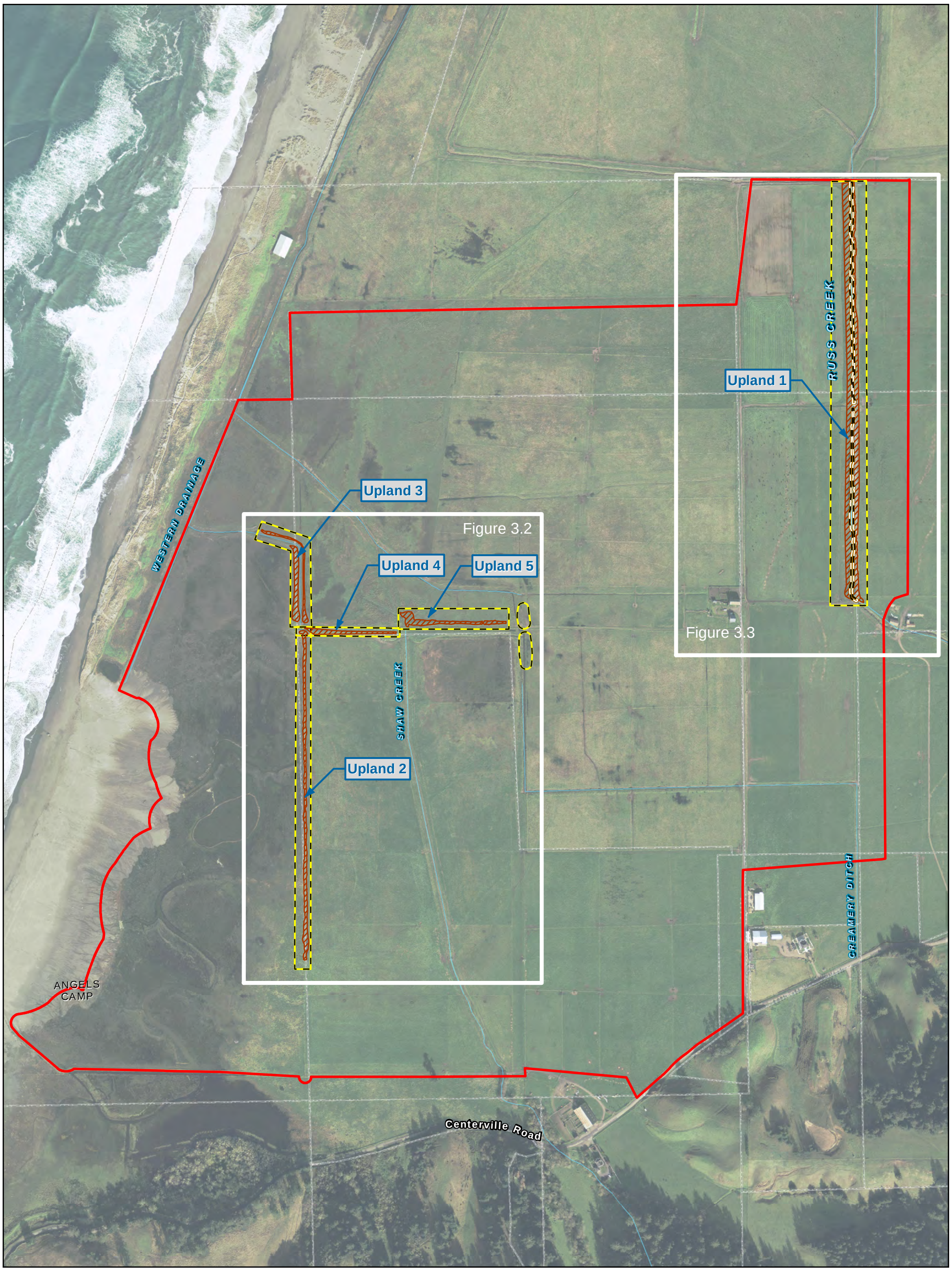
Figure 2

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Upland Delineation\F2_StudyAreaOverview.mxd

718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:gldavidson



Upland Boundary | Upland | Other Waters of the US | Upland Survey Boundary | Upland Delineation Study Area

Paper Size 11" x 17" (ANSI B)

0 250 500 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number 84-10882-07
Revision B
Date 18 Sep 2015

Upland Delineation Results Key Map

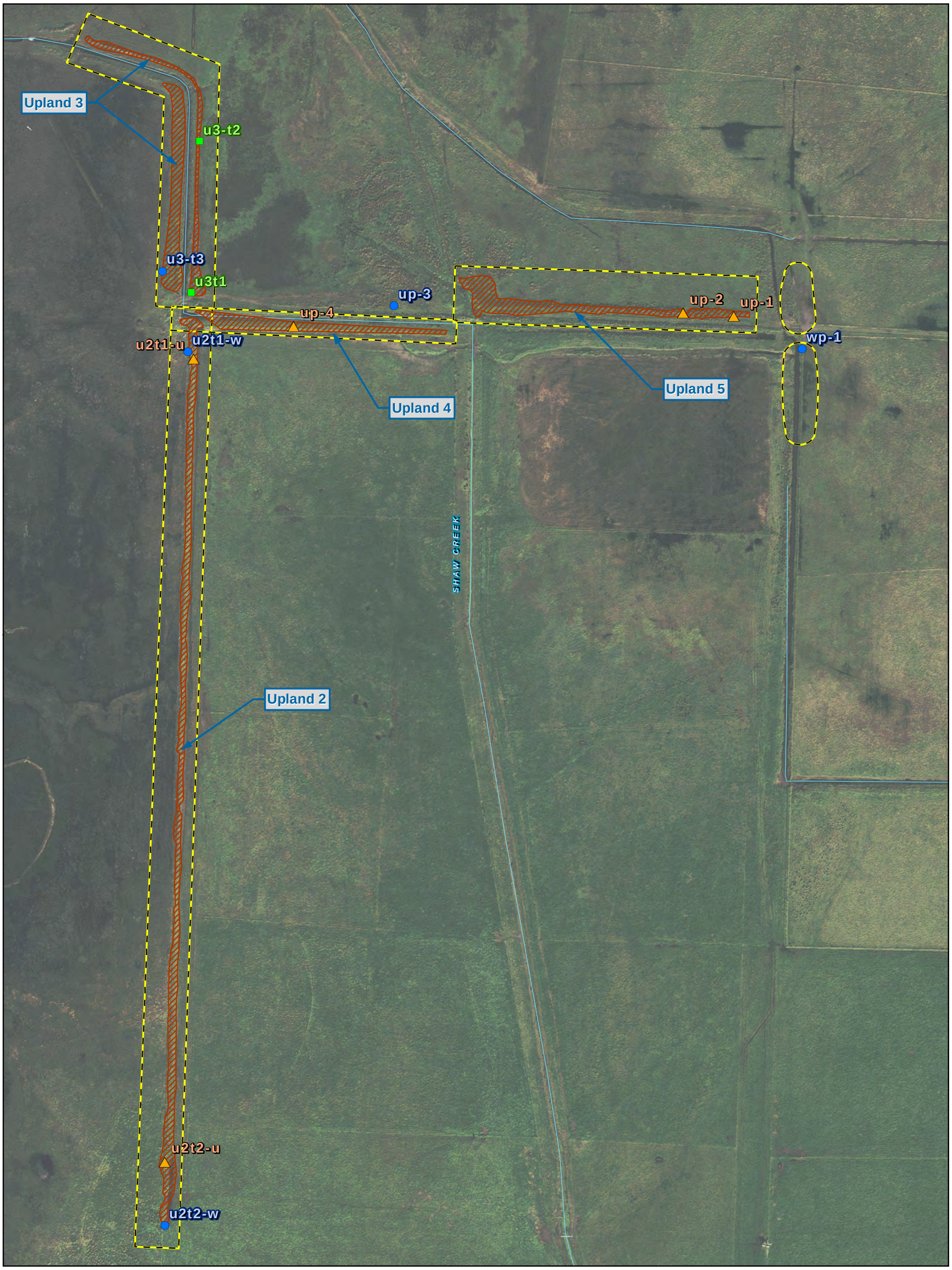
Figure 3.1

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Upland Delineation\F3.1_UplandDelineationResults.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:gldavidson



upland plot
wetland plot
transect boundary point
Upland
Other Waters of the US
Upland Survey Boundary

Paper Size 11" x 17" (ANSI B)
0 50 100 200
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number 84-10882-07
Revision B
Date 18 Sep 2015

Upland Delineation Results

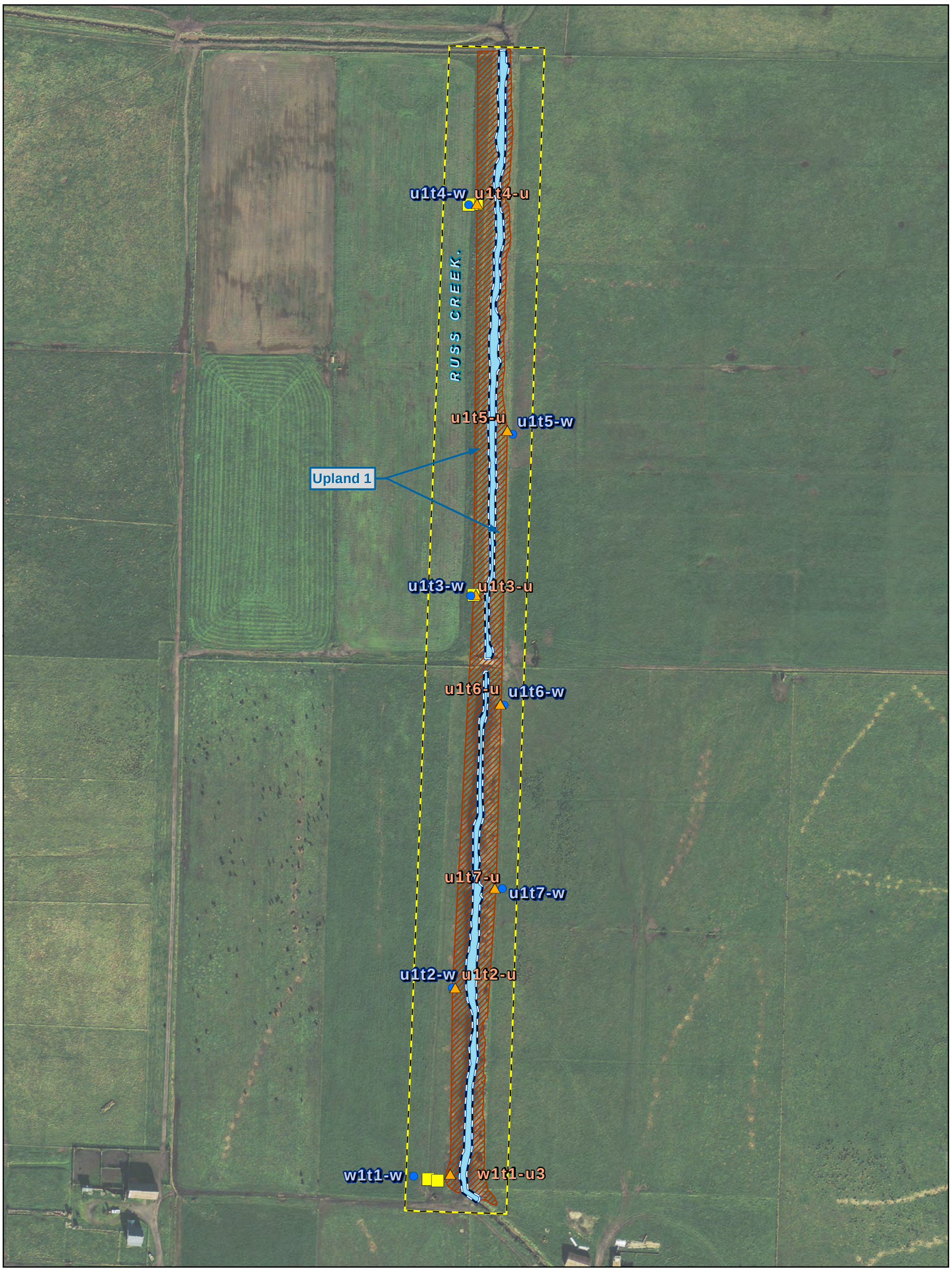
Figure 3.2

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Upland Delineation\F3.2_UplandDelineationResults.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:gldavidson



Wetland Plot | One Parameter Soils | Upland | Upland Survey Boundary

Upland Plot | Upland Boundary | Other Waters of the US | Study Area

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Upland Delineation Results

Job Number	84-10882-07
Revision	A
Date	18 Sep 2015

Figure 3.3

G:\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\Upland Delineation\F3.3_UplandDelineationResults.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:gldavidson

Appendix B - (Data Sheets)

Wetland Determination Data Forms – Western Mountains, Valleys, and Coast Region

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: #EELEP City/County: Ferndale, Hum Sampling Date: 6-2-15

Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: W1 T1-W1

Investigator(s): CS & LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? ND (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Dactylis glom	20	D	FACU
2. Ranunculus repens	15		FAC
3. Cirsium vulgare	5		FACU
4. Rumex transitorius	5		FACW
5. Ecchrea perra	25	D	FAC
6. Poa compressa	20	D	FACU
7. Trifol repens	10		FAC
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	50	x 3 =	150
FACU species	45	x 4 =	180
UPL species	0	x 5 =	0
Column Totals:	100 (A)		23 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL

Sampling Point: UITI-U1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR3/2	100	–	0	–	–	silt loam	
2-4	2.5Y4/2	95	10YR3/3	5	C	M	"	faint redox
4-9	10YR3/2	98	10YR3/3	2	C	M	"	faint redox
9-16	10YR3/2	95	10YR3/4	5	C	M		distinct redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
9-16" does not meet F6 b/c not thick enough w/ 12" of surface
4-9" does not meet F6 b/c faint
2-4 does not meet F6 b/c high value, + not F3 b/c faint

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
dry season, Lush vegetation and no signs of ponding or cattle hoof marks
Near toe of berm along Russ Cr., soil may be surface manipulated/mixed thus layering w/ faint redox

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: RU EREP City/County: Fendale HUM Sampling Date: 6-2-15

Applicant/Owner: Ross Ranch & Timber State: CA Sampling Point: U1T1-U2

Investigator(s): CS & LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): convex Slope (%): < 5

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	Is the Sampled Area within a Wetland? Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Arctotheca calendula	20	D	NL
2. Festuca arundinacea	20	D	FAC
3. Rumex transitorius	15		FACW
4. Festuca arundinacea	20	D	NL
5. Trif. repens	10		FAC
6. Malva nicaensis	5		NL
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	15	x 2 = 30
FAC species	30	x 3 = 90
FACU species	0	x 4 = 0
UPL species	45	x 5 = 225
Column Totals:	90 (A)	345 (B)

Prevalence Index = B/A = 3.83

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- ____ 2 - Dominance Test is >50%
- ____ 3 - Prevalence Index is ≤3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ 5 - Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

SOIL

Sampling Point: U1T1-U2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100	—	0	—	—	silt loam	—
5-8	2.5Y 3/2	95	10YR 3/3	5	C	M	silt loam	faint redox
8-16	2.5Y 4/2	98	10YR 3/3	2	C	M	"	faint redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet F6 b/c 8-16" layer redox is faint. Does not meet F3 b/c 5-8" layer is not thick enough + redox are faint.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Mid topo on berm along Russ Cr.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Russ Ranch & Timber City/County: Ferndale HUM Sampling Date: 6-2-15
Applicant/Owner: Jay Russ ERLEP State: CA Sampling Point: U1 T1 - U3
Investigator(s): CS & LW Section, Township, Range:
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): convex Slope (%): <5
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	Is the Sampled Area within a Wetland? Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Rumex transitorius	10		FACW
2. Dactylis glom	20	D	FACU
3. Ranunculus repens	10		FAC
4. Trifolium repens	10		FAC
5. Festuca perenne	25	D	FAC
6. Poa compressa	5		FACU
7. Holcus lanatus	20	D	FAC
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	65	x 3 =	195
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	100 (A)		315 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- ____ 2 - Dominance Test is >50%
- ____ 3 - Prevalence Index is ≤3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ 5 - Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

not growing as hydrophyte

SOIL

Sampling Point: UT1-U3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y4/2	98	10YR3/3	2	C	M	loamy sand	faint redox (spotty/discontinuous)

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet S5 b/c faint redox (not enough contrast). Also redox are spotty/discontinuous, possibly from surface compaction

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERLEP City/County: Fendale HUM Sampling Date 6-2-15
Applicant/Owner: Russ Ranch + Timber State CA Sampling Point: V1T1-W1
Investigator(s): CS & LW Section, Township, Range: _____
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? Yes X No _____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Infolium repens	15		FAC
2. Festuca perennis	60	D	FAC
3. Ranunculus repens	10		FAC
4. Rumex transitorius	5		FACW
5. Poa compressa	10		FACU
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	5	x 2 = 10
FAC species	85	x 3 = 255
FACU species	10	x 4 = 40
UPL species	–	x 5 = –
Column Totals:	100 (A)	305 (B)

Prevalence Index = B/A = 3.05

Hydrophytic Vegetation Indicators:

X 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:
~~Vegetation not growing as hydrophytes~~

SOIL

Sampling Point: UT1-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/2	100	—	0	—	—	silt loam	—
7-16	2.5Y 3/2	95	7.5YR 3/3	5	C	M	silt	root linings 10YR 3/3 2%

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Facultative vegetation dominates, not strongly hydrophytic

~~hydrology, wetland indicators not observed~~

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERLEP City/County: Ferndale HUM Sampling Date: 6-2-15
Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: DIT2-U1
Investigator(s): CS & LW Section, Township, Range: _____
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): convex Slope (%): <5
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca arundin	25	D	NL
2. Plant vulgaris	15		FAC
3. Trif repens	20	D	FAC
4. Rumex transitorius	5		FACW
5. Holcus lanat	5		FAC
6. Poa compressa	5		FACU
7. Dactylis glom	5		FACU
8. Festuca perenn	20	D	FAC
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	5	x 2 = 10
FAC species	95	x 3 = 285
FACU species	10	x 4 = 40
UPL species	25	x 5 = 125
Column Totals:	135 (A)	460 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

vegetation not growing as hydrophytes, Facultative species dominant

SOIL

Sampling Point: UIT 2-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100	–	0	–	–	loam	
5-10	2.5Y 3/3	99	10YR 3/4	1	C	M	loamy sand	faint redox
10-16	5Y 4/2	98	10YR 3/4	2	C	M	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet S5 b/c not enough contrast and <2%
does not meet F6 @ 10" b/c would have to start at 8" (not thick enough)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R EREP City/County: Fendale HUM Sampling Date: 6-2-15

Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: U1 T2-W

Investigator(s): Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): convex Slope (%): <5

Subregion (LRR): Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? ND Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? ND (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? (Soil/Veg) CC USACE Yes X No X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: ____)			
1. Holcus lanatus	40	D	FAC
2. Trifolium repens	15		FAC
3. Festuca perennis	20	D	FAC
4. Poa compressa	10		FACU
5. Ranunculus repens	15		FAC
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum Ø

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	90	x 3 =	270
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	100 (A)		310 (B)

Prevalence Index = B/A = 3.10

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- ____ 2 - Dominance Test is >50%
- ____ 3 - Prevalence Index is ≤3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ 5 - Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: U1T2-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
5-16	5Y3/2	95	10YR3/3	5	C	M	Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Vegetation dominant is all FAC (not strongly wetland
Near toe of berm
Densely vegetated, not signs of hydrology indicators

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ERP City/County: Ferndale HUM Sampling Date: 6-2-15
Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: U1T3-U
Investigator(s): CS + LW Section, Township, Range: _____
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Convex Slope (%): _____
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca perenne	30	D	FAC
2. Dactylis glom.	25	D	FACU
3. Poa compressa	20	D	FACU
4. Bromus hord.	5		FACU
5. Geranium dissect	5		NL
6. Ranunculus repens	10		FAC
7. Rumex crispus	5		FACW
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL

Sampling Point: UIT3-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	2.5Y3/3	98	10YR3/3	2	C	M	loam	faint (in pockets)
7-16	2.5Y3/3	95	10YR3/4/5Y4/2	5	C/R	M	loamy sand	soil mixed/layered

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
Chroma too high and contrast too low to meet F6 (0-6")
does not meet S5 b/c not w/in 6" of surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERLEP City/County: Ferndale HUM Sampling Date: 6-2-15

Applicant/Owner: NSS Ranch & Timber State: CA Sampling Point: U1T3-W

Investigator(s): CS & LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	Is the Sampled Area within a Wetland? Yes ☆ No X
Hydric Soil Present?	Yes X	No ____	☆Yes- ccc definition (soils) NO=USACE
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
one parameter wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Poa compressa	25	D	FACU
2. Rumex ~~Patis formtans~~	5		FACW
3. Brom hord	10		FACU
4. Ranun repens.	10		FAC
5. Festuca perenne.	20	D	FAC
6. Dactylis glom	20	D	FACU
7. Cirsium vulgare	5		FACU
8.			
9.			
10.			
11.			
	95 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

SOIL

Sampling Point: UT3-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	2.5Y 3/2	100	—	0	—	—	loam	
7-15	5Y 4/2	95	10YR 3/3	5	C	M	"	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: Soil features could be remnant, lots of soil texture mixing b/w silt + fine sand (= loam)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: RL ERE P City/County: Fernak Hum Sampling Date: 6-2-15
Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: D1T4-1
Investigator(s): CS & LW Section, Township, Range: _____
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Trifolium repens	20	D	FAC
2. Holcus lanatus	20	D	FAC
3. Festuca perennis	20	D	FAC
4. Grindelia stricta	5		N
5. Poa compressa	15		FACU
6. Dactylis glom.	15		FACU
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	30	x 2 = 60
FAC species	60	x 3 = 90
FACU species	0	x 4 =
UPL species	5	x 5 = 25
Column Totals:	100 (A)	175 (B)

Prevalence Index = B/A = 1.75

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- N 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
* Vegetation not acting as hydrophytes / seeded in

SOIL

Sampling Point: WT4-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5Y 3/2	99	2.5Y 4/4	1	C	M	Sandy loam	pockets of
6-18	2.5Y 3/3	100	—	0	—	—	loamy sand	color variation

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R EREP City/County: Ferndale HUM Sampling Date: 10-2-15

Applicant/Owner: Ross Ranch + Timber State: CA Sampling Point: U1T4-W

Investigator(s): CS + LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? CC (soils) (USACE) Yes X No X
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Poa compressa	25	D	FACU
2. Dactylis glom	20	D	FACU
3. Daucus carota	10		FAC
4. Trifol. repens	20	D	FAC
5. Festuca perenn	20	D	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	50	x 3 = 150
FACU species	45	x 4 = 180
UPL species	0	x 5 = 0
Column Totals:	95 (A)	330 (B)

Prevalence Index = B/A = 3.47

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Vegetation not growing as hydrophytic PI = 3.4

SOIL

Sampling Point: 2PT4-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y3/1	95	10YR3/3	5	C	M	silt loam	distinct
4-16	5Y4/2	95	10YR3/4	5	C	M	"	prominent

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
dense vegetation, although lower beyond toe of berm, there are not primary or secondary hydrology parameters apparent. Assume only soils (vege is upland)

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: PL EPLEP City/County: Fendale HUM Sampling Date: 6-2-15
Applicant/Owner: PWJ Ranchet Timber State: CA Sampling Point: UITS-U
Investigator(s): CS FIW Section, Township, Range: _____
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Linear/Linear Slope (%): 0
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Hordeum compressum	40	D	FACU
2. Festuca perennis	35	D	FAC
3. Rumex ~~spectabilis~~ transl.	10		FACW
4. Trifolium repens	10		FAC
5. Ranunculus repens	5		FAC
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of		Multiply by:
OBL species	0	x 1 = 0
FACW species	10	x 2 = 20
FAC species	50	x 3 = 150
FACU species	40	x 4 = 160
UPL species	0	x 5 =
Column Totals:	100 (A)	330 (B)

Prevalence Index = B/A = 3.3

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- NO 2 - Dominance Test is >50%
- NO 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
Vegetation not acting as hydrophytes

SOIL

Sampling Point: UT5-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 3/2	100	—	0	—	—	silt	
2-11	2.5Y 3/2	98	10YR 3/3	2	C	M	silt loam	faint
11-16	2.5Y 4/1	98	10YR 3/3	2	C	M	"	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

does not meet F3 b/c does not start in <10" bgs.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R PREP City/County: Fendale HUM Sampling Date: 6-2-15

Applicant/Owner: Mos Ranch & Timber State: CA Sampling Point: U1+S 70 W?

Investigator(s): CS + LW Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): _____ Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	Is the Sampled Area within a Wetland? Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Dactylis glom	25	D	FACU
2. Festuca perenne	25	D	FAC
3. Trifolium repens	20	D	FAC
4. Poa Compressa	15		FACU
5. Alopecurus saccatus	5		FAC
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

veg acting as hydrophytic

SOIL

Sampling Point: UIT5-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 3/1	100	–	0	–	–	Silt loam	low chroma due to A+OM
2-16	5Y 4/2	98	2.5Y 4/4	2	C	M	"	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

densely vegetated, ∅ hydrology indicators

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Russ EREP City/County: Ferndale Hum Sampling Date: 6/3/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: U1T6-U

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): flood plain Local relief (concave, convex, none): _____ Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca perennis	30	D	FAC
2. Poa compresa (bulbous rooted)	35	D	FACU
3. Holcus lanatus (velvet grass)	15		FAC
4. Trifolium repens	15		FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	100 = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	35	x 4 =	140
UPL species	–	x 5 =	–
Column Totals:	95 (A)		320 (B)

Prevalence Index = B/A = 3.37

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Vegetation not acting as hydrophytes

SOIL

Sampling Point: UT6-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 3/2	100	–	0	–	–	Silt loam	
4-18	2.5Y 3/2	88	10YR 3/3	10	C	M	"	10YR 4/4 2% C/M 10% faint, 2% distinct

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks:

does not meet F6 b/c distinct redox are <5%, and other redox @ 10% are faint

does not meet F3 b/c not depleted matrix (value <4)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): _____

Water Table Present? Yes ____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ELEP City/County: Ferndale / Humboldt Sampling Date: 6/3/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: UT6 - W

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): flood plain Local relief (concave, convex, none): _____ Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	Is the Sampled Area within a Wetland? CC(soils hydro) USACE Yes X No X
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Ranunculus repens	15	D	FAC
2. Trifolium repens	15	D	FAC
3. Poa compressa	25	D	FACU
4. Alopecurus saccatus	10		FAC
5. Festuca perennis	30	D	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	0	x 2 = _____
FAC species	70	x 3 = 210
FACU species	25	x 4 = 100
UPL species	0	x 5 = _____
Column Totals:	95 (A)	310 (B)

Prevalence Index = B/A = 3.26

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- N 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

veg. not acting as hydrophyte

SOIL

Sampling Point: UT6-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR3/2	100	—	0	—	—	Silt loam	
2-5	5Y4/2	90	2.5Y 3/3	10	C	M	Sandy loam (VFS)	faint redox
5-18	5Y4/1	85	10YR3/3	15	C	M	Silt loam	prominent redox ox rhyzo @ 7"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale / Humboldt Sampling Date: 6/3/15

Applicant/Owner: Ross Ranch + Timber State: CA Sampling Point: VIT7-U

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): _____ Slope (%): 4

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Holcus lanatus	75	D	FAC
2. Festuca perenn	15		FAC
3. Poa compressa	10		FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	90	x 3 = 270
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	100 (A)	310 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X ✱

Remarks:

✱ veg. not growing as hydrophytes, dominated by single FAC species

SOIL

Sampling Point: U17-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y3/2						silt loam	
8-11	2.5Y3/2	98	10YR3/3	2	C	M	"	faint redox
11-18	2.5Y3/2	95	7.5YR3/3	5	C	M	"	distinct redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale, Humboldt Sampling Date: 6/3/15

Applicant/Owner: Ross Ranch Timber State: CA Sampling Point: U1T7-W

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): flood plain Local relief (concave, convex, none): _____ Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:
PEM1 A f

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Poa compressa	30	D	FACU
2. Festuca perennis	20	D	FAC
3. Rumex ~~salicifolius~~ transi.	5		FACW
4. Trifolium repens	10		FAC
5. Ranunculus repens	15	D	FAC
6. Holcus lanatus	5		FAC
7. Cirsium vulgare	5		FACU
8.			
9.			
10.			
11.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	5	x 2 = 10
FAC species	85	x 3 = 255
FACU species	5	x 4 = 20
UPL species	—	x 5 = _____
Column Totals:	95 (A)	285 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:
veg. acting as hydrophytes

SOIL

Sampling Point: UT 7-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/2	100	—	0	—	—	Silt loam	
3-7	2.5Y 3/2	90	10YR 3/3	10	C	M	"	faint redox
7-18	5Y 4/1	90	10YR 3/3	10	C	M	"	ox rhizo 10YR 3/3 prominent redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ERED City/County: Ferndale / Humboldt Sampling Date: 6/4/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: WETL-U

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee Local relief (concave, convex, none): convex/linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? N Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 1)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: 1)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Bromus hordeaceus	25	D	FACU
2. Rumex ~~sclerus~~ crispus	10		FACW
3. Festuca perennis	35	D	FAC
4. Sonchus asper	15		NL
5. Hordeum marinum	4		FAC
6. Cirsium vulgare	10		FACU
7. Geranium dissectum	1		NL
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: 1)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	10	x 2 = 20
FAC species	39	x 3 = 117
FACU species	35	x 4 = 140
UPL species	16	x 5 = 80
Column Totals:	100 (A)	357 (B)

Prevalence Index = B/A = 3.57

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- N 2 - Dominance Test is >50%
- N 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: U2T1-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y3/2	100	—	0	—	—	loam	
3-12	2.5Y3/2	95	10YR3/3	5	C	M	silt loam	faint redox
12-18	2.5Y3/2	100	—	0	—	—	Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ERED City/County: Ferndale / Humboldt Sampling Date: 6/4/15

Applicant/Owner: Russ Rock + Timber State: CA Sampling Point: U2T1-W

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee Local relief (concave, convex, none): Concave/linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology no significantly disturbed? N Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology no naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Potentilla anserina	55	D	OBL
2. Sanchus asper	15		NL
3. Geranium dissectum	10		NL
4. Cirsium vulgare	5		FACU
5. Festuca perennis	5		FAC
6. Holcus lanatus	5		FAC
7. Poa compressa	5		FACU
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	55	x 1 = 55
FACW species	0	x 2 =
FAC species	10	x 3 = 30
FACU species	10	x 4 = 40
UPL species	25	x 5 = 125
Column Totals:	100 (A)	250 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

veg. acting as hydrophytes

SOIL

Sampling Point: U2T-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/2	98	10YR 3/4	2	C	M	silt loam	distinct redox
3-18	2.5Y 4/1	95	10YR 4/4	5	C	M	"	prominent redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
assumed hydrology due to topography (toe of slope adjacent to salt marsh edge/fringe), strong hydric soils, and hydrophytic veg dominance

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale/Humboldt Sampling Date: 6/4/15

Applicant/Owner: Russ Rand + Timber State: CA Sampling Point: U2T2-U

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): end of levee Local relief (concave, convex, none): Convex / linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca perennis	65	D	FAC
2. Trifolium repens	5		FAC
3. Holcus lanatus	15		FAC
4. Potentilla anserina	5		OBL
5. Poa compressa	10		FACU
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	5	x 1 = 5
FACW species	0	x 2 = 0
FAC species	85	x 3 = 255
FACU species	10	x 4 = 40
UPL species	–	x 5 =
Column Totals:	100 (A)	300 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X*

Remarks:

*veg. not growing as hydrophytes, right on edge for PI, dominated by 1 FAC. species that is planted

SOIL

Sampling Point: U2T2-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR3/2	100	—	—	—	—	loam	
4-8	10YR3/2	98	7.5YR3/3	2	C	M	silt loam	faint redox
8-16	10YR2/2	98	10YR3/3	2	C	M	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
does not meet F6 b/c faint redox and <5%.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale / Humboldt Sampling Date: 6/4/18

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: U2T2-W

Investigator(s): Jordan Mayer Section, Township, Range: _____

Landform (hillslope, terrace, etc.): levee transition to field Local relief (concave, convex, none) Concave / linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca perennis	35	D	FAC
2. Ranunculus repens	15		FAC
3. Poa compressa	10		FACU
4. Rumex ~~sativus~~ crispus	15		FACW
5. Holcus lanatus	20	D	FAC
6. Trifolium repens	5		FAC
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	15	x 2 = 30
FAC species	75	x 3 = 225
FACU species	10	x 4 = 40
UPL species	–	x 5 = _____
Column Totals:	100 (A)	295 (B)

Prevalence Index = B/A = 2.95

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

Veg. acting as a hydrophyte

SOIL

Sampling Point: U2T2-WD

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y3/2	100	—	0	—	—	loam	
3-6	2.5Y3/2	98	10YR3/3	2	C	M	"	faint redox
6-18	5Y4/2	95	10YR3/6	5	C	M	"	prominent redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

* assume subsurface hydrology due to strong soil redox 6-18" bgs. Surface is well vegetated w/no visible signs of surface hydro

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale / Humboldt Sampling Date: 6/3/15

Applicant/Owner: Russ Ranch - Timber State: CA Sampling Point: UP-1

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): road berm Local relief (concave, convex, none) Convex/linear Slope (%): 1

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology NO significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: _____)			
1. Juncus c.f. patens	10		FACW
2. Trifolium wormskioldii	35	D	FACW
3. Speraulonca macrothecu	2		FAC
4. Festuca macrostachys	35	D	NL
5. Festuca perennis	5		FAC
6. Holcus lanatus	5		FAC
7. Medicago polymorpha	8		FACU
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	35	x 2 = 70
FAC species	12	x 3 = 36
FACU species	8	x 4 = 32
UPL species	35	x 5 = 175
Column Totals:	90 (A)	313 (B)

Prevalence Index = B/A = 3.48

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: UP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	2.5Y4/2	100	—	0	—	—	loam	
5-10	2.5Y4/2	60	—	40			loam	clods of 2.5Y4/2 silt loam w/ 2% 10YR3/3
10-16	2.5Y3/2	90	10YR3/3	10	C	M	silt loam	faint redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: 5-10" soil mixed in texture + color w/ clods of non insitu soil (~40%)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: top of road berm, upland topo/vege/soils indicates not likely wetland hydrology.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale / Humboldt Sampling Date: 6/3/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: UP-2

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): road berm Local relief (concave, convex, none) Convex / linear Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	Is the Sampled Area within a Wetland? Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Anthoxanthum odoratum	15	D	FACU
2. Hypochaeris radicata	10		FACU
3. Bellis perennis	15	D	NL
4. Cirsium vulgare	15	D	FACU
5. Juncus effusus	20	D	FACW
6. Medicago polymorpha	5		FACU
7. Trifolium repens	10		FAC
8. Festuca perennis	10		FAC
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	20	x 2 = 40
FAC species	20	x 3 = 60
FACU species	45	x 4 = 180
UPL species	15	x 5 = 75
Column Totals:	100 (A)	355 (B)

Prevalence Index = B/A = 3.55

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: UP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	2.5Y4/1	95	10YR3/3	5	C	M	silt loam	distinct redox
1-3	2.5Y3/2	100	—	0	—	—	loam (VFS)	
3-18	2.5Y4/2	98	10YR3/3	2	C	M		2% 2.5Y4/1 R/M faint redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (except MLRA 1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No X

Remarks:
3-18" does not meet F3 b/c faint redox concentrations

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): _____

Water Table Present? Yes ____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ERED City/County: Ferndale / Humboldt Sampling Date: 6/4/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: UP-3

Investigator(s): Jordan Mayer Section, Township, Range: _____

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): _____ Slope (%): 1

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology no significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology no naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	Is the Sampled Area within a Wetland? C.C. (soils) ACE (plants) Yes X No X
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. Juncus c.f. patens	20	D	FACW
2. Trifolium repens	23	D	FAC
3. Geranium dissectum	5		NL
4. Holcus lanatus	25	D	FAC
5. Bromus microstachys	20	D	NL
6. Bellis perennis	2		NL
7. Hypochoeris radicata	5		FACU
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	20	x 2 = 40
FAC species	48	x 3 = 144
FACU species	5	x 4 = 20
UPL species	27	x 5 = 135
Column Totals:	100 (A)	339 (B)

Prevalence Index = B/A = 3.39

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks:

SOIL

Sampling Point: UP 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR3/2	100	—	0	—	—	loam	
2-7	5Y4/2	90	10YR3/4	10	—	—	silt	prominent redox
7-18	5Y4/1	90	2.5Y3/3	5	C	M (distinct)	sand mixed w/ silt	50/50
sand	2.5Y3/3	5		—	—			

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:
7-18" mixed, not in situ due to sand clods 50% with high chroma

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: ERED City/County: Ferndale / Humboldt Sampling Date: 6/4/15
Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: UP-4
Investigator(s): Jordan Mayor Section, Township, Range: _____
Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): Convex/linear Slope (%): 0
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology ND significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology ND naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No Y	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No Y	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Holcus lanatus	30	D	FAC
2. Bromus hordeaceus	30	D	FACU
3. Festuca perinnis	15		FAC
4. Trifolium repens	15		FAC
5. Poa pampestris	10		FACU
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = _____
FACW species	0	x 2 = _____
FAC species	60	x 3 = 180
FACU species	40	x 4 = 160
UPL species	–	x 5 = _____
Column Totals:	100 (A)	340 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:
veg. not acting as hydrophytes

SOIL

Sampling Point: UP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR3/2	100	—	0	—	—	loam	
3-8	10YR3/2	98	7.5YR3/3	2	C	M	silt loam	faint redox
8-18	2.5Y3/2	93	10YR3/3	5	C	M	"	faint redox w/ 5Y5/1 2%

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: topo high, elevated from pasture, does not appear to flood in adjacent well vegetated pasture

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: EREP City/County: Ferndale / Humboldt Sampling Date: 6/3/15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: WP-1

Investigator(s): Jordan Mayor Section, Township, Range: _____

Landform (hillslope, terrace, etc.): berm along ditch Local relief (concave, convex, none): _____ Slope (%): 0

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology NO naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes ✓ No _____
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Potentilla (Argentina) anserina	55	D	OBL
2. Eleocharis palustrus	15		OBL
3. Rumex ~~Cattleum~~ transi.	10		FACW
4. Poa compressa	5		FACU
5. Festuca perin	5		FAC
6. Holcus lanatus	10		FAC
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	70	x 1 = 70
FACW species	10	x 2 = 20
FAC species	15	x 3 = 45
FACU species	5	x 4 = 20
UPL species	—	x 5 = —
Column Totals:	100 (A)	155 (B)

Prevalence Index = B/A = 1.55

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

veg. acting as a hydrophyte

SOIL

Sampling Point: WP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	5Y4/1	90	10YR3/3	10	C	M	silt loam	distinct redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): 14

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 12

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R FREP City/County: Fondlo, HUM Sampling Date: 9-17-15

Applicant/Owner: Rusk Ranch & Timber State: CA Sampling Point: U3T1-U

Investigator(s): MS & CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain. Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: test pit ≈ 4 feet from boundary

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Hordeum marinum.	60	D	FAC
2. Cynodon dactylus	20	D	NL
3. Crsium vulgare.	20	D	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ✓ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: 4 feet

SOIL

9/17/15 Sampling Point: U3T1-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5Y 4/2	100					silt loam	
6-14	2.5Y 4/2	80	7.5YR 4/6	20	C	M	silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: Soil in upland position on spoil pile. No aquic moisture resime (based on Topographic position). Reduce remenant from dredge area.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Upland area of spoil pile. Assumed no wetlands hydrology base on Topographic position.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ENED. City/County: Ferndale, Hum Sampling Date: 9-17-15
Applicant/Owner: RRT State: CA Sampling Point: U3T1-W
Investigator(s): MS + CS Section, Township, Range: _____
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave ± Slope (%): < 2
Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:
test pit ≈ 3 feet from bundag

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Salicornia pacifica	30	D	OBL
2. Hordeum marinum.	20	D	FAC
3. Festuca perennis.	~~15~~ 20	D	FAC
4. Lotus corniculatus.	5		FAC
5. Festuca rubra	10		FACU
6. Cirsium vulgare	15		FACU
7.			
8.			
9.			
10			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
✓ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

9/17/15 Sampling Point: U3T1-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y4/2	100	Ø				Silt loam	
3-16	2.5Y4/2	80	7.5YR4/4	20	C	M	Silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Assumed wetlands hydrology

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERP City/County: Ferndale, HUM Sampling Date: 9-17-15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: U3T2-U

Investigator(s): MS + CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

test pit is 2 feet from boundary

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: _____)			
1. Festuca perennis	25	D	FAC
2. Distichlis spicata	45	D	FACW
3. Salicornia pacifica	20	D	OBL
4. Holcus lanatus	10		FAC
5.			
6			
7.			
8			
9.			
10			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size _____)			
1.			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	_____	x 3 = _____
FACU species	_____	x 4 = _____
UPL species	_____	x 5 = _____
Column Totals:	_____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ 5 - Wetland Non-Vascular Plants[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No ☆

Remarks:

Vegetation not growing as hydrophytes on upland berms.

SOIL

Sampling Point: U3 T2-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/2	100	—	—	—	—	Silt Loam	
3-16	2.5Y 3/2	90	7.5YR 4/6	10	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

Same Condition as U3T1-U

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Upland portion of Spoil pile. Assumed No Wetland Hydrology

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERLEP City/County: Ferndale, HUM Sampling Date: _____

Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: U3T2-W

Investigator(s): MS & CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	Is the Sampled Area within a Wetland? Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

test pit ≈ 4 feet from boundary

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Lotus corniculatus	15		FAW
2. Trifolium striatum	10		NBL
3. Cynosurus echinatus	20	D	NL
4. Distichlis spicata	25	D	FACW
5. Festuca perna	20	D	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ✓ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: U3T2-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5Y 4/2	80	7.5YR 4/6	20	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2) Low
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Base on soils and Topographic position

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R EREP City/County: Ferndale, Hum Sampling Date: 9-17-15

Applicant/Owner: Russ Ranch & Timber State: CA Sampling Point: U3 T3-U

Investigator(s): MS & CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): < 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	Is the Sampled Area within a Wetland? Yes _____ No X
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Holcus lanatus	65	D	FAC
2. Agrostis stolo	20	D	FAC
3. Rumex sp	10		FAC
4. Rumex transitorius	5		FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	_____	x 3 = _____
FACU species	_____	x 4 = _____
UPL species	_____	x 5 = _____
Column Totals:	_____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Vegetation not growing as hydrophytes on spoils berm

SOIL

9/17/15 Sampling Point: U373-U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR3/2	100	—	—	—	—	Silt Loam	
3-15	2.5Y4/2	80	7.5YR4/6	20	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: No aquic moisture regime based on topographic position - Thus not a hydric soil. Redox remnant from dredge area

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Upland position on spoil pile. Does not meet wetlands hydrology

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: R ERLEP City/County: Ferndale, HUM Sampling Date: 9-17-15

Applicant/Owner: Russ Ranch + Timber State: CA Sampling Point: U3 T3-W

Investigator(s): MS + CS Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): —

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? Yes X No _____

Remarks:

test pit ≈ 3 feet from boundary

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Agrostis stolonifera	40	D	FAC
2. Distichlis spicata	40	D	FACW
3. Salicornia pacifica	10		OBL
4. Atriplex prostrata	5		FAC
5. Elymus sp.	5		FAC
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL

Sampling Point: U3 T3-W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 4/2	95	7.5YR 4/4	5	C	M	Silt Loam	
3-14	2.5Y 4/2	80	7.5YR 4/6	20	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Wetlands hydrology

www.ghd.com

This document is in draft form. The contents, including any opinions, conclusions or recommendations contained in, or which may be implied from, this draft document must not be relied upon. GHD reserves the right, at any time, without notice, to modify or retract any part or all of the draft document. To the maximum extent permitted by law, GHD disclaims any responsibility or liability arising from or in connection with this draft document.

Russ Ranch and Timber

Habitat and Vegetation Mapping

September 2015

1. Introduction

1.1 Overview

On May 22, June 3, and June 12, 2015, habitat and vegetation mapping was conducted at the Russ Ranch and Timber property in Humboldt County, California. The RR&T project site encompasses approximately several acres which includes agricultural (grazing) land, tidal salt marsh, brackish marsh, riparian, sloughs/open water channels, freshwater ponds and ditches, and nearshore dune ridges and swales.. Areas of the site with the highest potential to be affected by proposed restoration activities were prioritized for vegetation characterization and mapping. The results of these field efforts will provide a basis to avoid, minimize, and/or mitigate potential impacts associated with project-related activities and guide future management goals and decision

1.2 Location

The Russ Ranch and Timber (RR&T) site is located west of Ferndale, California, and north of Centerville Beach (Figure 1). The site is accessed via Centerville Road. The Pacific Ocean is located directly west of the site. The confluence of Salt River and Eel River is located approximately 3.7 miles north of the project site. Prominent water features include Russ Creek, Shaw Creek, and the southern portion of the Western Drainage as well as smaller (seasonal) slough channels and drainage ditches. The northern portion of the site borders The Wildlands Conservancy while the southern area is bordered by private property.

The climate is Mediterranean with precipitation most abundant in the winter months, and the average annual rainfall is approximately 48.5 inches. Approximately two thirds of the year, the site is influenced by coastal fog.

The site corresponds to portions of Sections 5, 6, 31 and 32, Township 2-3 North, Range 2 West on the USGS 7.5 Minute Ferndale quadrangle. The coordinates for the Centerville Road access route are 40.576407N and -124.333866W.

2. Methods

Prior to field investigations, aerial imagery, remote sensing and existing data and reports for the region were reviewed to serve as background for habitat mapping efforts. On May 13, June 3, and June 12, 2015, GHD staff conducted vegetation characterization and mapping field efforts. The field staff worked in coordination with the Applicant to develop the limits of the Project Study Boundary (PSB) (Figure 1). The PSB approximately corresponds to the RR&T property boundary (excluding portions of the beach), but mapping efforts were especially focused on areas within the PSB where project-related impacts may potentially occur. Detailed survey and mapping was not performed where the potential for ground disturbing work was determined to be low. Managed pastures presented on Figure 3.2 and 3.4 were not formally surveyed; and were mapped based on a limited reconnaissance site visit and photo-interpretation of aerial imagery. The western portion of the PSB and Russ Creek riparian area on the eastern edge were described and mapped in more detail because these areas are included within preliminary project alternatives being evaluated with potential ground-altering work occuring in these areas.

While in the field, staff used a Tablet PC with a Pro 6H receiver which has GPS accuracy of one to three feet depending on environmental and site conditions. A total of three field days were spent mapping vegetation communities within the PSB.

Vegetation types for the project site were classified following California vegetation classification standards per *A Manual of California Vegetation* (MCV) (Sawyer et al. 2009), with updated regional information as available. Many of the alliances described herein were previously classified and described by Pickart (2006) for diked wetlands of Humboldt Bay National Wildlife Refuge where Pickart collected elevation, salinity, and soil moisture data to characterize the vegetation alliances. The results of that study are used here as a basis for groupings relating to salinity, with dominant species indicating various salinity regimes.

As descibed in the MCV, the basic unit of classification is called an alliance. Alliances are based on the dominant or diagnostic species of the stand, usually of the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others. Alliances reflect regional to sub-regional climates, substrates, hydrology, and disturbance regimes. Sub-units called associations are used to further refine alliances, capturing variety in species composition and structure. Vegetation types dominated by non-native plant species are referred to as semi-natural stands rather than alliances and have stand types rather than associations (Sawyer et al. 2009).

Other habitat features, such as slough channels and improvements including roads and levees, were digitized using high-resolution true color and infrared imagery available through NOAA (National Oceanic and Atmospheric Administration) (2009 and 2012) and NAIP (National Agriculture Imagery Program) (2012). When possible, aerial signatures visible on the imagery were confirmed in the field and relayed to the GIS analyst for further digitizing.

3. Results

3.1 Overview

The distribution of vegetation types at RR&T is influenced by hydrology, salinity, and past and current land use and modifications (Figure 2). Historically, much of the site was diked for agricultural use and currently remains actively managed for grazing.

Table 1 is a summary of vegetation alliances grouped by vegetation name (underlined) and habitat type (bolded), at RR&T within the PSB. Some alliances occur in more than one habitat type. Vegetation types are described within the context of existing vegetation classification standards. It is possible that further investigation would reveal new associations of existing alliances and/or new alliances, but this is beyond the scope of the current study.

The vegetation map produced for RR&T uses the following map conventions:

- Map units relate to the classification at different levels of the hierarchy. In general, alliance names were used. In one case, the association name was used because it was the only type within that alliance type present at RR&T
    - (the *Juncus breweri* association of the *Abronia latifolia-Ambrosia chamissonis* Herbaceous Alliance (dune mat) (Pickart per.comm 2008)).
- Map unit complexes were created when the individual vegetation types repeatedly occurred together in the landscape, but were not distinct on the aerial photographs and were not practical to delineate in the field such as the *Agrostis-Distichlis* complex.

Table 1 Vegetation alliances, grouped by generalized habitat type (bolded) and habitat type (bolded), at Russ Ranch and Timber.

Salt marsh and brackish marshes	
Salt marsh	
	Sarcocornia pacifica Herbaceous Alliance (pickleweed mats)
Brackish marsh	
	Argentina egedii (currently named *Potentilla anserina* ssp. *pacifica*[1]) Herbaceous Alliance (Pacific silverweed marshes)
	Atriplex prostrata-Cotula coronopifolia Semi-Natural Herbaceous Stands (fields of fat hen and brass buttons)
	Bolboschoenus maritimus Herbaceous Alliance (salt marsh bulrush marshes)
	Distichlis spicata Herbaceous Alliance (salt grass flats)
Freshwater marsh	
Freshwater marsh	
	Juncus effusus Herbaceous Alliance (soft rush marshes)
Pasture and/or Agricultural Wetland	

[1] Ertter, B., 2013. *Potentilla*, in Jepson Flora Project (eds.) *Jepson eFlora*, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=52485, accessed on Jul 29 2015.

Table 1 Vegetation alliances, grouped by generalized habitat type (bolded) and habitat type (bolded), at Russ Ranch and Timber.	
Freshwater wetland pasture	
	Lolium perenne (currently named *Festuca perennis*[2]) Semi-Natural Herbaceous Stands (perennial rye grass fields)
Brackish wetland pasture	
	Argentina egedii (*Potentilla anserina* ssp. *pacifica*) Herbaceous Alliance (Pacific silverweed marshes)
	Agrostis stolonifera Semi-Natural Herbaceous Stands (creeping bent grass flats) with *Distichlis spicata* Association
	Eleocharis macrostachya Herbaceous Alliance (pale spike rush marshes)
Nearshore Dune Ridges	
Foredune grassland	
	Ammophila arenaria Semi-Natural Herbaceous Stands (European beach grass swards)
Nearshore Dune Swales	
Herbaceous swales	
	Juncus breweri Association (Brewer's rush swales) within the *Abronia latifolia-Ambrosia chamissonis* Herbaceous Alliance
Riparian	
Deciduous riparian	
	Alnus rubra Forest Alliance (red alder forests) with *Salix hookeriana* (coastal willow dune thickets)
Ruderal Uplands	
	Holcus lanatus-Anthoxanthum odoratum Semi-Natural Herbaceous Stands (common velvet grass-sweet vernal grass meadows)

3.2 Vegetation communities mapped within RR&T PSB

Salt marsh

The western portion of the RR&T site is tidally inundated, although the historical configuration of tidal channels has been partially lost. The area now receives tidal input directly and indirectly (sub-surface) from the Pacific Ocean. As a result, the area supports a complex of tidal salt and brackish marshes. The area was described and mapped based on field-level surveys and aerial photo-interpretation. On a whole, the area of tidal marsh was mapped as a "*Sarcocornia* complex" in which the *Sarcocornia pacifica* Herbaceous Alliance is the dominant alliance type with inclusions of soft rush marshes (*Juncus effusus* Herbaceous Alliance), *Agrostis stolonifera* Semi-Natural Stand with *Distichlis spicata,* and ruderal uplands associated with dikes.

[2]Smith, J.P., 2013. *Festuca*, in Jepson Flora Project (eds.) *Jepson eFlora*, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=91964, accessed on Jul 29 2015.

Salt marsh

Sarcocornia pacifica (Pickleweed) Herbaceous Alliance (pickleweed mats)

Sarcocornia pacifica (currently known as *Salicornia pacifica*[3]) is dominant or co-dominant with a variety of associated species, including *Distichlis spicata*, *Alopecurus geniculatus*, *Triglochin maritima*, *Triglochin striata* as well as non-natives including *Agrostis stolonifera* and *Plantago coronopus* (Figures 3.1 and 3.3). The pickleweed salt marsh at RR&T is young and mostly monotypic in comparison to other salt marsh stands in the vicinity as the dune system breached with the Pacific Ocean aproximately six to seven years ago (J. Russ per. comm. 2015). Several associations that have been previously described based on co-dominant or diagnostic species are present at RR&T, and it is possible that additional associations could be identified with further investigation. Associations previously described for Northern California tidal marshes include *Sarcocornia pacifica—Atriplex prostrata* Association and the *Sarcocornia pacifica—Distichlis spicata* Association. This alliance type includes areas of potential rare plant habitat. Protocol-level rare plant surveys were conducted by GHD, Inc. on May 22 and June 12, 2015.

Brackish marshes

Brackish marshes occur at RR&T in areas west of ruderal upland levees and adjacent to pickleweed marshes and in wet depressions having residual soil salinity.

Brackish marsh

Atriplex prostrata-Cotula coronopifolia Semi-Natural Herbaceous Stands (fields of fat hen and brass buttons)

Small patches of this community type were observed in brackish areas along the Western Drainage, Shaw Creek and other seasonal slough channels on site. Most areas where this community type was mapped did not include *Cotula coronopifolia* or was present at small absolute cover. Areas with this alliance type were mapped along drainage edges in the western portion of the PSB. Associated species included the native species such as *Distichlis spicata* and *Sarcocornia pacifica* as well as non-native *Agrostis stolonifera*.

Bolboschoenus maritimus Herbaceous Alliance (salt marsh bulrush marshes)

Bolboschoenus maritimus (saltmarsh bulrush), a perennial herb commonly found in tidal brackish to saline coastal marshes, was found growing on slough channel margins with standing water along the southern edge of the PSB (Figure 3.3). Areas where salt marsh bulrush was mapped included perennial, wet areas adjacent to pickleweed mats. Sub-dominants of this alliance type observed include *Potentilla anserina* ssp*. pacifica*, *Schoenoplectus pungens*, *Juncus bolanderi,* and *Juncus patens*.

Distichlis spicata Herbaceous Alliance (salt grass flats)

Distichlis spicata (saltgrass*)* is a halophytic perennial plant of salt marshes, coastal dunes, and moist alkaline areas (Sawyer et al. 2009). Salt grass flats occurred in small patches along the channel banks and saline wet depressions (Figures 3.2 and 3.4). Associated species included *Sarcocornia pacifica, Atriplex prostrata,* and *Agrostis stolonifera.* Occasionally, *Cotula coronopifolia*, *Schoenoplectus pungens,* and *Potentilla anserina* ssp*. pacifica* were present.

[3]Ball, P.W., 2013. *Salicornia*, in Jepson Flora Project (eds.) *Jepson eFlora*, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=42666, accessed on Jul 29 2015

Early successional salt grass flats at RR&T have been severely invaded by *Agrostis stolonifera*, which has altered this native plant community sufficiently to be considered a different vegetation type (*Agrostis stolonifera* Semi-Natural Stands). Where *Distichlis spicata* was dominant, it can be considered the *Distichlis spicata* Herbaceous Alliance; however, most of these areas had *Agrostis stolonifera* present, often with high cover, and this type occurred in a patchy fashion with *Agrostis stolonifera* Semi-Natural Stands. Boundaries between these types were indistinct and not readily discernible; and were therefore mapped as the *Agrostis-Distichlis* complex. In general, *Distichlis spicata* Herbaceous Alliance was dominant in areas with higher salinity and flooding.

Freshwater marsh

Freshwater marsh

Juncus effusus Herbaceous Alliance (soft rush marshes)

Juncus effusus (common rush), a cespitose perennial rush of seeps, shores and damp sunny ground, was mapped in the managed pasture areas of the PSB and in the southeastern corner of the salt marsh complex (Figures 3.1, 3.3, 3.4). Co-dominants consist of *Rumex conglomeratus* and *Triglochin striata* along with non-native such as *Holcus lanatus* and *Ranunculus repens*.

Pasture (or agricultural wetland)

Historically, much of the site was tidelands which have been diked for agricultural use and remain actively managed for grazing. The fields flood seasonally and in general have poorly drained soils. Upland pasture occurs throughout the majority of the PSB, but some locations support marsh plant species. Areas with residually high soil salinity and/or muted tidal seepage are considered brackish wetland pastures.

Perennial rye grass (currently named *Festuca perennis*[4]), an invasive non-native grass, was mapped extensively in the wet pastures and diked upland areas of RR&T (Figures 3.1 through 3.4). Within the PSB and in close proximity, ranchers have historically seeded pastures with perennial rye grass for cattle feed and it is considered naturalized in this region. Associated species included the weedy/invasive species such as *Holcus lanatus*, *Rumex crispus,* and *Plantago lanceolata* in the upland areas. In the perennial brackish seeps, native and non-native species such as *Atriplex prostrata*, *Cotula coronopifolia* and *Eleocharis macrostachya* are commonly found. Smaller discrete patches of other vegetation alliances/types occur as inclusions within the area mapped as *Lolium perenne* Semi-Natural Herbaceous Stands. Due to time constraints, the managed pasture areas were not mapped with the same detail as the more complex areas on site.

Eleocharis macrostachya Herbaceous Alliance (pale rush spike marshes)

*Eleocharis macrostachya (*pale spike rush), a mat or hummock forming perennial rush of freshwater and brackish wetlands, was present on RR&T. Much of the area mapped with this alliance type was observed in or near standing water in close proximity to ponds containing fresh water (Figures 3.1 through 3.4). *Potentilla anserina* ssp*. pacifica* and *Agrostis stolonifera* comprised the sub-dominant component of this community type. Other associated species included *Distichlis spicata, Juncus effusus, Rumex crispus,* and *Festuca perennis*.

Brackish wetland pasture

[4]Smith, J.P., 2013. *Festuca*, in Jepson Flora Project (eds.) *Jepson eFlora*, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=91964, accessed on Jul 29 2015.

Agrostis stolonifera Semi-Natural Herbaceous Stands (bent grass meadows)

Small stands of this vegetation type were mapped in the western portion of the project site and were commonly found with *Distichlis spicata* and *Festuca perennis* in brackish pasture areas on the margins of salt marsh (Figure 3.3). *Agrostis stolonifera*, a perennial herb not native to California, has invaded native vegetation types throughout the state, especially mesic ones (Sawyer et al. 2009). It has a Cal-IPC Inventory rank of Limited, meaning the ecological impact of this species is considered minor on a state-wide level (Cal-IPC 2013). Within our region; the Humboldt Weed Management Area (HWMA) rates this species as High Priority, based on its widespread invasion of diked wetlands and ability to alter native plant communities. This aggressive competitor has a wide environmental tolerance, a long growing season, and the ability to spread vegetatively. Once established, *Agrostis stolonifera* causes changes to soil and water characteristics, such as forming a thick thatch layer that buffers it from high salinities in underlying soils, and alters native plant communities (Pickart 2006).

Argentina egedii Herbaceous Alliance (Pacific silverweed marshes)

Pacific silverweed (now known as *Potentilla anserina* ssp. *pacifica*) is a salt-tolerant perennial herb commonly found in seasonally coastal brackish wetlands. At RR&T, Pacific silverweed occurred as a dominant species within perennial seeps of brackish wetlands (Figures 3.1 and 3.3). Associated species found within this herbaceous layer included non-native, invasive grasses such as, *Agrostis stolonifera, Holcus lanatus, Festuca perennis* as well as non-native forbs, *Lotus corniculatus and Rumex crispus*. Occurrences of this alliance were identified along the Western Drainage and in lower elevation depression of the levees and berms.

Nearshore Dune Ridges

Foredune grassland

Ammophila arenaria Semi-Natural Herbaceous Stands (European beach grass swards)

The foredune ridge and low-lying beach wash area of Angel's Camp in the western portion of the project study area are dominated by the invasive *Ammophila arenaria* (European beach grass), a Cal-IPC clumping perennial grass of high priority. Native species such as *Abronia latifolia*, *Calystegia soldanella*, *Tanacetum bipinnatum* and *Erigeron glaucus* are present albeit in low percentages (Figure 3.1 and 3.3).

Nearshore Dune Swales

Herbaceous swales

Juncus breweri Association (Brewer's rush swales) *within Abronia latifolia-Ambrosia chamissonis Herbaceous Alliance* (dune mat)

On the backside of the foredune at RR&T are herbaceous dune swales which occur landward of the foredune and are dominated by *Juncus breweri* (Figures 3.1 and 3.3). These "dry swales" have been described for the South Spit of Humboldt Bay (Pickart 2005) and for the North Spit of Humboldt Bay (Pickart 2009), and identified as the *J. breweri* association of the *Abronia latifolia-Ambrosia chamissonis* Alliance (dune mat) in a recent floristic classification of Humboldt County dunes (Pickart and Solomescsh unpublished data). At RR&T, a few associated species typically characteristic of dune mat were present in *Juncus breweri* swales and include: *Abronia latifolia, Ambrosia chamissonis, Calystegia soldanella,* and *Cardionema ramosissimum.*

Lower, wetter swales were vegetated primarily by *Schoenoplectus pungens*, with *Potentilla anserina* ssp*. pacifica,* and *Agrostis stolonifera*. This species composition differs from wet dune swales described for the North Spit of Humboldt Bay, which are characterized by *Carex obnupta* (Pickart 2009).

Riparian

Alnus rubra Forest Alliance (red alder forest) with *Salix hookeriana* (coastal dune willow)

Alnus rubra, a common native tree shrub of coastal and inland areas of California, was observed in an upland Russ Creek riparian area intergrading with coastal dune willow, *Salix hookeriana* (Figure 3.2). The understory of this vegetation type was sparse; yet contains native plant species such as *Polystichum munitum* and non-natives like *Trifoilum repens*, *Malva nicaeensis,* and ruderal grasses.

Ruderal Levee/berm and Upland Areas

The RR&T PSB is interspersed with old levee and berm systems constructed to control seasonal flooding. The vegetation associated with these levees and berms are ruderal with a species composition of several non-native and invasive species including *Holcus lanatus, Festuca perennis, Ranunculus repens, Agrostis stolonifera, Trifolium repens,* and *Trifolium fragerium*. Few native species occurred on the levees, including *Symphyotrichum chilense* and *Achillea millefolium*.

4. Conclusions

The most extensive habitat type at the RR&T is managed pasture comprised mostly of agricultural brackish wetlands. The most abundant vegetation type mapped at RR&T was perennial rye grass fields (*Lolium perenne (*now *Festuca perennis)* Semi-Natural Herbaceous Stands). Pickleweed mats (*Sarcocornia pacifica* Herbaceous Aliiance) was the second dominant vegetation type.

5. References

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, editors. 2012. *The Jepson Manual: Vascular Plants of California, Second Edition*. University of California Press, Berkeley.

California Invasive Plant Council 2013. http://www.cal-ipc.org/.

Eicher, A. 1987. Salt marsh vascular plant distribution in relation to tidal elevation, Humboldt Bay, California. Master's Thesis. Humboldt State University, Arcata, CA.

Eicher, A. and Bivin, M. 1991. Vegetation Survey of the Eel River Delta. in R. C. Roberts. 1992. Biological Conditions in the Eel River Delta. Report prepared for the Eel River Resource Conservation District.

Eicher, A. Memorandum to GHD: Wildland Conservancy Eel River Property Restoration, Notes RE: habitat characterization and mapping. November 12, 2013. Email)

Keeler-Wolf, T., and M.Vaghti. 2000. *Vegetation mapping of Suisun Marsh, Solano County: A Report to the California Department of Water Resources*. California Department of Fish and Game, California Natural Diversity Database, Sacramento, CA.

Keeler-Wolf, T., D. Schirokauer, J. Meinke, and P. van derLeeden. 2003a. *Classification of the Vegetation of Point Reyes National Seashore, Golden Gate National Recreation Area, Samuel P. Taylor, Mount Tamalpais, and Tomales State Parks, Marin, San Francisco, and San Mateo Counties, California*. California Department of Fish and Game, Wildlife Habitat Data Analysis Branch, Sacramento, CA.

Lovelace, J. B. 2011. Delineation of Wetlands and Waters of the U.S. for the Eel River Estuary Preserve, Humboldt County, Illinois. Mad River Biologists, Eureka CA.

Mad River Biologists. 2009. Delineation of Wetlands and Waters of the US for Connick Ranch. Mad River Biologists, Eureka CA.

Mad River Biologists. 2011. Eel River Estuary Preserve biological evaluation and wetland delineation for proposed bridge construction and road improvement project. Mad River Biologists, Eureka CA.

Morrissette, S. 2012. Eel River Estuary Preserve biological evaluation and wetland delineation for Russ Creek bridge replacement project. Biological Resource Consulting, Eureka CA.

Pickart, A. 2005. A preliminary description of the Table Bluff unit wetland vegetation, Humboldt Bay National Wildlife Refuge 18

Pickart, A. 2006. *Vegetation of diked herbaceous wetlands of Humboldt Bay National Wildlife Refuge: classification, description, and ecology*. Arcata, CA, U.S. Fish and Wildlife Service, Humboldt Bay National Wildlife Refuge: 93.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. *A Manual of California Vegetation, Second Edition*. California Native Plant Society, Sacramento, CA.

6. List of Preparers

Prepared by:

Cara Scott, Botanist, GHD Inc., Eureka CA

Reviewed by:

Stephanie Klein, Restoration Ecologist, GHD Inc., Eureka CA

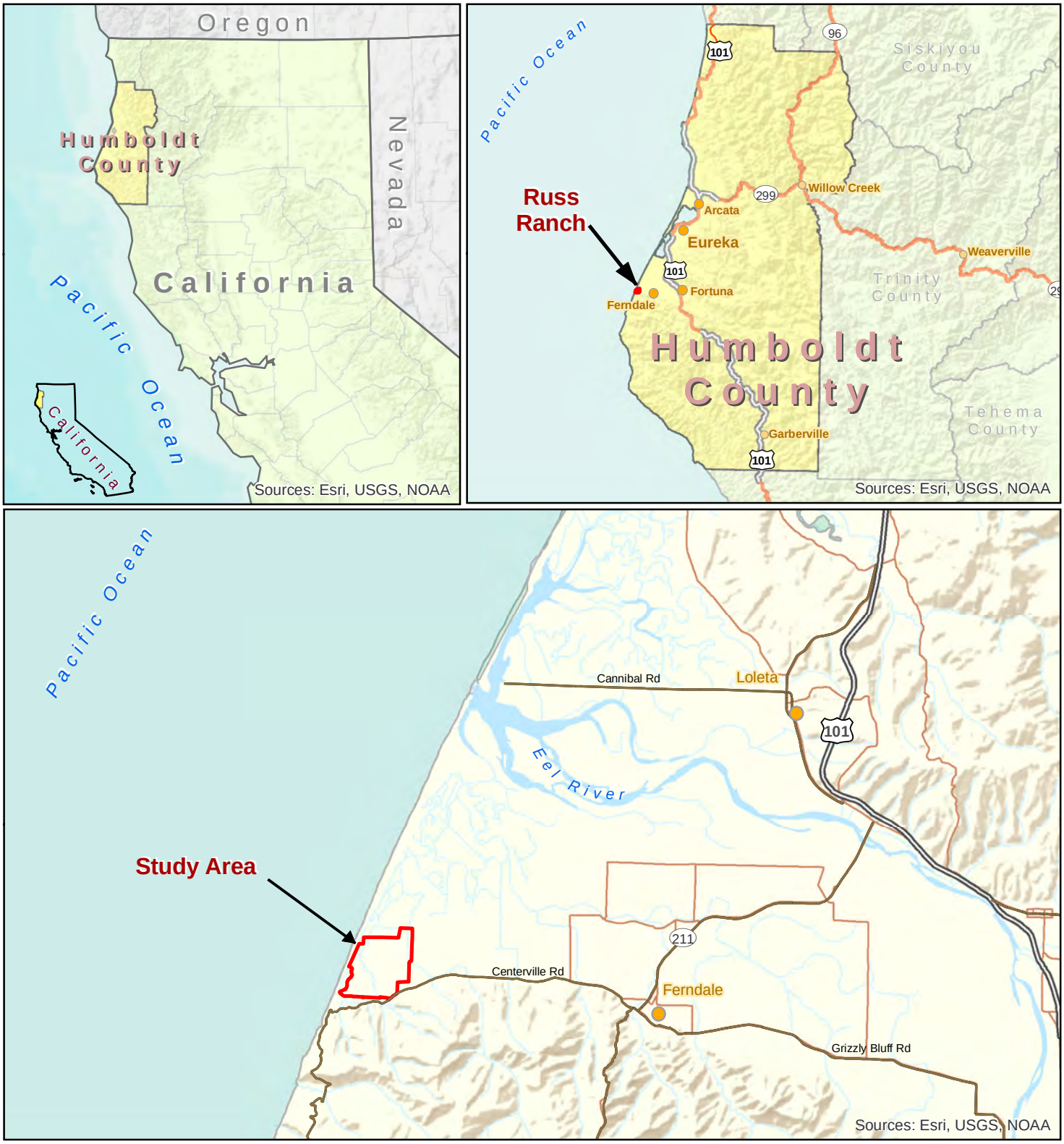
Ken Mierzwa, Senior Project Manager, GHD Inc., Eureka CA

Appendix A - Figures

Figure 1: Vicinity Map and Project Study Boundary

Figure 2: Results of Habitat Mapping at Russ Ranch and Timber

Figure 3: Map Set of Habitat Mapping



Study Area
Humboldt County
Counties
Freeway
Highway
Roadway
Streams

Paper Size ANSI A
0 0.5 1 2 3
Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

Russ Ranch
Vegetation/Habitat Mapping

Job Number	8410882-07
Revision	1
Date	16 Sep 2015

Project Vicinity and Location

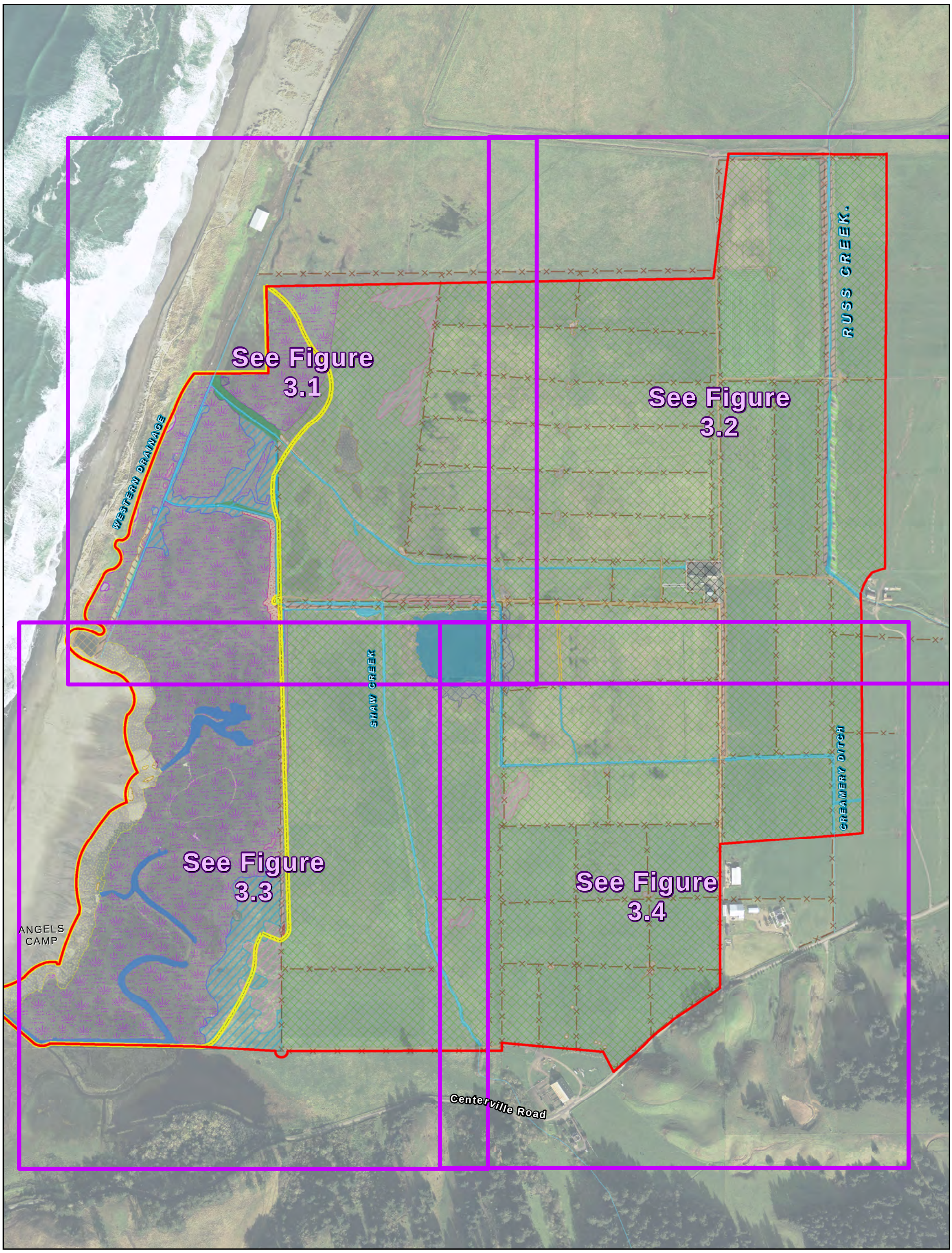
Figure 1

718 Third Street Eureka, CA 95501 T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F1_Vicinity.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD, ESRI, make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: USA Base Maps; Humboldt County transportation data, 2008. Created by:porogers



Vegetation Mapping Study Area
Rare Plant Survey Boundary
Fences

Vegetation Alliance

- *Atriplex prostrata-Cotula coronopifolia*
- *Ammophila arenaria*
- *Agrostis - Distichlis*
- *Bolboschoenus maritimus*
- *Distichlis spicata*
- *Eleocharis macrostachya*
- *Festuca perenne*
- *Holcus lanatus*
- *Juncus breweri*
- *Juncus effusus*
- *Potentilla anserina ssp. pacific*
- *Alnus rubra - Salix hookeriana*
- Dune Mat Alliance

Other Habitat

- Bare Ground
- Beach
- *Sarcocornia pacifica*
- Ruderal - Levee/Berm
- Ditch
- Development
- Managed Pasture
- Open Water
- Slough
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-07
Revision	A
Date	16 Sep 2015

Reference Map for Habitat/Vegetation Figures

Figure 2

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F2_HabitatVege_Overview.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers

Study Area
Rare Plant Survey Boundary
Approx. Fence Locations

Vegetation Alliance

- *Atriplex prostrata-Cotula coronopifolia*
- *Ammophila arenaria*
- *Agrostis - Distichlis*
- *Bolboschoenus maritimus*
- *Distichlis spicata*
- *Eleocharis macrostachya*
- *Festuca perennis*
- *Holcus lanatus*
- *Juncus breweri*
- *Juncus effusus*
- *Potentilla anserina ssp. pacific*
- *Sarcocornia pacifica*
- *Alnus rubra - Salix hookeriana*
- *Abronia latifolia–Ambrosia chamissonis* Alliance

Other Habitat

- Bare Ground
- Beach/Ammophila
- Ruderal - Levee/Berm
- Ditch
- Development
- Managed Pasture
- Open Water
- Slough
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-08
Revision	A
Date	16 Sep 2015

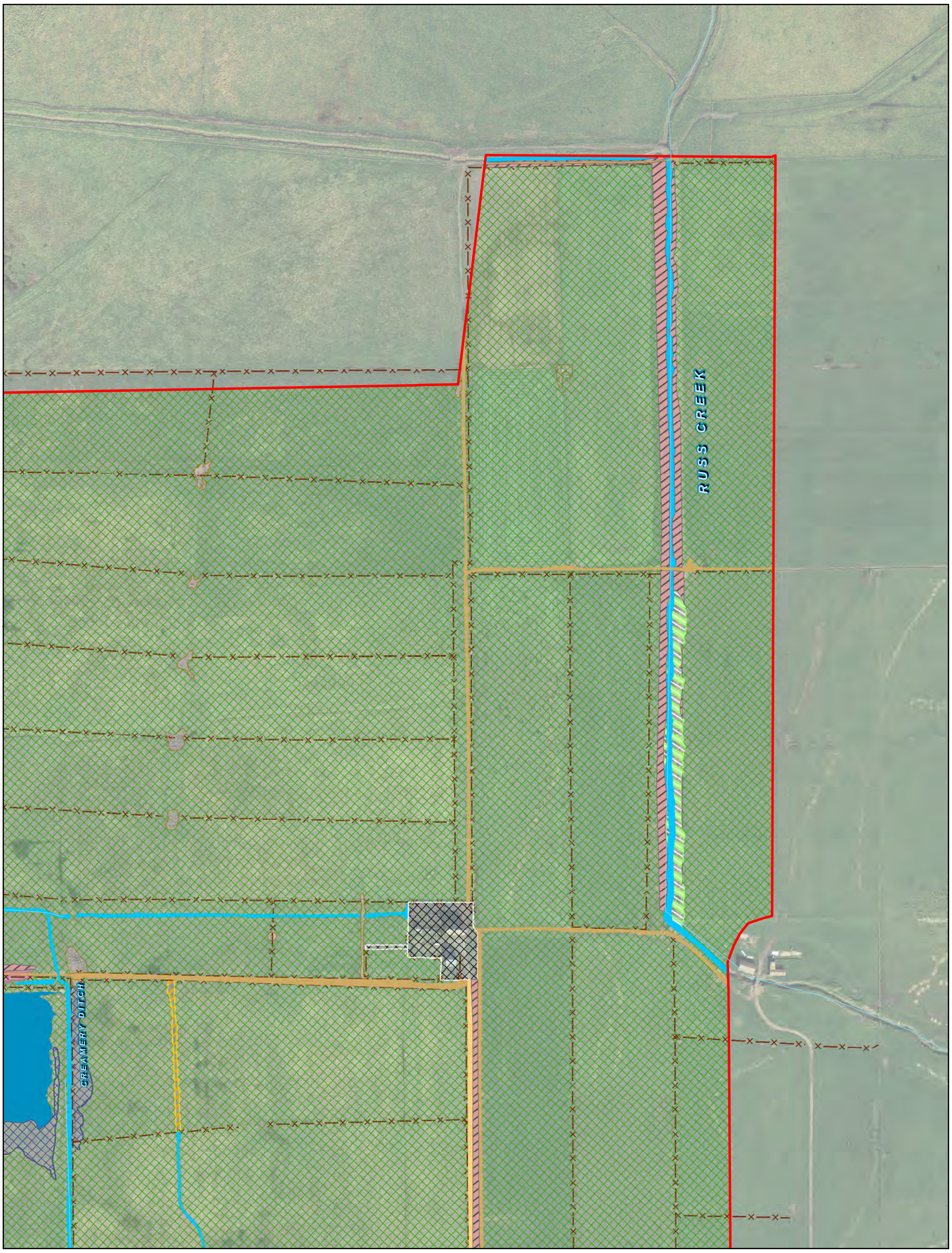
Habitat/Vegetation Map Figure 3.1

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F3_HabitatVege_MB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers



Study Area
Rare Plant Survey Boundary
Approx. Fence Locations

Vegetation Alliance

- *Atriplex prostrata-Cotula coronopifolia*
- *Ammophila arenaria*
- *Agrostis - Distichlis*
- *Bolboschoenus maritimus*
- *Distichlis spicata*
- *Eleocharis macrostachya*
- *Festuca perennis*
- *Holcus lanatus*
- *Juncus breweri*
- *Juncus effusus*
- *Potentilla anserina ssp. pacific*
- *Sarcocornia pacifica*
- *Alnus rubra - Salix hookeriana*
- *Abronia latifolia–Ambrosia chamissonis* Alliance

Other Habitat

- Bare Ground
- Beach/Ammophila
- Ruderal - Levee/Berm
- Ditch
- Development
- Managed Pasture
- Open Water
- Slough
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-08
Revision	A
Date	16 Sep 2015

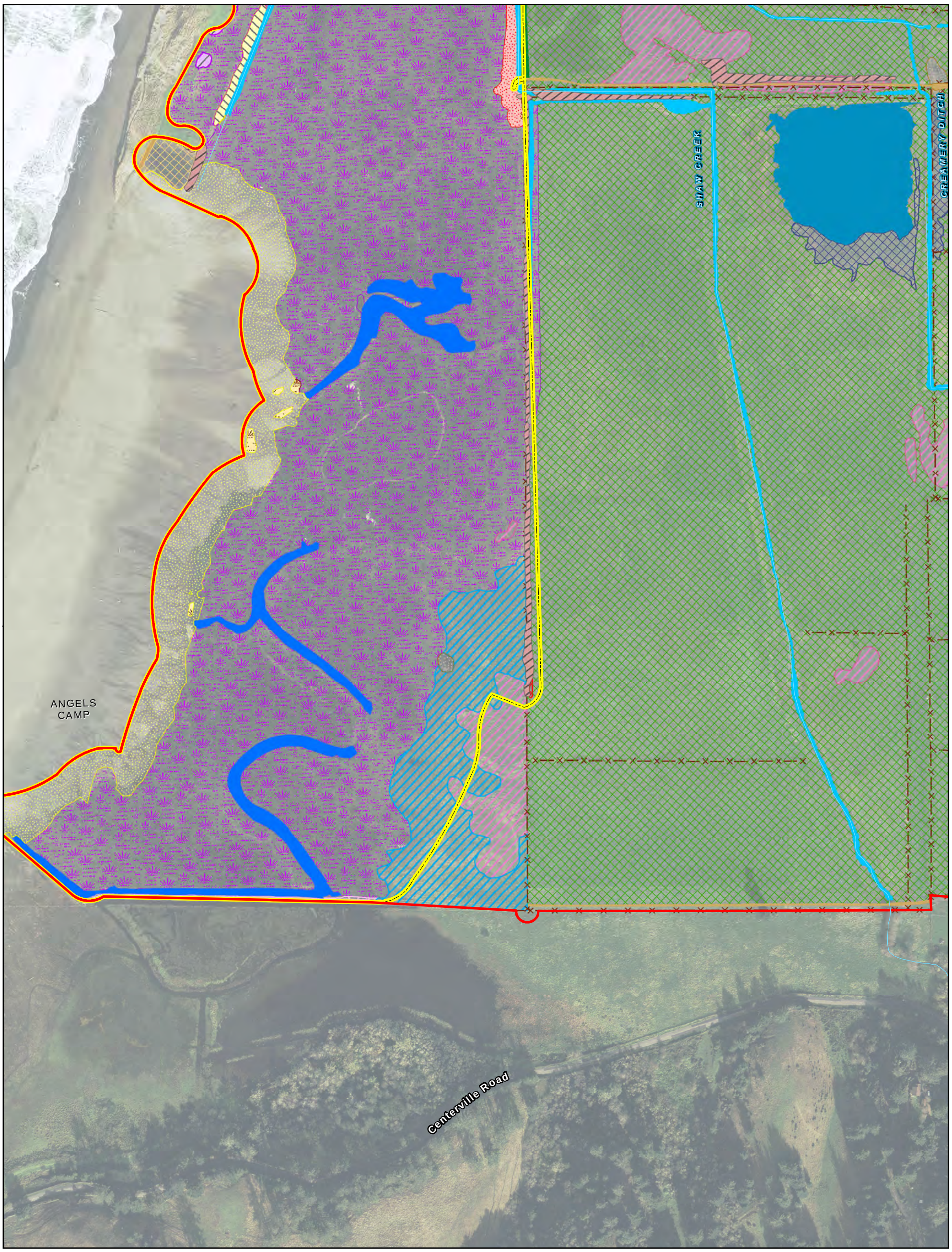
Habitat/Vegetation Map Figure 3.2

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F3_HabitatVege_MB.mxd

718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers



Study Area
Rare Plant Survey Boundary
Approx. Fence Locations

Vegetation Alliance

- *Atriplex prostrata-Cotula coronopifolia*
- *Ammophila arenaria*
- *Agrostis - Distichlis*
- *Bolboschoenus maritimus*
- *Distichlis spicata*
- *Eleocharis macrostachya*
- *Festuca perennis*
- *Holcus lanatus*
- *Juncus breweri*
- *Juncus effusus*
- *Potentilla anserina ssp. pacific*
- *Sarcocornia pacifica*
- *Alnus rubra - Salix hookeriana*
- *Abronia latifolia–Ambrosia chamissonis* Alliance

Other Habitat

- Bare Ground
- Beach/Ammophila
- Ruderal - Levee/Berm
- Ditch
- Development
- Managed Pasture
- Open Water
- Slough
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-08
Revision	A
Date	16 Sep 2015

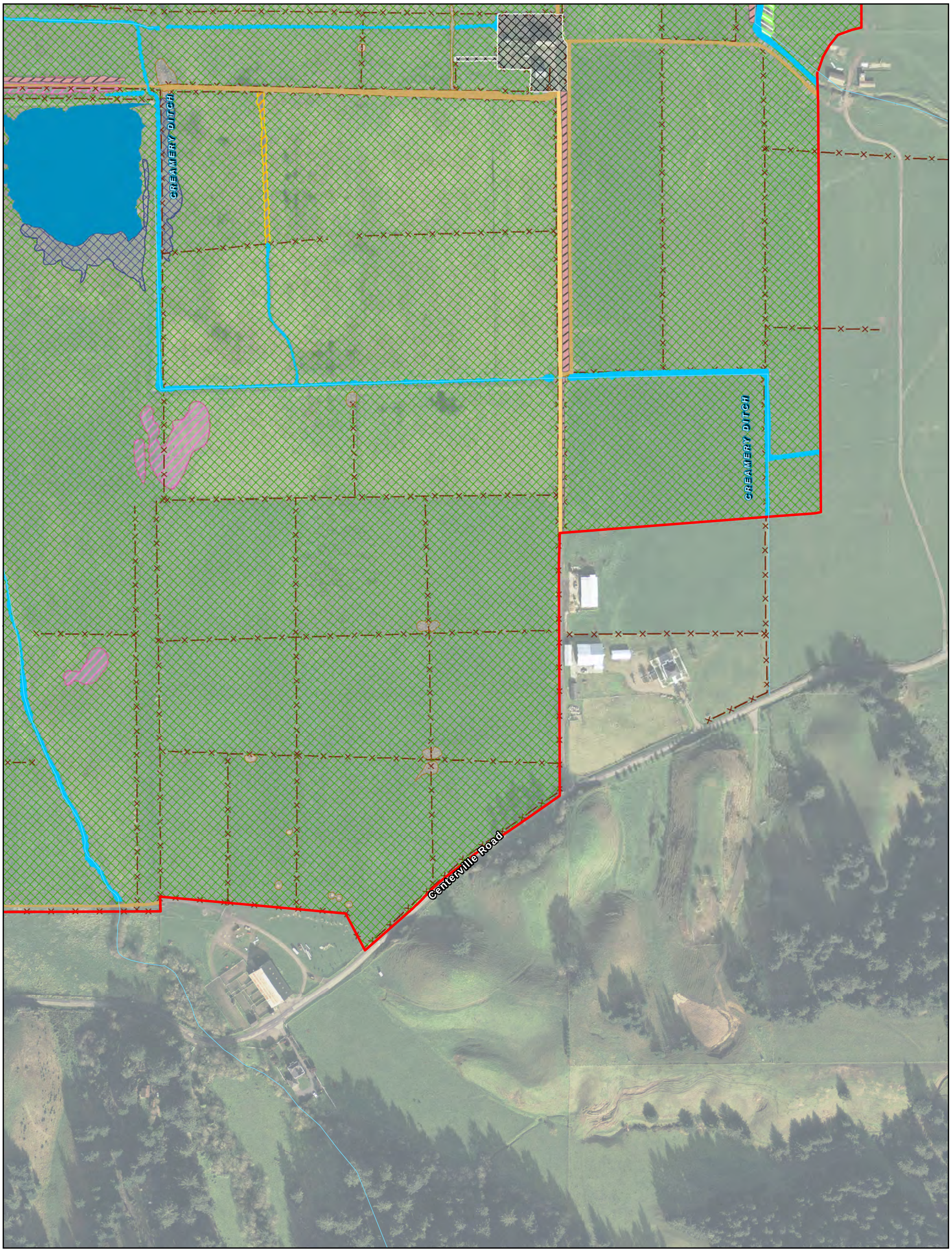
Habitat/Vegetation Map Figure 3.3

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F3_HabitatVege_MB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers



Study Area
Rare Plant Survey Boundary
Approx. Fence Locations

Vegetation Alliance

- *Atriplex prostrata-Cotula coronopifolia*
- *Ammophila arenaria*
- *Agrostis - Distichlis*
- *Bolboschoenus maritimus*
- *Distichlis spicata*
- *Eleocharis macrostachya*
- *Festuca perennis*
- *Holcus lanatus*
- *Juncus breweri*
- *Juncus effusus*
- *Potentilla anserina ssp. pacific*
- *Sarcocornia pacifica*
- *Alnus rubra - Salix hookeriana*
- *Abronia latifolia–Ambrosia chamissonis* Alliance

Other Habitat

- Bare Ground
- Beach/Ammophila
- Ruderal - Levee/Berm
- Ditch
- Development
- Managed Pasture
- Open Water
- Slough
- Improved Road
- Unimproved Road

Paper Size 11" x 17" (ANSI B)

0 50 100 200 300 400

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

N

GHD

Russ Ranch

Job Number	84-10882-08
Revision	A
Date	16 Sep 2015

Habitat/Vegetation Map Figure 3.4

N:\US\Eureka\Projects\Legacy\Projects\1000298 CalTrout\8410882 EREP EcosystemEnhancement\08-GIS\Maps\Figures\RussRanch_Habitat\F3_HabitatVege_MB.mxd

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

© 2012. While every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:porogers

www.ghd.com

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Memorandum

Project# 3526-01

March 30, 2016

To: Jeremy Svehla and Ken Mierzwa, GHD

From: Sharon Kramer, Ph.D., Senior Fish Ecologist

Subject: Tidewater Goby Habitat Assessment for Eel River Estuary and Centerville Slough Enhancement Project

Introduction

Implementing the Eel River Estuary and Centerville Slough Enhancement Project (Project) would enhance the approximately 1,850-acre Project area by transforming it from a landscape of mostly diked pastureland to a system of pastures and natural habitats, including estuarine and tidal slough channels, freshwater streams and ponds, and agricultural pastures. Specific project objectives include improving access to restored aquatic habitats for salmonids and other aquatic-dependent species and enhancing tidal influence and connectivity between tributaries, sloughs, and the estuary. Although project activities ultimately are intended to benefit aquatic species, they may have an impact on aquatic species during Project implementation.

This memorandum has been prepared to (1) describe the life history and habitat requirements of the tidewater goby (*Eucyclogobius newberryi*), which is federally listed as endangered and has designated critical habitat in the Project area, and describe its occurrence in and adjacent to the Project area; (2) describe past water quality measurements taken in the Project area during goby surveys to help inform conditions that are likely favorable for tidewater goby; (3) identify possible impacts on tidewater goby that could occur during project implementation; and (4) identify avoidance and minimization measures to reduce potential impacts on tidewater goby from Project activities. This memorandum summarizes observations and measurements made during surveys conducted by H. T. Harvey & Associates and others in 2010, 2012, 2014, and 2016, along with relevant information obtained from literature on the tidewater goby.

Life History and Habitats of the Tidewater Goby

Tidewater goby occur in coastal lagoons, brackish marshes, and estuaries that are seasonally disconnected from tidal action when sand bars form at the ocean's edge (Swenson 1999, Moyle 2002) or when anthropogenic structures (e.g., perched culverts, tide gates) mute tidal action (Ritter et al. 2008). They rarely

are found in freshwater environments, but adults occasionally are found in marine environments when sandbars breach following storm events and they are flushed out of lagoons and estuaries (Swenson 1999). Flushing events that disperse tidewater goby into coastal marine habitats may result in colonization or recolonization of localities within several kilometers of extant populations (Lafferty et al. 1999a, 1999b). Tidewater goby populations can fluctuate substantially throughout the year, plummeting directly after flooding and breaching events and quickly recovering during summer (Swenson 1999, Moyle 2002).

In general, tidewater goby live for only 1 year (Swenson 1999), although some live longer (Hellmair and Kinziger 2014). Spawning can occur from April through November, with distinct peaks in spring and late summer (Swenson 1999). Male tidewater goby dig breeding burrows, usually after lagoons become disconnected from the ocean (Swift et al. 1989, Swenson 1995), and female tidewater goby deposit their eggs into the burrows. Female tidewater goby have six to 12 clutches per year (Swenson 1999), with 300–500 eggs per clutch (Swift et al. 1989). Male tidewater goby guard the eggs for approximately 9–11 days, until they hatch. Tidewater goby larvae are planktonic for 1–3 days after hatching, and then they become benthic (Moyle 2002).

Tidewater goby feed on small crustaceans (mysid shrimp, gammarid amphipods, ostracods) and aquatic insects, especially chironomid midge larvae (Moyle 2002). Tidewater goby found in marshes tend to be larger than those found in lagoons and creeks, possibly because the relatively stable physical environment in marshes may foster a more consistent or abundant supply of prey (Swenson 1999). Predators of tidewater goby include native fishes, such as juvenile steelhead (*Oncorhynchus mykiss*), prickly sculpin (*Cottus asper*), and staghorn sculpin (*Leptocottus armatus*) (Swift et al. 1989), and may include nonnative fishes, such as centrarchids (*Lepomis* spp., *Micropterus* spp.) and ictalurids (catfish and bullheads) (USFWS 2005).

Although adult and juvenile tidewater goby tolerate a wide range of temperatures (5.8–25ºC) and salinity levels (0–51 parts per thousand [ppt]), larval and small juvenile tidewater goby (14–35 millimeters [mm]) are unable to tolerate high salinity levels (Hellmair and Kinziger 2014). In lagoons and estuaries with muted tidal exchange along the northern California coast, tidewater goby are found in high densities in habitats where (1) water temperatures range from 12ºC to 24ºC, (2) salinity levels are less than or equal to 15 ppt, and (3) water depths are 20–100 centimeters. However, reported tidewater goby depth preferences probably are biased toward depths that do not exceed the typical size of sampling gear (Stillwater Sciences 2006).

Tidewater goby prefer bare substrate (e.g., sand and mud) and areas with dense emergent vegetation, especially *Ruppia* spp. (Chamberlain 2006). They use unvegetated areas during reproduction and vegetated habitats for juvenile rearing and overwintering because vegetation can provide refuge from high flows (Moyle 2002).

Eggs and planktonic larvae are susceptible to entrainment during flood and breaching events; therefore, survival is greater where there is infrequent breaching and where off-channel sloughs serve as a refuge from high-velocity waters (Chamberlain 2006). Larval and small juvenile tidewater goby are more sensitive to high

salinity levels and strong tidal flows than are larger juveniles and adults (Hellmair and Kinziger 2014). Sensitivity to high salinity levels may explain why tidewater goby are often present in waters with muted or intermittent tidal connectivity, such as bar-built estuaries, waters upstream of tide gates, off-channel marshes, and perched ponded areas.

Tidewater Goby in the Eel River Estuary and Centerville Slough Enhancement Project Area

Surveys to document the presence of tidewater goby in the Project area were conducted in 2010 and 2012. The surveys were conducted in the Inner Marsh, a portion of the Project area enclosed by levees, and in waters located outside the Inner Marsh. Non-protocol-level tidewater goby surveys were conducted in and adjacent to the Project area at four sites on October 13, 2010, by the U.S. Fish and Wildlife Service (Chamberlain 2010) (Figure 1) and at 10 sites by H. T. Harvey & Associates on October 26, 2012 (Figure 1). In 2010, three of the survey sites were located in the Inner Marsh, and one survey site was located in the western drainage. Tidewater goby were found at all four survey sites. In 2012, tidewater goby surveys were conducted at 10 sites located in and outside of the Inner Marsh. All the sites where tidewater goby were found were located in the Inner Marsh. These results, along with the results of past surveys, indicate that there is a persistent tidewater goby population in the Inner Marsh upstream of the Cut-Off Slough tide gate. The muted tidal exchange in the Inner Marsh may create isolated habitat conditions that support goby populations. However, the absence of goby at survey sites cannot be verified unless protocol-level surveys are conducted (USFWS 2005).

In the Inner Marsh, threespine stickleback (*Gasterosteus aculeatus*) was the only fish species found with tidewater goby. Sites surveyed outside the Inner Marsh are subject to full tidal exchange and greater connectivity to the Eel River estuary. Threespine sticklebacks, staghorn sculpin (*Leptocottus armatus*), prickly sculpin (*Cottus asper*), and unidentified larval smelt were found at sites located outside the Inner Marsh.

Tidewater Goby in the Riverside Ranch Restoration Area

Riverside Ranch, located northeast of the Project area, adjacent to the Salt River, is the site of the Riverside Ranch Tidal Wetland Restoration Project, an extensive restoration project designed to improve hydrologic function and fish and wildlife habitat in the Salt River watershed. Before the project was implemented, Riverside Ranch was primarily diked pastureland with little available habitat for tidewater goby. Small numbers of tidewater goby (one to five) were found primarily in small plunge pools located downstream of tide gates draining pastureland on Riverside Ranch during three prerestoration surveys conducted in May 2010, September 2010, and May 2011 (Figure 2).

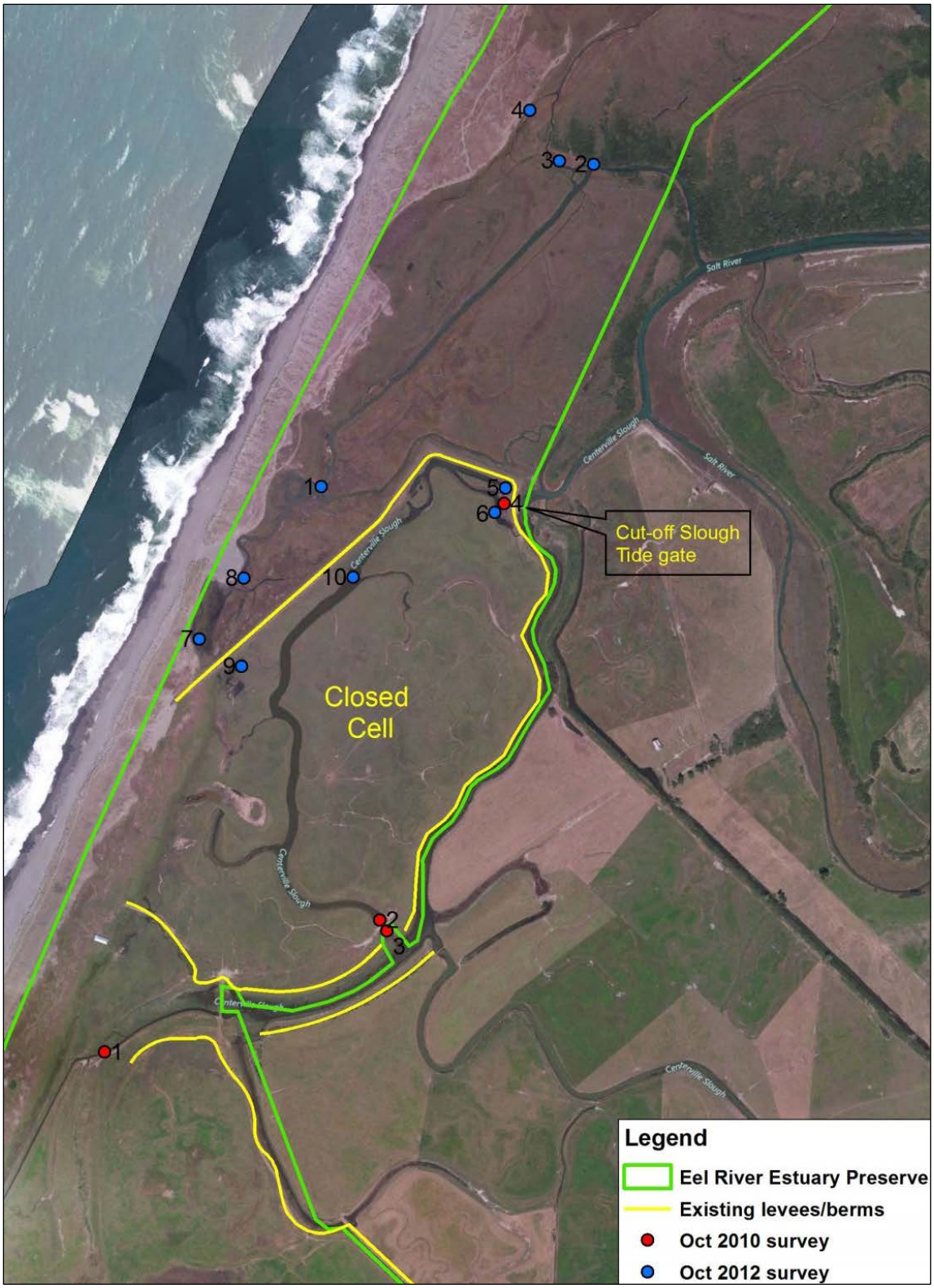


Figure 1. Eel River Estuary Preserve Tidewater Goby Survey Locations, 2010 and 2012

Note: Closed Cell = Inner Marsh.
Source: Survey points provided by Chamberlain 2011 and H. T Harvey & Associates survey information from 2012.

Figure 2. Riverside Ranch Tidewater Goby Survey Locations, 2010 and 2011

Note: Yellow circles indicate surveys locations where tidewater goby were found, and blue circles indicate where surveys were conducted and no tidewater goby were found.

Source: USFWS 2010.

Major components of the Riverside Ranch restoration project involved converting approximately 300 acres of pastureland back to intertidal wetland habitat and excavating 3 miles of internal slough networks to provide habitat for tidewater goby and other aquatic species (HCRCD 2014). After the project was completed, postconstruction fish monitoring surveys conducted in 2014 (spring) and 2015 (fall and winter) demonstrated that tidewater goby were using restored habitats on Riverside Ranch. Tidewater goby occurred at most of the 11 Salt River fishery monitoring sites (HCRCD 2014, Ross Taylor and Associates 2014). They were most abundant at the terminal ends of sloughs in backwater features specially designed to support tidewater goby (Figure 3).

In addition to tidewater goby, many other aquatic species were documented in restored habitat on Riverside Ranch, including juvenile coho salmon (*Oncorhynchus kisutch*.), juvenile Chinook salmon (*Oncorhynchus tsawytscha*), juvenile steelhead (*Oncorhynchus mykiss*), threespine stickleback, sculpin (Cottidae), herring (*Clupea pallasii*), smelt (Osmeridae, Atherinidae), pipefish (*Sygnathus leptorhynchus*), perch (Embiotocidae), juvenile rockfish (*Sebastes* spp.), gunnels (Pholididae), starry flounder (*Platichthys stellatus*), lamprey (*Entosphenus tridentatus*), Sacramento pikeminnow (*Ptychocheilus grandis*), California roach (*Hesperoleucus symmetricus*), Dungeness crab (*Metacarcinus magister*), and shrimp (*Crangon* spp.) (HCRCD 2014, Ross Taylor and Associates 2014).

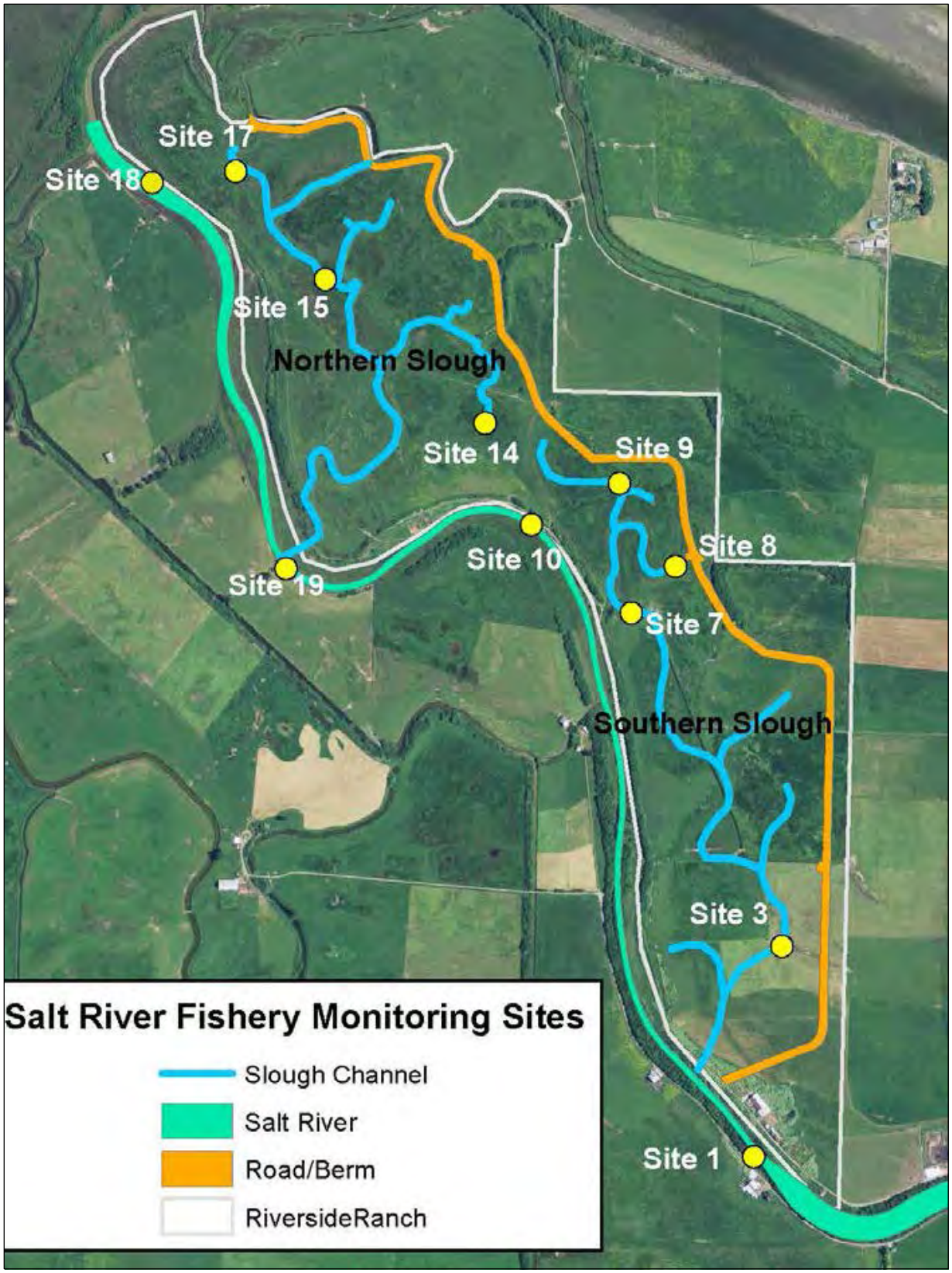


Figure 3. Salt River Fishery Monitoring Sites

Source: HCRCD 2014.

Water Quality

The Project area contains a mix of grazing land, tidal salt marsh, freshwater marsh, brackish marsh, riparian scrub, slough channels, ditches, freshwater ponds, and nearshore dune ridges and swales. Portions of the Project area may receive full, muted, or no tidal exchange. As a result, water quality fluctuates widely depending on the location and season. For example, salinity in the Project area ranges from 0 ppt in fresh water to approximately 34 ppt in coastal marine waters. In 2010 and 2012, water quality parameters (temperature, dissolved oxygen, and salinity) in the Project area were measured. In 2014–2016, additional salinity measurements were taken at sites in or near the Project area for the purposes of informing hydrologic modeling. The water quality measurements are presented in Tables 1 and 2 and the following text.

Table 1. Tidewater Goby Detections and Water Quality Measurements (Temperature, DO, Salinity) at Four Sites in the Eel River Estuary Preserve, October 21, 2010

Site[1]	Depth (feet)	Temperature (°C)	DO (mg/L)	Salinity (ppt)
1	0 (surface)	12.6	5.90	6.5
	1.0 (bottom)	12.9	6.76	17.1
2	0 (surface)	14.5	5.44	25.3
	1.5 (bottom)	14.7	5.01	26.5
3	0 (surface)	13.6	3.70	11.9
	0.5 (bottom)	14.0	2.41	24.4
4	0 (surface)	13.0	4.35	28.2
	0.5 (bottom)	13.4	4.20	28.2

Source: Shows pers. comm. 2010.

Table 2. Tidewater Goby Detections and Water Quality Measurements (Temperature and Salinity) at 10 Sites in the Eel River Estuary Preserve, October 26, 2012

Site[1]	Tidewater Goby Found?	Depth (feet)	Temperature (°C)	Salinity (ppt)
1	No	<3.0	11.8	15.8
2	No	<3.0	11.5	14.1
3	No	x	x	x
4	No	<1.5	11.7	13.9
5	Yes	<3.0	13.6	13.7
6	No	<1.5	x	x
7	No	x	x	x
8	No	x	x	x
9	Yes	x	x	x
10	Yes	x	x	x

Source: H. T. Harvey & Associates survey information from 2012.
Notes: mg/L = milligrams per liter; ppt = parts per thousand; x = data not collected.
[1] Sites are shown in Figure 1.

Wildlands Conservancy staff members collected discrete salinity measurements on an approximately monthly schedule between early November 2014 and mid-January 2016 at 25 established sites located in or adjacent to the Project area. In general, salinity levels at all sites were low, between 0 and 20 ppt, from late fall through early spring (from November 2014 through March 2015) and increased to between 15 and 35 ppt during late spring through fall (from April 2015 through November 2015) until they decreased again in winter (December 2015 and January 2016) (Kamman Hydrology & Engineering 2011). Groundwater salinity levels measured in wells did not fluctuate as much as levels measured at tidally influenced sites, but they followed the same seasonal salinity level trend. Salinity levels in irrigation ditches increased rapidly during summer (May through August), from approximately 0 ppt to between 10 and 20 ppt (Kamman Hydrology & Engineering 2011).

Surface water and groundwater salinity levels in the Project area follow seasonal precipitation and river discharge patterns. They are lower in spring and early summer because of increased precipitation and discharge from the Eel River and higher in summer and fall, when precipitation and discharge from the Eel River decrease. Although measured salinity levels did not exceed tolerable levels for adult and large juvenile tidewater goby (43–53 mm), salinity levels of 26 ppt are considered sufficient to cause mortality to small tidewater goby (Hellmair and Kinziger 2014). In spring and early summer, salinity levels could support larval tidewater goby; however, salinity levels in midsummer and fall may exceed tolerable levels for larvae and small juveniles.

Potential Impacts of the Project on Tidewater Goby

The Project will require activities that could directly or indirectly affect tidewater goby. Impacts on tidewater goby could occur during various project activities, including the retrofit of the tide gates, the installation of new tide gates, improvements to Centerville Slough, the reconnection of Russ Creek to Centerville Slough, the reconnection of Shaw Creek to Centerville Slough, and the improvement of existing and creation of new off-channel habitat in the Project area.

Tidewater goby could be killed or injured during implementation of preconstruction and construction activities. For example, improper handling of goby or relocation of goby to unsuitable habitat during preconstruction efforts to preserve individual tidewater goby could result in mortality or injury. During dewatering of the Project area, goby could become stranded or entrained into pumps. Goby also could be crushed by equipment or debris, or they could be removed from their habitat during construction. Injury could result indirectly from habitat destruction, increased turbidity and sediment in channel waters related to construction activities, and exposure to contaminants (e.g., spills). Improvements to the Project area will benefit other aquatic species, including nonnative species, such as Sacramento pikeminnow, which can prey on tidewater goby. The installation and operation of improved and new tide gates may alter hydrologic functions. This change may alter hydrologic conditions (e.g., salinity, flow, velocity) and create an environment intolerable for some life stages of tidewater goby, resulting in goby mortality.

Avoidance and Minimization Measures

Because implementing the Project could directly or indirectly harm or kill tidewater goby, the following avoidance and minimization measures will be incorporated into the Project:

1. Construction activities will be phased and conducted in a sequence that minimizes impacts on tidewater goby. Construction also will be limited to dry-season work windows (June 15 through October 15) to reduce the amount of goby habitat affected and minimize the impact on water quality. Although dry-season work windows may coincide with spawning and larval development, the footprint of available goby habitat may be smaller because summer conditions typically are drier, reducing the area in which tidewater goby may be present. In addition, conducting work during the dry season will minimize the impact on water quality from sediment generated by construction activities and from spills that could occur during construction and maintenance of the Project (e.g., oil, fuel, hydraulic fluid).

2. Phase project construction so tidewater goby can be relocated to sites in the Project area but away from areas targeted for restoration. During excavation, tidewater goby may be crushed by equipment or debris or may be removed from channels or marshes unintentionally by equipment. Mortality can be minimized by capturing and relocating tidewater goby out of construction areas. Relocating tidewater goby from areas targeted for restoration to habitat outside of the immediate restoration area before construction begins is intended to protect individual fish; however, improper capture and handling may result in injury or mortality. In addition, tidewater goby that need to be relocated should be taken to areas that have suitable habitat (e.g., where tidewater goby are known to thrive). Therefore, the capture and handling of tidewater goby will be conducted by qualified biologists, and suitable habitats for relocation will be identified before construction begins.

3. Where dewatering needs to occur, all pump intakes will be screened, and only qualified biologists will conduct goby rescue during dewatering. Dewatering to facilitate excavation and other construction activities may be harmful if goby become entrained into dewatering pumps or if goby become stranded.

4. Tide gates will be adjusted seasonally as described in the operating plan. The operating plan will be developed to address floodwater management and will identify specific tide gate levels and include seasonal operation guidelines. The plan will identify measures to minimize adverse effects on tidewater goby. In addition, specially designed restoration features, such as grade controls and areas that remain ponded at mean lower low water, will be installed upstream of the tide gates to provide habitat for tidewater goby.

5. To compensate for the increased potential for predation by nonnative species on tidewater goby, the quantity and quality of habitat for tidewater goby will be increased in the Project area. Goby populations are expected to expand into restored areas and be able to withstand any potential increase in predation by nonnative species such as Sacramento pikeminnow.

References

Chamberlain, C. D. 2006. Environmental Variables of Northern California Lagoons and Estuaries and the Distribution of Tidewater Goby (*Eucyclogobius newberryi*). Arcata Fisheries Technical Report Number TR 2006-04. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California.

Chamberlain, C. D. 2011. Tidewater Goby Investigations: 2010 North Coast Populations. Arcata Fisheries Data Series Report DS-2011-21. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California.

[HCRCD] Humboldt County Resource Conservation District. 2014. Salt River Ecosystem Restoration Project, Phase 1–Year 1 Monitoring Report. Eureka, California.

Hellmair, M., and A. P. Kinziger. 2014. Increased Extinction Potential of Insular Fish Populations with Reduced Life History Variation and Low Genetic Diversity. PLoS ONE 9(11):e113139. <Doi:10.1371/journal.pone.0113139>.

Kamman Hydrology & Engineering. 2011. Riverside Ranch Tidal Marsh Restoration and Preliminary Salt River Channel Design. Volume I: Draft Basis of Design Report, Salt River Ecosystem Restoration Project, Humboldt County, California. Prepared for Humboldt County Resource Conservation District, Eureka, California.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999a. Postflood persistence and recolonization of endangered tidewater goby populations. North American Journal of Fisheries Management 19:618–622.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999b. Extirpation and recolonization in a metapopulation of an endangered fish, the tidewater goby. Conservation Biology 13:1447–1453.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley.

Ritter, A. F., K. Wasson, S. I. Lonhart, R. K. Preisler, A. Woolfolk, K. A. Griffith, S. Connors, and K. W. Heiman. 2008. Ecological signatures of anthropogenically altered tidal exchange in estuarine ecosystems. Estuaries and Coasts 31:554–571.

Ross Taylor and Associates. 2015. Fisheries Sampling in the Lower Salt River during the Fall and Winter of 2014–2015. McKinleyville, California. Prepared for NOAA Fisheries, the Humboldt County Resource Conservation District, and Ducks Unlimited.

Shows, Amber. Project Coordinator. Humboldt County Resource Conservation District, Ferndale, California. October 27, 2010—email message to Adam Wagschal of H. T. Harvey & Associates.

Stillwater Sciences. 2006. Guidelines to Evaluate, Modify and Develop Estuarine Restoration Projects for Tidewater Goby Habitat. Final report. Arcata, California. Prepared for U.S. Fish and Wildlife Service, Arcata, California.

Swenson, R. O. 1995. The Reproductive Behavior and Ecology of the Tidewater Goby *Eucyclogobius newberryi* (Pisces: Gobiidae). Dissertation. University of California, Berkeley.

Swenson, R.O. 1999. The ecology, behavior, and conservation of the tidewater goby, *Eucyclogobius newberryi*. Environmental Biology of Fishes 55:99–119.

Swift, C. C., J. L. Nelson, C. Maslow, and T. Stein. 1989. Biology and Distribution of the Tidewater Goby, *Eucyclogobius newberryi* (Pisces: Gobiidae) of California. No. 404. Natural History Museum of Los Angeles County. Los Angeles, California.

[USFWS] U.S. Fish and Wildlife Service. 2005. Recovery Plan for the Tidewater Goby (*Eucyclogobius newberryi*). Portland, Oregon.

[USFWS] U.S. Fish and Wildlife Service. 2010. Tidewater Goby Surveys Field Note for: Salt River, Tributary to Eel River, Humboldt County, California. Unpublished report. Arcata Fish and Wildlife Office, Arcata, California.

Appendix F Hydraulic Design Report

DRAFT
HYDRAULIC DESIGN AND FEASIBILITY ASSESSMENT REPORT

Eel River Estuary and Centerville Slough Enhancement Project
Humboldt County, California

Prepared For:

California Trout, California Coastal Conservancy &
California Department of Fish and Wildlife

Prepared by:

Kamman Hydrology & Engineering, Inc.
7 Mt. Lassen Drive, Suite B250
San Rafael, CA 94903
(415) 491-9600

June 2016

TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	1
1.1	Study Goals and Objectives	1
1.2	Study Approach	2
1.3	Hydrologic Site Setting and History	3
2.0	DESCRIPTION OF PROJECT ALTERNATIVES	5
2.1	No Action	5
2.2	2015 NOP Alternative – Original Channel Width	5
2.3	2015 NOP Alternative – Reduced Channel Sizes	8
2.4	2014 NOP Alternative – Original Channel Width	8
2.5	2014 NOP Narrow Alternative – Reduced Channel Width	9
2.6	Full Tidal Exchange	9
3.0	HYDRODYNAMIC MODEL DEVELOPMENT	10
3.1	Hydrodynamic Model Description	10
3.2	Model Network	11
3.3	Boundary Conditions	12
3.3.1	Downstream Tidal Water Levels	12
3.3.2	Upstream Surface Water Inflow	12
3.3.3	Simulation Periods	13
3.3.4	Groundwater Inflow	14
3.3.5	Ocean Seepage through Dunes	15
3.3.6	Wave Overwash	15
3.3.7	Sea Level Rise	16
3.4	Channel and Floodplain Roughness	17
3.5	Control Structures	17
3.6	Initial Conditions	17
3.7	Hydrodynamic Model Calibration and Validation	17
3.7.1	Calibration Simulations	18
3.7.2	Validation Simulations	18
4.0	SALINITY (ADVECTION-DISPERSION) MODELING	20
4.1	Modeling Assumptions	20
4.2	Dispersion Coefficients and Factors	20
4.3	AD Model Calibration	20

TABLE OF CONTENTS (continued)

Page No.

5.0 NUMERICAL MODELING RESULTS 22
5.1 Water Level and Inundation Area 22
5.1.1 Simulation Period 1: 2009 Spring Storm 22
5.1.2 Simulation Period 2: 2012 Winter Storm 23
5.1.3 Simulation Period 3: 2014/15 Winter Storms 24
5.1.3.1 Comparison of Project Alternatives 24
5.1.3.2 Wave Overwash 25
5.1.3.3 Sea Level Rise (SLR) 26
5.1.4 Simulation Period 4: 2014 Dry Winter Period 27
5.1.5 Simulation Period 5: 2005 Summer Period 27
5.1.5.1 Comparison of Project Alternatives 27
5.1.5.2 Sea Level Rise 28
5.2 Velocity and Channel Stability Assessment 29
5.2.1 Simulation Period 3: 2014/15 Winter Storms 29
5.2.2 Simulation Period 5: 2005 Summer Period 30
5.2.3 Sediment Transport Thresholds and Channel Stability 30
5.3 Salinity Conditions 32
5.3.1 Simulation Period 3: 2014/15 Winter Storms 32
5.3.2 Simulation Period 5: 2005 Summer Period 32
5.4 Fish Passage Assessment 33
5.4.1 Passage through Existing Tide Gates 34
5.4.2 Passage through Project Tide Gate Structure 34
5.4.3 Passage through Project Auxiliary Door 37
5.5 Predicted Project Wetland Habitat Distribution 39
5.6 Changes in Drainage and Flood Storage 40
5.7 Effects on Off-Site Channels 41

6.0 SEDIMENT MANAGEMENT AREA ANALYSIS 45

7.0 CONCLUSIONS 47

8.0 REFERENCES 50

TABLE OF CONTENTS (continued)

Page No.

LIST OF TABLES

Table 1	Peak flow rates and recurrence intervals for simulation periods	14
Table 2	Summary of water level calibration results	18
Table 3	Summary of water level validation results	19
Table 4	Critical shear stress and critical velocity values for non-cohesive and cohesive sediment types	31
Table 5	CDFG and NMFS Fisheries fish passage criteria	33
Table 6	Estimated upstream and downstream salmonid passage through existing Tide gates during 2005 summer period and 2014/15 winter periods	35
Table 7	Estimated upstream and downstream salmonid passage through the Project tide gate structure during 2005 summer period and 2014/15 winter periods	36
Table 8	Estimated upstream and downstream salmonid passage through auxiliary door during 2005 summer period and 2014/15 winter periods	38
Table 9	Difference in flood storage volume (AF) for 2015 NOP alternatives above elevation of 2.5-feet NAVD88	42
Table 10	Elevation-Volume-Area relationships for proposed Sediment Management Areas (SMA)	46

LIST OF FIGURES

(Figures located at end of report)

Figure 1	Project site map (circa 2012)
Figure 2	Historic site conditions (circa 1916)
Figure 3	Cut-Off Slough tide gates
Figure 4	2015 Revised NOP alternative components
Figure 5	2014 NOP alternative components
Figure 6	Existing Conditions and Full Tidal alternative hydrodynamic model geometry
Figure 7	2015 NOP alternative hydrodynamic model geometry
Figure 8	2014 NOP alternative hydrodynamic model geometry
Figure 9	Wildcat Mountain tributary watersheds contributing runoff to the project area
Figure 10	Tidal and flow model boundary conditions 5/1/09 - 6/4/09
Figure 11	Tidal and flow model boundary conditions 3/11/12 – 5/2/12
Figure 12	Tidal and flow model boundary conditions 11/19/14 – 4/15/15
Figure 13	Tidal and flow model boundary conditions 11/14/13 – 1/26/14
Figure 14	Tidal, flow and salinity model boundary conditions for summer period (6/23/05 - 10/22/05)
Figure 15	Coastal conditions during observed site dune overwash events on 1/29/16 and 2/4/16
Figure 16	Estimated typical inundation area (180-acres) during wave overwash events
Figure 17	Coastal conditions during 11/17/14 – 12/31/14 simulation period
Figure 18	Sea level rise tidal and flow model boundary conditions 11/19/14 – 4/15/15
Figure 19	Sea level rise tidal and flow model boundary conditions 6/23/05 - 10/22/05
Figure 20	Model calibration results 8/18/05 – 10/20/05
Figure 21	Model calibration results 11/14/13 – 1/30/14

TABLE OF CONTENTS (continued)

LIST OF FIGURES (continued)

Figure 22 Model validation results 11/19/14 – 4/22/15
Figure 23 Simulated inundation area for April 1, 2012 storm
Figure 24 Simulated inundation area for April 1, 2012 storm
Figure 25 Simulated inundation area for April 1, 2012 storm
Figure 26 Locations of measured (4/30/14 – 4/22/15) and simulated water quality results
Figure 27 Comparison of simulated and measured salinity at selected monitoring locations
Figure 28 Locations of simulated water level results
Figure 29 Maximum inundation areas for each project alternative during 2009 spring storm
Figure 30 Simulated water levels for the 2009 spring storm
Figure 31 Maximum inundation areas for each project alternative during 2012 winter storm
Figure 32 Simulated water levels for the 2012 winter storm
Figure 33 Maximum inundation areas for each project alternative during 2014/15 winter storm
Figure 34 Simulated water levels for the 2014/15 winter storm
Figure 35 Simulated water levels and flow rates of Existing Conditions wave overwash event on 12/20/14
Figure 36 Simulated water levels for the 2014/15 winter storm with 1-foot of SLR
Figure 37 Maximum inundation areas for each project alternative during 2014 dry winter period
Figure 38 Simulated water levels for the 2014 dry winter period
Figure 39 Maximum inundation areas for each project alternative during 2005 summer period
Figure 40 Average inundation areas for each project alternative during 2005 summer period
Figure 41 Simulated water levels for the 2005 summer period
Figure 42 Simulated water levels for the 2005 summer period with 1-foot of SLR
Figure 43 Locations of simulated velocity and salinity results
Figure 44 Simulated velocities for the 2014/15 winter period
Figure 45 Simulated velocities for the 2005 summer period
Figure 46 Simulated salinities for the 2014/15 winter period
Figure 47 Simulated salinities of Existing Conditions wave overwash event on 12/20/14
Figure 48 Simulated salinities for the 2005 summer period
Figure 49 Duration and level of summer tidal exchange in Eel River Estuary and outer Cut-Off Slough tide gate in relation to tidal datums, vegetation communities and marsh types
Figure 50 Comparison of simulated summer water level inundation curves for Project alternatives with tidal datums and marsh habitat zones
Figure 51 Simulated total project flooded areas and volumes for 2005 summer period
Figure 52 Flood storage-volume above elevation of 2.5-feet for selected project alternatives
Figure 53 Simulated cumulative discharge through existing and project tide gates during 2005 summer period
Figure 54 Locations of simulated water level and velocity results on lower Cut-Off Slough and Salt River
Figure 55 Simulated pre- and post-project water levels in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period.
Figure 56 Simulated pre- and post-project velocities in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period.
Figure 57 Proposed Sediment Management Area (SMA) locations – 2015 NOP Alternatives

TABLE OF CONTENTS (continued)

APPENDICES

Appendix A: Imagery Depicting Land Use Change – 1945 to 2012
Appendix B: Proposed Project Design Components and Preliminary Alternatives
Appendix C: Topography and Bathymetry of Project Site
Appendix D: Water Level and Salinity Monitoring
Appendix E: H.T. Harvey Memorandum presenting 2009 Estuary Water Level Monitoring
Appendix F: Synthesis of Storm Hydrographs in the Eel River Estuary
Appendix G: Design Alternatives for Project Culverts
Appendix H: Fluvial Sediment Yield Analysis
Appendix I: Equilibrium Channel Dimensions for 2015 NOP Alternative

Chapter 1: Introduction

1.1 Study Goals and Objectives

This report, prepared by Kamman Hydrology & Engineering, Inc. (KHE), presents the results of technical study associated with the planning and hydrodynamic feasibility analysis of alternatives for ecosystem enhancement on the Wildland Conservancy's (TWC) Eel River Estuary Preserve and Russ properties (Russ) located on the Eel River Delta south of the river mouth and west of Ferndale, California. A complete description of the project study area is provided in the project environmental compliance documents. This study summarizes several years of work completed on behalf of the California State Coastal Conservancy through various contracts with the Five Counties Salmonid Conservation Program (5C Program) and California Trout.

The goal of the Project is to improve geomorphic and ecosystem functions that would enhance habitat for native fisheries and aquatic species, support waterfowl and wildlife species, and benefit agricultural land management by more effectively managing onsite flooding and sedimentation. Project objectives also include designing and planning for future climate scenarios and sea level rise in relation to agricultural land management, capacity and uses, dune enhancement, and vegetative communities. Specific objectives of the Project include:

- Improve access to restored aquatic habitats for salmonids and other aquatic dependent species by increasing or creating migratory access between estuarine and inland waters and by restoring overwintering and rearing habitat for juvenile salmonids;
- Improve drainage efficiency and manage sediment loads more effectively using both passive natural processes and active management approaches, while enhancing tidal influences by reestablishing connectivity of Russ Creek, Shaw Creek and Creamery Ditch to a rehabilitated Centerville Slough;
- Increasing resiliency to sea level rise and reducing salt water influences to pastures, enhancing drainage and establishing avulsion management areas for Russ Creek and Shaw Creek;
- Enhance tidal processes by restoring tidal prism and improve reliability of tide gate infrastructure to provide adaptability for sea level rise and varied land management;
- Enhance dune formation to increase resiliency to sea level rise;
- Enhance freshwater pond habitat for water birds and other native aquatic dependent species;
- Facilitate access for continued passive and active agricultural land management, and nature study opportunities consistent with existing conditions;

- Suppress invasive species; and
- Establish long-term Adaptive Management Program.

The project goals and objectives are further described in both the December 2014 Notice of Preparation (NOP; GHD, 2014) and in the November 2015 Revised Notice of Preparation (NOP; GHD, 2015). The hydrologic and hydraulic intent of the project is to:

- Improve hydraulic connectivity for aquatic species passage from estuary to inland waters.
- Not increase the risk of flooding on project and adjacent parcels, primarily due to loss of flood storage capacity within area draining to the Cut-Off Slough tide gate structure;
- Investigate opportunities for improving agricultural productivity by improving drainage of currently flood-prone low-lying areas at the TWC, Russ and adjacent lands;
- Minimize impacts to agricultural productivity by targeting ecosystem enhancements in areas less viable from an agricultural perspective and more suitable for achieving natural resource enhancement;
- Identify areas suitable for coastal dune enhancement measures that may reduce the threat of wave over-wash and project flooding by high salinity marine water; and
- Evaluate approaches to better transmit/manage water and sediment from tributary creeks entering the project area from the southern Wildcat Mountains.

1.2 Study Approach

The approach used in conducting this study included developing and evaluating a suite of channel and tidal restoration alternatives within the project footprint. This study also evaluates and quantifies muted tidal exchange with outboard tide waters, either via retrofitting the existing Cut-Off slough tide gates or through gated culverts installed through the existing outboard levee. Desired outcomes of this study include the following:

- Quantify the benefits and impacts to agriculture, wetland and aquatic habitat (via hydrology and water quality-salinity) under various muted tidal regimes.
- Evaluate seasonal management options that optimize agricultural production while restoring historic habitat for anadromous salmonids and existing tidewater goby habitat (e.g. maximum muted tidal exchange in winter and reduced exchange in summer to maximize freshwater marsh habitat).
- Quantify time and duration of tide gate opening and associated velocity/depths in order to assess benefits and impacts to tide-water goby and coho.

Using available topographic and bathymetric information, KHE developed a 1-dimensional hydrodynamic model of the project area using the Danish Hydraulic Institute's (DHI)

hydrodynamic modeling code to evaluate a suite of proposed project alternatives. By modeling muted tidal exchange, water levels, flow velocity and salinity, KHE quantified the changes in site hydrologic and water quality conditions under each of the proposed project alternatives. In turn, these data are available to the project design team's aquatic ecologist to evaluate and characterize the potential benefits and impacts to important species that exist or could colonize the project area, including coho salmon, tidewater goby, coastal cutthroat trout, longfin smelt, lamprey eel, water fowl, shore-birds, eel grass and other sensitive fish, wildlife and plant species. Study results will also be used in combination with the findings from an independent agricultural impact assessment to identify opportunities to improve net agricultural production in concert with potential ecosystem enhancements. Unless noted otherwise, all elevations are reported in NAVD-88.

1.3 Hydrologic Site Setting and History

The study area lies within a large multi-parcel, leveed-off area. The area is segregated from the Pacific Ocean by a long, linear dune field and separated from the Eel and Salt Rivers by constructed levees lying north of the Inner Marsh and bordering Mill and Smith Creeks (see Figure 1). To the south, the site is bordered by the Wildcat Mountains. Shaw and Russ Creeks are the main tributaries entering the study area from the Wildcat. Because of the high sediment loads originating from the marine mudstones that dominate the Wildcat Mountains, there are large and extensive alluvial fans that build out onto the south side of the Eel River delta plain. These are prominent features associated with active and historic alignments of Russ and Shaw Creeks (Figure 1)

Historically, the project area was relatively flat with freshwater inflows from the Wildcat Mountains flowing northward through a system of historic slough channels. The 1916 USGS topographic map of the project area (Figure 2) indicates a long and continuous back-dune wetland system, dominated by the bifurcating Centerville slough channel, which extended from Centerville Beach to the Salt River. By 1945, much of the delta plain between the Eel River and Wildcat Mountains had been converted to pasture through the construction of levees and ditches. The continued conversion and development of these lands through 2012 is captured in the series of aerial photographs and maps presented in Appendix A.

Concurrent with reclamation efforts and continuing to this day was a steady erosion of the dune network. The last figure in Appendix A superimposes delineations of dune overwash and sediment splay areas observed in the historic aerial photographs. This graphic depicts the systematic reduction of the southern dunes from overwash since 1998. By 2012, over 4000-linear feet of foredune located north of Centerville Beach was been lowered/leveled due to wave over-wash. Since 2012, a second foredune breach has become more established further north, adjacent to the confluence of Russ Creek and the Western Drainage ditch (Figure 1). The area behind the larger southern degraded dune, locally referred to as Angels Camp, is seasonally flooded by overwash from the Ocean. Other highlights of changes revealed by comparison of

these images include: migration of the Eel River mouth (further detailed in KHE, 2015); filling of northern portion of Centerville Slough within current L.D. O'Rourke Foundation property (ORF) and extending to the Salt River confluence; progressive construction of the current levee system; installation of internal drainage ditches, most notably the Western Drainage Ditch that parallels the dunes and Pacific Ocean between Centerville Beach and Cut-Off Slough; and repeated realignment and construction of the primary northern levee and large tide gate structure that provides the primary outfall of drainage from the entire project area. Human manipulation of the alignment of Russ Creek over this time has also created an alluvial ridge through the south central part of the project area, creating a drainage divide between Angels Camp and the northern project area (see Figure 1).

Currently, tributary flow moves onto and through the project vicinity via the elevated alluvial fan channels of Russ and Shaw Creek or the Creamery ditch on the Russ and TWC properties. These flows generally travel northward until they intersect or are directed to the Western or Eastern Drainage Ditches (Figure 1). These ditches also flow northward into the remnant Centerville Slough channel and then Cut-Off Slough. Water then exits the project area through the Cut-Off Slough tide gates (Figure 3), ultimately discharging to the Salt River located further to the northeast. Some of the lowest-lying terrain occurs on lands owned by ORF, located east of the TWC property. This area, bordered by Mill and Smith Creeks, is drained by a system of remnant slough channels equipped with culverts and tide gates, with runoff directed westward into Cut-Off Slough opposite the Inner Marsh.

For a complete description of the physical setting of the project area, the reader is referred to the report entitled, "Draft Eel River Coastal Plain Dunes Assessment and Restoration Feasibility Analysis" (KHE, 2015). The dune study report contains a detailed description of: the physiographic setting and history, site and local area geology and hydrogeology; flow and sediment transport conditions on the Eel River; and near-shore coastal processes and controls over dune morphology and stability.

Chapter 2: Description of Project Alternatives

Meetings with adjacent property owners to discuss land management and project alternative options began in 2011. Various project alternatives have been explored in the context of these discussions and in the development of a proposed project. Some of these are summarized in a memorandum dated January 16, 2013 (Appendix B). Ultimately, a proposed project limited to TWC property was developed and a Notice of Preparation was circulated December 2014. Subsequently, and in order to extend drainage and sea level rise adaptation benefits to surrounding properties, adjacent landowners requested participation in a broader project. The proposed project was revised and re-scoped in 2015.

In order to fully analyze the proposed project, and as part of this study, a suite of six potential project alternatives were identified for hydraulic analysis to determine how they perform with regard to satisfying project goals and objectives. These alternatives include: No Action or Existing Conditions alternative; 2014 NOP alternative as described in the original 2014 NOP and a modified version that reduces channel width by 50-percent; 2015 Revised NOP alternative and modified version that reduces new channel widths by 50-percent; and Full Tidal Exchange alternative, an alternative proposed during project scoping. Detailed descriptions and objectives of the specific project design components integrated into project alternatives are presented in Appendix B as well as the 2015 Revised NOP. A description of each alternative analyzed as part of this study is presented below.

2.1 No Action

No modifications to the Project area are proposed under this alternative. The alternative maintains the existing levee and tide gate conditions and continues to preclude tidal exchange within the project area. The site would continue to be managed to maximize agricultural potential and flood control. There are no internal channel, culvert, tide gate or levee improvements proposed under the No Action alternative. By design, this alternative incorrectly assumes that the existing channel geometry of Western Drainage Ditch and Russ Creek is static, and not subject to aggradation and infilling.

2.2 2015 Revised NOP Alternative – Original Channel Width

The 2015 Revised NOP (GHD, 2015) provides a detailed description of the proposed project elements for this alternative. Figure 4 summarizes the enhancement features associated with the 2015 Revised NOP alternative that spans the Russ and TWC properties. Specific alternative hydraulic design details that are integrated into the numerical model include the following.

1. Install new culverts between the Inner Marsh and existing outer Cut-Off Slough channel. These culverts will be installed through the existing outer levee immediately west of existing Cut-Off Slough tide gate structure. The new culverts could consist of either: a) three (3) 5-foot diameter circular side hinged gated culverts to allow one-way flow out of

the Inner Marsh and a fourth 5-foot diameter circular culvert equipped with Muted Tidal Regulator to allow both full positive (ebb) and managed negative flow (flood); or b) two (2) 5' by 6' (width x height) concrete box culverts equipped with side-hinge tide gates to allow one-way flow out (positive) of the Inner Marsh and a third 5' by 6' concrete box culvert equipped with side-hinge gate and Muted Tidal Regulator (MTR) to allow full positive and managed negative flow. The two culvert configurations provide very similar flow capacity as modeled throughout this study and the benefits/constraints associated with both installations are discussed in Appendix G.

Muted tidal exchange through the new Inner Marsh MTR would be controlled seasonally. In winter, maximum tidal inflow elevation into the Inner Marsh would be restricted to approximately 2.5-feet, equal to current conditions. Maintaining this level would preserve the existing flood storage capacity of the Inner Marsh. During the dry season, when flooding is not a hazard, the MTR would be adjusted and operated to allow the maximum muted tide levels to rise to an elevation of approximately 5-feet, increasing the depth and area of aquatic habitat.

2. Replace one (1) existing flap gate in the existing Cut-Off Slough tide structure with a new side-hinge tide gate equipped with a 1-meter square auxiliary fish passage door. Retrofitted structure is intended to maintain the current water levels within inner Cut-Off Slough.

3. Excavate a new 80 to 90-foot wide by 400-foot long channel at the north end of the Inner Marsh to connect the existing Inner Marsh remnant slough channel to the new tide gates[1].

4. Improve existing internal berm around the north and east sides of Inner Marsh to uniform elevation of approximately 8-feet. Remove two northern-most existing culverts through inner berm and fill and reconstruct berm.

5. Remove existing culverts at south end of Inner Marsh berm and replace with three (3) new 5-foot diameter gated culverts to allow positive flow only from Centerville Slough into the Inner Marsh.

6. Excavate new 140- to 120-foot wide Centerville Slough channel along alignment indicated in Figure 4. Connect the north end of new channel with existing remnant slough channel within Inner Marsh. Bottom of channel constructed to elevations ranging from 2 feet at south end to -3.94 feet NAVD88[2] at the tie-in to the Inner Marsh.

[1] The initial 2014 and 2015 NOP alternative Inner Marsh, Centerville Slough and Russ Creek channels discussed in this section were sized to convey Wildcat Tributary floodwaters having a 2-year recurrence interval.
[2] This invert elevation matches the approximate invert elevation of existing tide gates and maximizes flow conveyance through the new structure (see Section 1.2 of Appendix G).

7. Construct new 60-foot to 50-foot wide Russ Creek channel on both Russ and TWC properties along alignment indicated on Figure 4, with provision for a more sinuous alignment. This channel merges with new Centerville Slough midway through TWC property. Bottom elevation of 2.0-feet NAVD at confluence with Centerville Slough grades up to existing 8.0-feet NAVD88 channel bed elevations at the EREP/Russ property boundary. Channel improvements extend another approximately 2600-feet south along the current channel alignment on Russ property.

8. Construct new internal guide berm on TWC property along east side of new Centerville Slough and Russ Creek channels with uniform crest elevation of 8-feet (see alignment Figure 4). This berm will eliminate all but flood flow exchange from TWC to ORF property.

9. Fill Centerville Slough channel as part of new guide berm construction near site of existing TWC Bridge. This channel fill berm merges with improved Inner Marsh internal berm to the north and the top would be constructed as a 330-foot wide high flow spillway by lowering crest to elevation to 5-feet NAVD88. This allows exchange of flood waters onto ORF property during flood events when water level in the new Centerville Slough channel reach 5-feet in elevation[3].

10. Grade existing topography on TWC property between new Russ Creek and Centerville Slough channels to create an approximately 63-acre shallow depression to capture sediment laden flow from Russ Creek. This sediment capture area is referred to Sediment Management Area 1 (SMA-1) throughout this report.

11. Construct new guide berm on Russ property along alignment of existing internal berm and parallel to southern extension of new Centerville Slough channel passing through Angels Camp. Crest elevation of this berm would be approximately 8-feet.

12. Construct pair of new 3-foot diameter culverts through new Russ guide berm equipped with flap gates to provide one-way positive flow, conveying Creamery ditch flow into new Centerville Slough channel.

13. Improve another existing guide berm adjacent to the lower section of Creamery ditch on the Russ property to create a pair of sediment capture areas referred to as SMA-2 and SMA-3. These areas would be approximately 47- and 42-acres in size, respectively.

[3] The crest elevation of this this spillway matches the minimum elevation of the internal berms that run parallel with and separate ORF from Centerville and Cutoff Sloughs.

14. Through construction of new channel, realign Shaw Creek westward to south end of new Centerville Slough channel in Angels Camp. This work is intended to capture and redirect all of Shaw Creek flow to the west side of new Russ guide berm.

Other small internal drainage and ecological components indicated on Figure 4 such as ditches and ponds are of too small and intricate in size to incorporate into the hydrodynamic model. Their impact on flow and water quality through the system are insignificant. Dune restoration efforts influence the numerical modeling analysis only to the extent and frequency of wave overwash.

2.3 2015 Revised NOP Alternatives – Reduced Channel Sizes

In an attempt to optimize the 2015 NOP project design, an additional pair of modified channel sizes were developed and analyzed. These varying designs incrementally reduce internal channel sizes and associated excavation volumes and were analyzed to determine the effect on project objectives, especially the ability to transport sediment. The two modified designs are referred throughout the report as the 2015 NOP Narrow and 2015 NOP Equilibrium alternatives.

The 2015 NOP Narrow alternative reduces the size of the new Centerville Slough and Russ Creek channels by approximately 40-percent. Under this alternative, the top width of the new Centerville Slough channel ranges from 70- to 90-feet and between 35- and 40-feet for the new Russ Creek channel. This alternative retains the original channel width (80- to 90-feet) for the segment of new channel excavated at the north end of the Inner Marsh.

The 2015 NOP Equilibrium alternative sizes internal channels based on the relationship between the amount of tidal exchange and local and regional hydraulic geometry. The approach and methods used to size the channels in the 2015 NOP Equilibrium alternative is presented in Appendix I and results in the smallest channel widths of the 2015 NOP alternative suite. Under the 2015 NOP Equilibrium alternative, the top width of the new Centerville Slough channel ranges from 45- to 60-feet and approximately 35-feet for the new Russ Creek channel. The top width of the 400-foot long Inner Marsh channel is reduced to approximately 70-feet. All other project components in these alternative design scenarios are treated as described in the original 2015 NOP Alternative description above.

2.4 2014 NOP Alternative – Original Channel Width

The 2014 NOP (GHD, 2014) provides a detailed description of the proposed project elements for this alternative. Figure 5 summarizes the enhancement features associated with the 2014 NOP alternative, which is restricted to the TWC property. Specific alternative hydraulic design details that are integrated into the numerical model include the following.

1. Install new culverts between the Inner Marsh and exiting outer Cut-Off Slough channel as described in the 2015 NOP alternative. Seasonal control of maximum muted tide levels would be the same as described for the 2015 Revised NOP alternatives.

2. Replace one (1) existing flap gate in the existing Cut-Off Slough tide structure with a new side-hinge tide gate equipped with a 1-meter square auxiliary fish passage door. Retrofitted structure is intended to maintain the current water levels within inner Cut-Off Slough.

3. Improve existing internal berm around north, east and south sides of Inner Marsh to uniform minimum elevation of 5-feet. Remove two northern-most existing culverts through inner berm and fill and reconstruct berm.

4. Remove existing culverts at south end of Inner Marsh berm and replace with three (3) new 5-foot diameter gated culverts to allow positive flow only between Centerville Slough and the Inner Marsh.

5. Excavate new 140- to 120-foot wide Centerville Slough along alignment indicated in Figure 5, upstream of the existing TWC Bridge. Connect the north end of new channel with existing Cut-Off Slough. Bottom of channel constructed to elevations ranging from 2-feet at south end to 0-feet NAVD88 at the tie-in to Cut-Off Slough.

6. Construct new 60-foot to 50-foot wide Russ Creek channel north of the Russ-TWC property boundary along alignment indicated on Figure 5. This channel merges with new Centerville Slough approximately 650-feet upstream (south) of the existing TWC Bridge. Bottom elevation of 2.0-feet NAVD at confluence with Centerville Slough grades up to existing 8.0-feet NAVD88 channel bed elevations at the Russ-TWC property boundary.

7. Raise the elevation of the access road bordering the TWC-ORF properties to a uniform elevation of 8-feet.

2.5 2014 NOP Narrow Alternative – Reduced Channel Width

Similar to the 2015 NOP Narrow Channel alternative, this alternative halves the channel width of the 2014 NOP alternative while maintaining all other components of this alternative as described above.

2.6 Full Tidal Exchange

The Full Tidal alternative assumes removing the existing Cut-Off Slough tide gates along with the existing levee bordering the north end of the Inner Marsh. This alternative allows for full and unrestricted tidal exchange back into the former wetlands. No other improvements or infrastructure protections are included in this alternative.

Chapter 3: Hydrodynamic Model Development

This chapter summarizes the model development process and final models used to simulate and analyze the various project alternatives. Modeling is a useful method to identify potential constraints associated with proposed project design elements as well as develop approaches to correct and mediate potential adverse impacts. The focus of this work was on hydrologic (flood), hydraulic, geomorphic and water quality (salinity) feasibility assessments. These assessments were completed through the development of a hydrodynamic model that can simulate the water movement, storage and salinity within the project area of influence under existing and proposed project conditions. An important step in this process is the collection and synthesis of data that accurately represents and accounts for project area topography and bathymetry (hereafter collectively referred as the project area or model domain).

3.1 Hydrodynamic Model Description

KHE selected the MIKE11 code (developed by the Danish Hydraulic Institute [DHI]) for hydraulic design and alternative feasibility assessment. The MIKE11 model is a well- proven model code used in applications around the world. It is FEMA-approved for use in flood impact assessments. The model is easily configured and reconfigured, facilitating rapid evaluation of "what-if" scenarios, design iterations and multiple design alternatives. The hydrodynamic (HD) code is capable of simulating both sub- and super-critical flow through a wide range of flow control structures including weirs, gated culverts and Muted Tidal Regulators. Through the advection-dispersion (AD) modules, the model is capable of simulating selected water quality constituents (e.g., salinity).

MIKE11 is a depth-averaged one-dimensional (1D) unsteady flow model. The model uses a finite difference scheme to solve the complete non-linear St. Venant equation for gradually varied open channel flow. The model predicts water surface elevations and flow rates across a series of accurately described cross-sections that are linked together to create a channel network.

The code offers added accuracy, when compared to many other codes, in the representation of floodplain/marsh-plain flows. MIKE11 permits links to be established between floodplain/marsh-plain areas and computational nodes of the main channel network. This pseudo-2D representation permits computation of both mass and momentum exchange via over-topped berms/levees/weirs separating channels and adjacent floodplain/marsh-plain areas. Most other 1D models only consider mass exchange (floodplain storage) in this scenario. Estimating floodplain momentum is important for accurate predictions at the project site where, in periods of flood, flow velocities across the flood/marshplain are likely to be both significant and different from channel velocities.

Salinity modeling in MIKE11 is accomplished using a 1D (vertically- and laterally-) averaged, implicit, finite difference transport and dispersal advection-dispersion (AD) scheme for dissolved material. Transport predictions are derived from results from the hydrodynamic flow model and an estimated dispersal rate that is proportional to concentration. A correction term, added to the algorithm, increases the accuracy of diffusive transport predictions across strong velocity gradients. It is important to reiterate that the model does not predict stratified flow or salinity conditions. More background on MIKE11 is available on the DHI website at www.DHIsoftware.com.

KHE originally began the hydrodynamic analysis with the development of a 2-dimensional (2-D) project model using the using the U.S. EPA's Environmental Fluid Dynamics Code (EFDC) to evaluate a suite of proposed project alternatives. However, head-discharge (h-Q) relationships for culverts and gated structures need to be developed independently and then integrated into the EFDC model. Because of the need to evaluate a multitude of varying tide gate structures on this project, alternative model codes with the ability to generate the necessary culvert h-Q relationships internally were evaluated. In addition, given the large number of project alternatives and simulation periods analyzed, a model code that permits more rapid model development and shorter simulation time was desired. The MIKE11 code was determined to be the most complete and cost-effective model code for this project.

3.2 Model Network

The MIKE 11 model network (also referred to as geometry) is developed by breaking the model domain into discrete sub watersheds and representing those watersheds as individual drainage alignments and cross-sectional profiles. The model network differs between alternatives as new channels and internal berms redefine drainage areas and preferred flow paths. For example, the Existing Conditions project model consists of 8 primary branches representing the Western Drainage Ditch, Shaw Creek, Upper Russ Creek, Lower Russ Creek, Russ area east of Russ Creek, O'Rourke Foundation area, Cut-Off Slough, and the Inner Marsh. Figure 6 illustrates the model network for the Existing Conditions alternative. This network is also serves as the basis for the Full Tidal alternative model network. Figure 7 and Figure 8 are the model networks for the 2015 NOP and 2014 NOP alternatives, respectively.

The project topographic/bathymetric map (see Appendix C) serves as the basis for the Existing Condition channel and floodplain conditions. Within the channel network, there are hundreds of nodes and dozens of cross-sections derived from the alternative DEMs that define channel geometry and floodplain or marshplain elevations. The DEMs representative of each alternative are provided as the background shaded relief maps in Figure 6-8.

In most cases, the area extent (boundary) of branches are defined by internal berms and levees that control water flow and inundation depths within the domain of a given branch. Within the

area encompassed by an individual branch, the water level in the channel or ditch is assumed to same as that in the adjacent flood/marsh plain. Branch junctions are termed link points. Hydraulic conditions are in dynamic equilibrium at the link point. As a result model, water levels equilibrate between adjacent branches that share a common link point and cumulatively represent a large flat area not separated by berm or levee. The MIKE11 code also has a pseudo 2-D network feature called a "link channel" that allows the simulation of floodwater flow over levees/berms between channel and adjacent flood/marshplain. In this schematization, the channel and adjacent floodplain are modeled as two separate branches. Link channels are essentially perpendicular branches that connect channel and floodplain branches and can be defined to represent an embankment, berm or levee. For example, link channels were incorporated into project alternative models to allow overbank water that overtops adjacent levees or berms along Russ Creek and Cutoff Slough to move laterally and flood into adjacent branch areas. In the case of flood water transfer between the Project Area and the O'Rourke Foundation (ORF) property, the berms separating the properties are modeled as broad-crested weirs, which allows for the transfer between properties once water levels rise above the weir crest elevation. The existing one-way gated culverts through these berms are also integrated into the models and allow drainage off the ORF property into Cutoff Slough.

3.3 Boundary Conditions

Water exchange into and out of the model domain is treated as point sources at the upstream and downstream end of all branches. The endpoints of branches depicted by the blue squares in Figures 6 through Figure 8, identify the locations of specified boundary conditions (e.g., downstream tidal water exchange and upstream freshwater inflows). Groundwater seepage and dune overwash are defined as evenly distributed inflows across internal model channel lengths of a defined channel reach. The following sections present the boundary conditions used in hydrodynamic modeling.

3.3.1 Downstream Tidal Water Levels

A time series of water surface elevations specified at the downstream model boundaries drives tidal exchange within the model. Tidal boundary conditions integrated into the models were derived from water level monitoring completed in outer Cut-Off Slough and the Eel River Estuary. A complete presentation and discussion of these monitoring data are provided in Appendix D.

3.3.2 Upstream Surface Water Inflow

There are a number of Wildcat Mountain tributary watersheds that contribute freshwater inflow the project area (see Figure 9). The total drainage area for all tributary watersheds is 5.88 square miles (mi^2). All runoff from these watersheds is directed into the model at the head of four model branches: Russ Creek (RC5 and RC6 combined 3.63 mi^2); Creamery Ditch (CVS4 of 0.16 mi^2); Shaw Creek (CVS3 of 1.19 mi^2), and Western Drainage Ditch (combined 0.93 mi^2).

Although the County and EPA have been monitoring suspended sediment concentrations on Russ Creek since late 2013, only water level data was available for this gauge. However, the County has been monitoring flow and suspended sediment concentrations on Francis Creek in Ferndale since 2008. Francis Creek also drains the Wildcat Mountains a short distance to the east and the watershed displays the same geology, slope and hydrologic characteristics as the project tributaries. A unit area conversion is used on the Francis Creek flow data to estimate inflows from the project tributaries. Thus, modeled freshwater inflow boundary conditions were derived for all simulation periods since 2008.

3.3.3 Simulation Periods

A suite of different simulation periods were identified from available data that represent varying winter and summer flow and tidal conditions. The simulation periods include winter flood flows representing 1- to 3-year recurrence interval events from the Wildcat Tributaries and periods coincide with 1- to 2-year recurrence interval events on the Eel River. Table 1 summarizes the peak flow rates and recurrence intervals on Francis Creek and Eel River during each simulation period. Hydrographs of measured and estimated boundary conditions are presented in Figures 10 through 14. The five model simulation periods are described as follows along with estimate of peak flow return period.

- *Simulation Period 1: 2009 Spring Storm –* This period includes a modest spring high flow event with a 1-year recurrent interval. The flow event occurs over a single day with little backwater effects from the Eel River. There was a short interruption in the estuary water level monitoring during the peak flow event over this period. To fill this downstream tidal boundary data gap, KHE developed an approach to synthesize Eel River estuary water levels during unmonitored high flow periods based on correlation to water levels measured at Fernbridge and North Spit tide levels. This approach is presented in Appendix F.

- *Simulation Period 2: 2012 Winter Storm –* The 2012 simulation period includes three sequential storms that elevate river and estuary water levels for a week-long period.

- *Simulation Period 3: 2015 Winter Storm –* The 2015 simulation period includes the two largest magnitude flow events on both the Eel River and Wildcat tributaries.

- *Simulation Period 4: 2014 Dry Winter Period –* The winter of 2013/14 was very dry. Only one minor storm occurs during the simulation period. This simulation is more representative of summer conditions, but was useful in evaluating low-flow project conditions during a period in which the MTR would restrict maximum internal tide levels to 2.5-feet NAVD88.

- *Simulation Period 5: 2005 Summer Period –* This simulation represents later summer, low flow conditions. Project operations and MTR settings during this simulation allow for internal tidal levels to rise to a maximum elevation of 5-feet NAVD88.

Although the peak flows are an important variable in flooding within the project area, the prolonged high water level in the Eel River Estuary restrict drainage through the existing Cut-Off Slough tide gates and is an important factor is controlling the depth and duration of flooding within the project area. For example, based on monitoring data and model simulation results, the depth and duration of flooding during April 2012 was more severe than during the floods during the winter of 2014/15, even though Eel River and Wildcat Tributary inflow rates were significantly higher in 2014/15. The more severe flooding during 2012 resulted from prolonged high Eel River and estuary water levels that kept the tide gates closed for a longer period of time, allowing waters to accumulate and pond to a greater extent and height than compared to the 2015 conditions. Anecdotal accounts from numerous local area residents verify that the most severe flooding within the project area occurs during multi-day high flow events on the Eel River that lead to sustained high water levels in the estuary and outer Cut-Off slough preventing the Cut-Off Slough tide gates from opening/draining.

TABLE 1: Peak Flow Rates and Recurrence Intervals for Simulation Periods

Simulation Period	Date Peak Flow (Q)	Francis Creek Peak Q (cfs)	Francis Creek Recurrence Interval	Eel River Peak Q (cfs)	Eel River Recurrence Interval (yrs)
1: 2009 Spring storm	5/5/09	52	<1.0 years	52,900	1.0 years
2: 2012 Winter Storm	3/30/12	201	1.3 years	90,600	1.3 years
3: 2015 Winter Storm	12/11/14	142	1.0 years	128,000	1.6 years
3: 2015 Winter Storm	2/6/15	489	3.0 years	148,000	2.0 years
3: 2015 Winter Storm	4/7/15	321	1.7 years	4,250	<1.0 year
4: 2014 Dry Winter Period	11/23/13	<3	<1.0 years	1,150	<1.0 year

3.3.4 Groundwater Inflow

During hydrodynamic model calibration, notable mass balance errors and resulting simulated low water levels suggested insufficient hydrologic inflows. Low simulated salinity concentrations also suggested an imbalance in the model water balance. Review of available

shallow groundwater data collected across the site indicated water table elevations consistent with the water levels observed and measured in low lying remnant slough channels. Thus, it is logical that there is groundwater inflow into interior channels during low tide periods when channels are drained and dewatered. Through an iterative modeling process of repeatedly adjusting groundwater inflow into the Inner Marsh, Cut-Off Slough and lower Centerville Slough channels, it was determined that a cumulative total constant groundwater inflow of 7.0-cfs was required to attain interior channel water levels equal to measured values. This constant disseminated groundwater inflow rate was applied to all alternative models and simulation periods. Based on shallow groundwater salinity measurements within the north-central portion of the project, it is estimated that the average salinity concentration of this groundwater inflow is 5.0-ppt.

3.3.5 Ocean Seepage through Dunes

Based on field monitoring data of salinity concentrations, ditch water levels and salinity mass balance errors, it appears that marine water infiltrates from the ocean through the dunes and into the Western Drainage ditch. Thus, a theoretical approach was used to estimate the volume of ocean seepage through the dune using Darcy's groundwater flow equation. The equation was used to calculate groundwater flow as the product of the dune sand hydraulic conductivity, water surface slope from ocean to interior channels and cross-sectional flow area through the dunes. For this analysis we assumed the following: a) dune sand hydraulic conductivity of 15,000 gpd/ft^2, as averaged from available published values (ASCE, 1996; Domenico and Schwartz, 1990; Driscoll, 1986; and Freeze and Cherry, 1979); b) flow gradient from Ocean to ditch of 0.0042 ft/ft, based on average head differential between mean Ocean tide level (3.35 ft NAVD88) and average Western Ditch water level (0.00 ft NAVD88) and distance of 800 feet between Ocean and ditch; and c) wetted flow area of 40,200 ft2 based on 12,000-foot ditch length fronting the back of the dunes and average wetted thickness of 3.35-feet based on head differential between MTL and bottom ditch level. The resulting flow rate of 3.91 cubic feet per second (cfs) was distributed along the entire ditch length. This flow rate was applied to all alternative models and simulation periods with a salinity concentration of 32-ppt.

3.3.6 Wave Overwash

Some model simulations integrate wave overwash as a source of water into the project area. The volume of overwash was estimated based on field observations and tidal and wave height data collected during the wave overwash events of January 29, 2016 and February 4, 2016. Observations were provided by Jay Russ of Russ Ranch & Timber (RRT) (personal communication January 29 through February 4, 2016) and ocean tide and significant wave height data was obtained from NOAA websites[4]. The following observations and data were used to

[4] Tides: https://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=9418767
Significant wave height: http://www.ndbc.noaa.gov/station_history.php?station=46022

estimate an inflow volume of 132.5 acre-feet (AF) during a typical wave overwash event lasting 2-hours, which is synchronous with the short periods of measured high wave energy.

- Overwash typically occurs when tides are high and significant wave heights exceed 22-feet. These conditions produced the wave overwash events observed on January 29 and February 4 (see Figure 15).
- The volume of water that enters the project model domain (132.5-AF) was calculated based on estimated water levels of 6 feet within the inundated area on RRT reported by Mr. Russ (see Figure 16).
- For numerical modeling purposes, the inflow hydrograph associated with an overwash event was represented as a distributed volume in an inverted "V"-shaped hydrograph with a duration of 2-hours. The duration is defined by the period of wave heights above 22-feet. Distributing the entire overwash volume over a 2-hour period results in a peak cumulative inflow rate of 1374 cfs at the center of the inflow hydrograph.
- The inflow from overwash is distributed evenly along a 3750-foot length of Western Drainage ditch extending from the County Park northward to the relatively intact dunes.
- Overwash is assumed to have a typical marine salinity of 32 parts per thousand (ppt).

A review of the available model simulation period boundary conditions suggests that a likely but undocumented wave overwash event occurred on December 20, 2014. Both tides and significant wave heights were elevated on this date, with wave heights exceeding the 22-foot threshold (see Figure 17). This overwash event was simulated using the Existing Conditions model to evaluate the effects of wave overwash on water levels, flow rates and salinity. Wave overwash was also integrated into simulations of sea level rise for the Simulation 3 winter period.

3.3.7 Sea Level Rise

In order to evaluate the future effects of sea-level rise (SLR), selected simulation period tidal boundary conditions were increased uniformly by 1-foot. A 1-foot rise in sea level was selected based on the 2050 regional and relative SLR estimates derived for Humboldt Bay (NHE, 2015). Two simulation periods were selected as boundary conditions for SLR analysis: the winter of 2014/15 (Simulation Period 3) and summer of 2005 (Simulation Period 5). Model input boundary conditions for these periods under SLR conditions are illustrated on Figures 18 and 19, respectively. The only modification to inflow hydrographs incorporated into the SLR simulations is the addition of wave overwash on 12/20/14 (Simulation Period 3). This short but acute inflow event is evident in the lower graphic of Figure 18.

3.4 Channel and Floodplain Roughness

The model relies on a Manning's roughness parameter (n) to characterize channel and marsh-plain bed resistance. For purposes of this feasibility study, KHE defined a uniform Manning's n-values of 0.03. No adjustments to this initial roughness parameter were necessary during model calibration.

3.5 Control Structures

The hydrodynamic model has internal algorithms to account for a wide variety of control structures of varying shapes, sizes and types (e.g., culverts, tide gates, and weirs). KHE defined existing weir and culvert geometries and invert elevations based on available field surveys. Upon entering all structure dimensions and flow variables (e.g., roughness, positive/negative flow, energy loss coefficients, etc.) a model algorithm generates an internal table of depth-flow relationships. These tables can be edited, which was done to simulate an MTR function by eliminating all negative flow (inflow) for depths above a desired value. Rectangular auxiliary doors of any size can also be integrated that allow for full or partial flow in either direction.

3.6 Initial Conditions

At the start of each simulation run, the water surface elevation, flow rate and salinity must be specified at each computational node in the model. The assumed values are called initial conditions. To eliminate transient effects (errors) associated with initiating model simulations, KHE utilizes a "hot start" initial condition for all final simulations. The initial conditions of the first simulation are set at a uniform value, typically a uniform flat water surface equal to the maximum expected tidal elevation. The model then steps forward in time until water surface elevations and flow rates equilibrate across the site. Once the model equilibrates, all simulation results are in balance. A single time during the "stable" period of output (water levels, flows, and salinity concentrations) from the first simulation may be used as the "hot start" initial conditions for a second and all subsequent runs. This "hot start" includes equilibrated hydrologic and water quality conditions at all model nodes as the initial conditions at the start of the next model simulation. KHE uses this approach of performing two simulations for each analysis to generate more realistic and fully stable simulation conditions for the full simulation period.

3.7 Hydrodynamic Model Calibration and Validation

This section presents the approach and results for hydrodynamic model calibration and validation. Hydrodynamic model calibration is an iterative procedure of parameter evaluation and refinement, as a result of comparing simulated and observed hydrologic variables. The objective of calibration is get the model to reproduce measured results. Model validation is a process to assure that the calibrated model properly assesses all the variables and conditions which can affect model results, and demonstrate the ability to predict measured observations for periods separate from the calibration period.

3.7.1 Calibration Simulations

To develop and calibrate the pre-project hydrodynamic model, KHE used tidal observations from two distinct but varied seasonal periods: June 23 to October 20, 2005, a summer/fall low flow period; and November 14, 2013 through January 26, 2014, a dry winter flow period. Tidal boundary conditions for both calibration simulations are based on measured water levels from Cut-Off Slough outboard of the existing tide gates.

An existing conditions model is the basis for model calibration. Model calibration included performing multiple simulations and adjusting the groundwater and dune seepage rates and locations to best match simulated and measured water levels. Simulated versus measured water levels at the Inner Cut-Off Slough tide gauge, located adjacent to the Cut-Off Slough tide gates, for both calibration simulations are presented in Figures 20 and 21. In general, the model accurately captured the amplitude and timing of tidal conditions at the site. Table 2 summarizes a statistical comparison between simulated and measured water levels at the inner Cut-Off Slough gauge.

TABLE 2: Summary of Water Level Calibration Results

Simulation Period	Peak Error (ft)	R^2	Maximum Residuals (ft)	
			Pos. (+)	Neg. (-)
Period 5: Summer 2005	-0.01	0.93	0.45	0.48
Period 4: Winter 2013/14	-0.31	0.94	0.89	0.42

The existing conditions model, once calibrated, serves as the basis for predictive analysis. A variety of numerical model configurations were developed as part of this study to reflect the project design elements and alternatives as discussed above. Although the physical condition varies between each model configuration, KHE defined boundary conditions (representing tidal conditions, freshwater inflow, groundwater inflow, and ocean seepage through the dunes) consistently between differing project alternative model configurations and simulations. This approach permits comparative analysis between each alternative configuration.

3.7.2 Validation Simulations

Validation of the existing conditions hydrodynamic model included two checks. First, model validation included comparing simulated to measured water levels for the November 19, 2014 through April 20, 2015 period. The results of this validation run are presented in Figure 22, which compares simulated and measured water levels at the Inner Cut-Off Slough gauge. Table 3 summarizes a statistical comparison between simulated and measured water levels.

TABLE 3: Summary of Water Level Validation Results

Simulation Period	Peak Error (ft)	R^2	Maximum Residuals (ft)	
			Pos. (+)	Neg. (-)
Period 3: Winter 2014/15	-0.15	0.94	0.59	0.95

The second model validation compares existing conditions model results for the April 1, 2012 storm to overhead video taken of the project area, depicting the extent of flood inundation within the project area on the same date. Because there is no monitoring data within the project area for the 2012 period, comparison of simulated versus photographed water levels served as the basis to determine if the model is accurately simulating peak flood conditions. Figures 23 through 25 present a comparison of the simulated inundation maps to oblique aerial imagery of the same general area at the same time of day. Letters on both inundation map and aerial image indicate match points between images to aid in comparison. Overall, the inundation map prepared from simulation results reflects historic conditions. One point of potential discrepancy is the presence of water on the alluvial fan located between letters A and B on the oblique aerial (Figure 24). This ponding is not indicated on the inundation map as it reflects sheet flow emanating from a sediment plugged and avulsing Russ Creek – a condition and process not captured in the numerical model.

Both validation runs accurately reproduced actual hydrologic conditions. Results of the statistical analysis comparing simulated and measured water levels for the validation run (Table 3) are similar to those generated during model calibration (Table 2).

Chapter 4: Salinity (Advection-Dispersion) Modeling

Predictions of the salinity variations across the site are developed by using the calibrated hydrodynamic model to incorporate conservative mass transport via advection (transport with flow) and dispersion (transport via mixing and diffusion) using the MIKE11 Advection-Dispersion module. At each time step, the MIKE11 AD module predicts salt transport as a function of the velocity through the section and the concentration of salinity in influent and effluent sections. The advection/dispersion model computes the concentration of matter in each computational grid point. The result is a fully integrated flow and salinity model calibrated to existing conditions.

4.1 Modeling Assumptions

Measured salinity concentrations in Cut-Off Slough are used at the downstream salinity boundary condition. Salinity is completely and instantaneously mixed over the cross-section. All ions making up salinity are conservative. All upstream freshwater inflows are considered to have a salinity concentration of 0.1-ppt. Groundwater inflow to remnant tidal slough channels was assigned a uniform salinity concentration of 5.0-ppt based on review of available groundwater quality data collected at the site. All ocean seepage through the dunes and overwash are considered to be marine salinity with a concentration of 32 ppt. Simulation initial conditions were established via the “hot-start” methods described above in Section 3.6 under the hydrodynamic model description.

4.2 Dispersion Coefficients and Factors

The advection-dispersion (AD) module is based on the one-dimensional equation of conservation of mass of a dissolved or suspended material (i.e. the advection-dispersion equation). For all simulations, and as determined during model calibration, a dispersion factor/coefficient of 10.0 with exponent of 0.20 was used in the one-dimensional (vertically and laterally integrated) equation for the conservation of mass of a substance in a solution.

4.3 AD Model Calibration

KHE checked salinity model calibration using the discrete salinity recordings collected across the site between August 2014 and April 2015. Most water quality data consists of discrete measurements collected at the locations indicated on Figure 26. A full presentation of these data is provided in Appendix D. In addition, TWC staff collected synoptic salinity measurements using a HOBO-brand conductivity logger for a week long period in the Western Drainage ditch and Centerville Slough at TWC Bridge. Selected results of the discrete and synoptic salinity measurements are plotted in Figure 27 (monitoring locations indicted on Figure 26).

KHE calibrated predicted salinities by adjusting model dispersion rate factor and coefficient until predicted salinities at selected model nodes best fit the salinity concentrations at corresponding

discrete monitoring locations. Based on prior modeling experience, it was decided to use a single dispersion rate coefficient throughout the entire project wetland system. Reasonable agreement between simulated and measured values (see Figure 27) was obtained by specifying a dispersion rate equation coefficient of 10.0 (exponent of 0.2).

Chapter 5: Numerical Modeling Results

This section of the report presents water level, velocity and salinity modeling results for each of the model simulation periods.

5.1 Water Level and Inundation Area

This section presents simulation results of alternative water levels for each model simulation period. Maps of maximum inundation area during the simulation period and water level hydrographs are presented and discussed. In addition, exceedance probability curves[5] for each simulation period are presented along-side the hydrographs to aid in identifying differences in flow magnitudes and durations between alternatives. For each simulation period, results at seven locations within the project area are presented. These sites include:

Site 1 - Existing Western drainage ditch or new Centerville Slough channel at Angels Camp;
Site 2 - The downstream end of Creamery Ditch on RR&T property;
Site 3 – Downstream end of the Western Drainage Ditch or new (Lower) Centerville Slough;
Site 4 – Central portion of TWC property at location of new lower Russ Creek channel;
Site 5 – Central location of the existing remnant tidal slough channel within the Inner Marsh;
Site 6 - Central location along Cut-Off Slough; and
Site 7 – The lower end of existing drainage on the ORF property upstream of the existing tide gates.

The site locations are indicated on Figure 28 and site numbers/names on the figure correspond to the numbered location indicated on all hydrographs and exceedance probability curve graphs. In summarizing results, proposed projects will commonly be compared to the Existing Conditions water levels as they represent the baseline condition.

5.1.1 Simulation Period 1: 2009 Spring Storm

The maximum inundation area for the four core project alternatives during the 2009 spring storm are presented on Figure 29a. Figure 29b also compares the maximum inundation areas between the original and “narrow” channel width versions of the 2015 and 2014 NOP alternatives. As will be seen for all the simulation periods, the Full Tidal alternative experiences the greatest area of maximum inundation within the project area and is almost 10-times the maximum inundation area of all other alternatives. In comparison to the Existing Conditions baseline, the 2014 NOP

[5] The probability of exceedance describes the likelihood a specific variable (water level, flow rate, salinity) will be equaled or exceeded over the analysis period. All exceedance probability curves were generated using only the data generated from each corresponding simulation period.

alternative results is a slight increase in inundation area (227- v. 214-acres) while the 2015 NOP alternative results in 1-acre less maximum inundation area (213 acres) even though a larger channel area is created when compared to the 2014 NOP alternative. Reducing the channel width of the NOP alternatives yield reduced inundation areas, but the 2014 NOP Narrow alternative inundation area is still greater than Existing Conditions (218- v. 214-acres) while the 2015 NOP Narrow alternative results in 210-acres of maximum inundation area. During the 2009 simulation period, both of the 2015 NOP alternatives result in lower maximum inundation area than Existing Conditions.

Simulated alternative water level hydrographs and exceedance probability curves for the seven sites during the 2009 period are presented in Figures 30a through 30g. As expected, the Full Tidal water levels are significantly higher than all other alternatives as downstream tidal exchange is not restricted or precluded. With the exception of water levels that are slightly higher at the RR&T (Site 2) and ORF (Site 7) locations, the 2014 NOP alternative water levels are equal to or lower than Existing Conditions. In contrast, the 2015 NOP alternative results in water levels that are lower than Existing Condition water levels at the RR&T and ORF sites. The lower 2015 NOP water levels in these areas occur because: a) this alternative includes a new deeper channel up through Angels Camp and guide berm that precludes backwater onto RR&T; and b) the alternative preferentially redirects the majority of flows into and through the Inner Marsh, reducing flows and water levels in Cut-Off Slough, which control water levels in ORF. The creation of the new Russ Creek channel into and through the TWC property under both NOP alternatives results in lower water levels as the grade has been lowered and non-peak flow water is contained within the banks of the new channel. Simulation results also indicate that there is very little if any difference between wide and narrow channels in the 2014 and 2015 NOP alternatives.

It's important to note here that although water levels are lower or higher at any given point in time and place relative to Existing Conditions, the NOP alternatives significantly increase the wetted area and length of interconnected channels in exchange for what is typically shallow flooded pasture. These alternatives also introduce passage for aquatic organisms from the outer marsh and estuary into habitat areas not previously available.

5.1.2 Simulation Period 2: 2012 Winter Storm

The 2012 simulation period experienced the greatest extent and depth of flooding of all simulation periods, mostly due to prolonged estuary water levels that restricted drainage form the project area for a longer period of time, allowing a greater accumulation of flood water volume. The maximum inundation area for the four core project alternatives during the 2012 winter storm are presented on Figure 31a. Figure 31b also compares the maximum inundation areas between the original and narrow channel width versions for both the 2015 and 2014 NOP alternatives. Although the Full Tidal alternative displays the greatest area of maximum inundation, flooding

associated with the other alternatives is much broader and deeper than that simulated in 2009. All of the NOP alternatives result in less total area of inundation compared to Existing Conditions and the inundation areas for both the original 2014 and 2015 NOP alternatives are essentially equal at 1291- and 1292- acres. Reducing the channel width of the NOP alternatives yield notably reduced inundation areas – 1290 acres for the 2014 NOP Narrow alternative and 1154 acres for the 2015 NOP Narrow alternative.

Water level hydrographs and exceedance probability curves for the 2012 period simulation results are presented in Figures 32a through 32g. Again, the Full Tidal water levels are the highest uniformly across the site with water levels generally 2-feet higher than all other alternatives. Although not displaying large deviations from the Existing Conditions water levels, the general trend in 2015 NOP alternative water levels is that they are equal to or lower than Existing Conditions throughout the project area, with short durations of higher levels during peak flow periods along the Centerville-Inner Marsh corridor. The same trends hold for the 2014 NOP alternative although these water levels track closer to Existing Conditions and display just slightly less variability in tidal amplitude than the 2015 NOP alternative levels. In comparing the 2014 NOP alternatives, there is virtually no difference in original and wide channel water level elevations. Water levels are typically the same between the 2015 NOP original and wide alternatives as well with the exception of 0.1-foot higher narrow channel water levels through the Centerville-Inner Marsh main flow corridor, likely due to decreased capacity associated with small channels. This, in turn, translates to comparable increases in water level (again only 0.1-foot) on RR&T due to backwater effects from new Centerville Slough. But again, these differences do not alter the general conditions and trend of lower water levels under NOP alternative versus those for Existing Conditions.

5.1.3 Simulation Period 3: 2014/15 Winter Storms

5.1.3.1 Comparison of Project Alternatives

Although the 2015 simulation period contains the two largest magnitude storms of all simulation periods, the maximum inundation areas are less that that experienced in 2012 for all alternatives. This is due to the relatively faster passage of storm hydrographs and shorter periods of elevated estuary water levels that restrict drainage from the project area. The maximum inundation area for the four core project alternatives during the 2014/15 winter storm are presented on Figure 33a. Figure 33b compares the maximum inundation areas between the original and narrowed channel width versions for both the original 2015 NOP, 2015 NOP Narrow and both 2014 NOP alternatives. Similar to previous simulation results, the maximum inundation areas for the 2014 NOP alternatives are all less than those generated for the Existing Conditions alternative, but the 2015 NOP inundation areas are slightly greater/higher. Inundation areas for the NOP alternatives are as follows (from greatest to least): 2015 NOP Narrow alternative at 1105 acres;

original 2015 NOP alternative at 1076 acres[6]; original 2014 NOP alternative at 1058 acres; and 2014 NOP Narrow alternative at 1050 acres. The maximum inundation area for Existing Conditions is calculated at 1065 acres.

Simulated alternative water level hydrographs and exceedance probability curves for the 2014/15 winter period are presented in Figures 34a through 34g. Again, the Full Tidal water levels are uniformly 2-feet higher than all other alternatives. Similar to prior simulation results, the general trend for the 2015 NOP alternative is that water levels are equal to or lower than Existing Conditions throughout the project area, with short durations of higher levels during peak flow periods along the Centerville-Inner Marsh corridor. Conditions and trends for the 2014 NOP alternatives are consistent with prior findings in that water levels track close to Existing Conditions and display just slightly less variability in tidal amplitude than the 2015 NOP alternatives. Differences and trends between the original and "narrow" channel NOP alternatives are consistent with the findings from prior simulations as presented above. Apart from lower water levels at Site 1: Angels Camp (Figure 34a), simulated water level results for the 2015 NOP Equilibrium alternative do not differ significantly from the original and "narrow" channel design versions. The lower water levels at Angels Camp under the "equilibrium" version result from a deeper channel design.

5.1.3.2 Wave Overwash

A wave overwash event under Existing Conditions was simulated for Simulation Period 3. The assumptions and boundary conditions associated with wave overwash are discussed in Section 3.3.6 above. This simulation was completed in an effort to better understand the implications of wave overwash on project water levels and salinity. Simulated water level and discharge results for the Western Drainage Ditch at the confluence with Creamery Ditch and Centerville/Cut-Off Slough at the TWC Bridge are presented in Figure 35a and 35b, respectively. These results indicate that overwash has relatively little impact, raising the local water level by approximately 0.25-feet, which dissipates quickly and imparts even less change in water level further downstream at the TWC Bridge. Simulation results indicate a short-lived spike in ditch flow rates that propagate at a similar rate downstream.

Unfortunately, model results do not agree well with field observations by local area residents who state that local water levels increase to an elevation of 6.0-feet during overwash periods. As seen in the hydrograph in Figure 35a, simulated water levels do not come close to reaching 6-feet in elevation. The cause for this discrepancy is likely due to inaccurate boundary conditions, more specifically an underestimate on the volume of water overtopping the dunes during a wave overwash event. The wave overwash simulation results are useful in that they reveal that water introduced by overwash is transported downstream quickly, especially if there is no restriction or

[6] Although not included in the inundation maps, the maximum inundation area of the 2015 NOP Equilibrium channel design is very similar to that for the 2015 NOP Narrow channel configuration.

backwater effect at the Cut-Off Slough tide gates. The overwash inflow volume estimate derived for this analysis is based solely on the observed flood volume at a single point in time. Given how fast water drains out of this area, it would take a considerably greater total volume of wave overwash to generate the level of flooding observed. Calculating the real overwash volume is problematic for two reasons; First, the source is as unlimited as the Pacific Ocean; Second, the water is draining off at the same time it is filling the Angels Camp area, although if the Eel River water levels are high and restricting outflow, it would require much less wave overwash volume to generate the know level of flooding.

Better understanding and quantifying wave overwash may warrant further study. Monitoring data of downstream boundary conditions at the Cut-Off Slough tides gates during an overwash event would help eliminate uncertainties associated with drainage rates out of the project/flooding area. Knowing the downstream model boundary conditions would allow for iterative model runs where overwash inflow rates/volumes are adjusted until simulated water levels match observed/measured internal water levels observed during an overwash event.

5.1.3.3 Sea Level Rise (SLR)

The SLR analysis of the winter period included simulating the effects of 1-foot of SLR on the 2015 NOP Narrow and Existing Conditions alternatives (see Section 3.3.7 for justification for this amount of SLR). In addition, the simulation of the NOP alternative included wave overwash as described above. Water level hydrographs and exceedance probability curves generated from simulation results for the SLR analysis are presented in Figures 36a through 36g.

The results of this analysis indicate the following:

- Although the downstream boundary water levels increase by 1-foot under the Existing Conditions SLR simulation, simulated water levels appear to increase by a larger magnitude, around 1.5-feet in the interior Cut-Off Slough and Inner Marsh channels. This causes backwater effects to the ORF property and increased water levels of well over 1-foot in their internal ditches.
- Water level rise in the project area under the 2015 NOP Narrow alternative does not appear any greater than the 1-foot rise simulated at the downstream boundary and generally appears around 0.5-feet.
- The magnitude of change in project area water levels due to SLR will be greater under Existing conditions across the northern half of the project area than under the 2015 NOP Narrow alternative.
- Wave overwash does not appear to have a significant effect on site conditions as modeled. However, as discussed above, the process of wave overwash has not been properly integrated into the existing models and could be further developed.

5.1.4 Simulation Period 4: 2014 Dry Winter Period

The 2014 simulation period represents a very dry winter period with only a single, relatively small peak flow event. The maximum inundation area for the core project alternatives during the 2014 winter are presented on Figure 37a and are the smallest of all winter-time simulation. Figure 37b also compares the maximum inundation areas between the original and narrow channel width versions for both the 2015 and 2014 NOP alternatives. Consistent with other findings, all of the NOP alternatives result in smaller inundation areas compared to Existing Conditions. Amongst the NOP alternatives, the original and narrowed 2014 NOP alternatives have smaller maximum inundation areas than the corresponding original and narrowed 2015 NOP alternatives.

Water level hydrographs and exceedance probability curves developed from simulation results for the 2014 dry winter period are presented in Figures 38a through 38g. As expected, the Full Tidal water levels are uniformly 2-feet higher than all other alternatives. Consistent with other simulation results, there are only minor differences in water levels between alternatives. The general trend for the 2015 NOP alternative is that water levels are equal to or lower than Existing Conditions in areas off of the Centerville Slough corridor. The same trends hold for the 2014 NOP alternative although these water levels track closer to Existing Conditions. In comparing the 2014 NOP alternatives, there is virtually no difference in original and narrow channel water level elevations. There is a larger water level differences between the 2015 NOP original and narrow channel alternatives (narrow channel water levels are higher than wide channel alternative) compared to other simulation periods, likely because of the predominantly low flow conditions this winter. During low flow periods, water is contained within channel banks and changes in flow magnitude result in relatively greater changes in water level elevation. Narrower channels also have less overall storage capacity than wide channels and yield higher water levels within the channels given the same water volume.

5.1.5 Simulation Period 5: 2005 Summer Period

5.1.5.1 Comparison of Project Alternatives

The 2005 simulation period represents summer low flow conditions. The maximum inundation area for the four core project alternatives during the 2005 winter are presented on Figure 39a. Figure 39b also compares the maximum inundation areas between the original and narrow channel width versions for both the 2015 and 2014 NOP alternatives. Because there are no storm events during this period, the maximum inundation areas represent the maximum extent of tidal inundation (i.e., highest tide during simulation period). Maps representing the inundation areas associated with average tidal water level over the simulation period are presented as Figures 40a and 40b.

The differences in inundation areas during this simulation period reflect the differing degrees to which tidal exchange is managed into the project area. The greatest inundation occurs under the Full Tidal exchange alternative where tidal exchange is unrestricted. Under the NOP alternatives, tidal exchange to the Inner Marsh is muted, with maximum summer water levels restricted to 5-feet in elevation. Muted tidal exchange in all other simulation periods, which are representative of winter periods, is restricted to a maximum interior muted tide level of 2.5-feet in elevation in order to maintain the existing amount of flood storage. Thus, during years with mild winters such as 2009 and 2014, maximum summer water levels and inundation areas are greater than those experienced during winter due to the increase muted tide levels permitted into the project area. As a result the summer maximum and average inundation areas for the NOP alternatives are greater than those simulated for Existing Conditions (no tidal exchange). Within the suite of NOP alternatives, the 2015 NOP alternative yields larger maximum and average inundation areas than the 2014 NOP alternative, chiefly due to the increase in created channel area and larger areas made available to tidal exchange. Narrowing the channels of the NOP alternatives causes a reduction in maximum and average inundation areas.

Water level hydrographs and exceedance probability curves generated from model simulation results for the 2005 summer period are presented in Figures 41a through 41g. These plots confirm the summary of conditions above with respect to how NOP alternatives increase the area and depth of inundation during the summer relative to Existing Conditions. This change is opposite to what would occur in winter, where NOP inundation areas are reduced relative to Existing Conditions. Again, these conditions are driven mostly by the seasonal control of the amount of muted tidal exchange permitted with the project area.

5.1.5.2 Sea Level Rise

The SLR analysis during the summer period included simulating the effects of 1-foot of SLR on the 2015 NOP Narrow and Existing Conditions alternatives. No wave overwash was integrated into these simulations. Water level hydrographs and exceedance probability curves prepared from model results for the 2005 summer SLR analysis are presented in Figures 42a through 42g.

The results of this analysis are consistent with those described above under the Simulation Period 3 results. The most significant finding is that the magnitude of change in project area water levels due to SLR is greater under Existing conditions than under the 2015 NOP Narrow alternative. Even with only 1-foot of SLR, Existing Conditions water levels in the lower Western Drainage ditch, Cut-Off Slough and Inner Marsh all increase by approximately 1.5- to 2.0-feet in elevation. SLR induced increases in project water levels under the 2015 NOP Narrow alternative appear to be generally 0.5- to 1.0-feet.

5.2 Velocity and Channel Stability Assessment

This section presents the simulated channel flow velocities for the 2014/15 winter and 2005 summer model simulation periods. Velocity time-series plots and exceedance probability curves for six locations are presented for each simulation period in order to illustrate conditions across the site. These locations include:

Site 1 – Upper Centerville Slough/Western Drainage;
Site 2 – Middle Centerville Slough/Western Drainage;
Site 3 – Lower Centerville Slough/Western Drainage;
Site 4 – Centerville Slough at the TWC Bridge;
Site 5 - Central Cut-Off Slough; and
Site 6 – Inner Marsh/Centerville Slough.

The site locations are indicated on Figure 43 and site numbers/names on the figure correspond to the numbered location indicated on all velocity and exceedance probability plots.

5.2.1 Simulation Period 3: 2014/15 Winter Storms

Simulated velocity profiles and corresponding exceedance probability curves for the 2014/15 winter period are presented in Figures 44a through 44f. Because it has the largest tidal amplitudes of all alternatives, the Full Tidal alternative displays the highest flow velocities. Maximum flow velocities under the Full Tidal alternative occur within Cut-Off Slough and range from 3.0 to -5.0 foot per second (ft/s) (positive velocities represent ebb flow and negative velocities occur during flood tides). With the exception of short-lived periods associated with higher amplitude tidal cycles, the NOP alternative velocities are very similar to Existing Conditions. During the 2014/15 winter period, all Existing Condition and NOP alternative maximum velocities are less than 1.0-ft/s and flow velocities are less than 0.5 ft/s the majority of time. Review of the simulation results for the suite of 2015 NOP channel designs, there isn't much difference between the original and narrow channel designs. However, under the 2015 NOP Equilibrium channel design, both ebb and flood velocities along the middle and lower portions of Centerville/Western Ditch are higher than the other 2015 NOP channel designs. This is due to these reaches having deeper channels and greater tidal amplitudes under the equilibrium channel design, which generates greater flow velocities (see lower graphs on Figures 44b and 44c).

Although not presented in Figures 44a through 44f, simulated flow velocities do not change significantly under the sea level rise (SLR) simulations for the 2015 NOP Narrow alternative. Differences, where present are minor (generally +/- 0.1-ft/s) and will not impart any changes to channel stability or sediment transport.

5.2.2 Simulation Period 5: 2005 Summer Period

Velocity profiles and exceedance probability curves generated from simulation results for the 2005 summer period are presented in Figures 45a through 45f. Because there are no rainfall high flows during this period, all flow within project channels is driven by tidal exchange. As a result, areas experiencing the greatest tidal cycle amplitudes display the highest velocities. For example, simulated velocities for the 2015 NOP and Full Tidal alternative are highest in the Inner Marsh than anywhere else, as their simulated tidal amplitudes are largest in this area. However, in general, the maximum summer velocities simulated throughout the project area are less than 0.5 ft/s and average velocities are typically less than 0.25 ft/s. Again, simulated velocities under SLR conditions (not presented in Figure 45a through 45f) are virtually identical to those generated from the non-SLR simulation for the 2015 NOP Narrow alternative.

5.2.3 Sediment Transport Thresholds and Channel Stability

Based on soil borings and grain-size analyses completed by LACO in 2015, there are five sediment soil types that dominate materials found at the surface and shallow depth throughout the project area: 1) unconsolidated medium grained dune sand; 2) interbedded Eel River flood or over-bank deposits consisting of fine sand, silt with sand, silt and clay; 3) non-cohesive silt and silty sand deposits from the Wildcat Tributaries that form thin alluvial fans; 4) fat- and lean-clay and peat tidal marsh deposits; and 5) clay and silt fill. The dune, fill and Wildcat alluvial deposits generally are found overlying layers of Eel River flood and tidal marsh sediments.

Standard approaches for characterizing erosion potential of sediments can be placed into two categories: maximum permissible velocity, and critical shear stress. The former approach is advantageous to this study in that flow velocity in proposed project channels is a parameter that has been modeled. The permissible velocity is defined as the maximum velocity of the channel that will not cause erosion of the channel boundary. It is often called the critical velocity because it refers to the condition for the initiation of particle motion.

Critical shear stress of bed material is obviously controlled by the physical properties of the material, thus a distinction between non-cohesive and cohesive material is warranted as both occur in the project area. Cohesive sediments are composed primarily of clay-sized material, which have strong inter-particle forces due to their surface ionic charges. As particle size decreases, its surface area per unit volume (i.e. specific surface area) increases, and the inter-particle forces, not the gravitational force, dominate the behavior of sediment. There is no clear boundary between cohesive sediment and non-cohesive sediment. In general, finer sized grains are more cohesive. For purposes of this study, sediment sizes smaller than 2 um (clay) are considered cohesive sediment. Sediment of size greater than 60 um is non-cohesive sediment. Silt (2um -60 um) is considered to be between cohesive and non-cohesive sediment. The cohesive properties of silt are primarily due to the existence of clay. For purposes of this analysis, silt and clay are both considered to be cohesive sediment. Table 4 presents published ranges of critical velocity and shear stresses that initiate particle motion for non-cohesive and cohesive sediments.

Comparing LACOs sediment descriptions to the critical velocity values in Table 4, suggests that the unconsolidated medium-grained sand dune deposits are mobilized at flow velocities of 0.8-0.9 ft/s, while the noncohesive overbank silt deposits are mobilized at velocities ranging from 1.6- to 3.2 ft/s. The critical velocity of the deeper cohesive clay/silt deposits is considered 2.0 ft/s.

As summarized above and indicated in velocity profiles of simulation results, the vast majority of both winter and summer flow velocities do not equal or exceed 2.0 ft/s. Apart from localized areas around culvert inlets and outlets, model results and the assumed critical velocities of site sediments suggest project channels, as designed, will not experience excessive erosion. This also means that velocities for the Existing Conditions and NOP project alternatives are generally not sufficient to transport unconsolidated sediments through the system.

TABLE 4: Critical shear stress and critical velocity values for non-cohesive and cohesive sediment types (Sources: critical shear stress values from Berenbrock and Tranmer (2008); critical velocity values from Vanoni (1977); clay data from Noble et al. (2005); and San Francisco Bay mud data from Partheniades (1965). Note: 1 N/m^2 = 0.02089 lbs/ft^2.

Particle classification name	Particle diameters mm	Critical shear stress (N/m^2)	Critical velocity (ft/s)
Non-Cohesive Sediments			
Coarse cobble	128 – 256	112 – 223	
Fine cobble	64 – 128	53.8 – 112	9.5 - 10.0
Very coarse gravel	32 – 64	25.9 – 53.8	8.0 - 9.5
Coarse gravel	16 – 32	12.2 – 25.9	5.5 - 8.0
Medium gravel	8 – 16	5.7 – 12.2	3.8 - 5.5
Fine gravel	4 – 8	2.7 – 5.7	2.5 - 3.8
Very fine gravel	2 – 4	1.3 – 2.7	1.7 - 2.5
Very coarse sand	1 – 2	0.47 – 1.3	1.2 - 1.7
Coarse sand	0.5 – 1	0.27 – 0.47	0.9 - 1.2
Medium sand	0.25 – 0.5	0.194 – 0.27	0.8 - 0.9
Fine sand	0.125 – 0.25	0.145 – 0.194	0.8 - 0.9
Very fine sand	0.0625 – 0.125	0.110 – 0.145	0.9 - 1.3
Coarse silt	0.0310 – 0.0625	0.0826 – 0.110	1.6 - 1.3
Medium silt	0.0156 – 0.0310	0.0630 – 0.0826	2.2 - 1.6
Fine silt	0.0078 – 0.0156	0.0378 – 0.0630	3.2 - 2.2
Cohesive Sediments			
Tidal channel cohesive clay	0.0052 - 0.0271	0.6	2.0
Tidal channel flocculated clay	0.0075 - 0.013	0.13	n/a
SF Bay Mud (cohesive)	n/a	0.011 - 0.93	n/a
SF Bay Mud (flocculated)	n/a	0.15 - 0.44	n/a

5.3 Salinity Conditions

This section presents the simulated salinities for the 2014/15 winter and 2005 summer model simulation periods. Only the results for the Existing Conditions and 2015 NOP suite of alternatives are presented. Salinity time-series plots and exceedance probability curves are presented for both simulation periods. For each simulation period, results for the same six locations discussed under the velocity section are presented here (see Figure 43).

5.3.1 Simulation Period 3: 2014/15 Winter Storms

Salinity concentration time-series plots and exceedance probability curves for the 2014/15 winter period simulation results are presented in Figures 46a through 46f. During the winter wet season, the NOP alternative simulated salinities across the site were significantly less than those simulated for Existing Conditions. The reason for this change is due to the increased tidal exchange of relatively lower salinity water during much of the winter. As documented in Appendix D, salinity in the Eel River and estuary during the winter is much lower than summer salinities due to the large and sustained influx of fresh river flow. Under existing conditions, this water is restricted from entering the site and inflow from the Wildcat Tributaries is the major supply of freshwater to the project area. This mixes with higher salinity ocean seepage through the dune and groundwater inflow to internal channels. The NOP alternatives have an additional source of freshwater inflow from the lower Eel River, which helps dilute internal project site salinities. When comparing the three 2015 NOP alternatives, there is virtually no difference in salinity concentration and distribution during the winter.

Wave overwash was simulated for this period as well, as described in Section 5.1.3.2 above. Simulated water salinities for the two locations (Western Drainage Ditch at the confluence with Creamery Ditch and Centerville/Cut-Off Slough at the TWC Bridge) are presented in Figure 47. These results indicate a short pulse in elevated salinity concentration at both locations. The salinity concentration decreases in the downstream direction, and there does not appear to be a prolonged elevated salinity concentration. However, as discussed above in Section 5.1.3.2, there is likely a significant under-accounting for the total volume and duration of wave overwash, which needs to be resolved and will likely alter these findings.

5.3.2 Simulation Period 5: 2005 Summer Period

Simulated salinity concentrations and exceedance probability curves for the 2005 summer period are presented in Figures 48a through 48f. The main findings from evaluation of these simulation results are as follows.

- Simulation results for the 2015 NOP alternatives indicate greater variability in salinity concentrations at any given location than occurs under Existing Conditions. Within the southern half of the project area and within Cut-Off Slough, the average salinity concentrations between the 2015 NOP and Existing Conditions are approximately equal

but the NOP alternative concentrations cycle higher and lower above this mean in rhythm with the tides.

- Within the northern half of the new Centerville Slough corridor, NOP salinity concentrations are notably higher than Existing Conditions. This is due to the increased tidal exchange centered on this corridor and the fact that summer salinities in the lower Eel River estuary approach marine concentrations.
- When comparing the original 2015 NOP alternative to the 2015 NOP Narrow and Equilibrium alternatives, differences in salinity concentrations are very small, with the original alternative having slightly higher concentrations in the Centerville Slough corridor. This small difference reverses in Cut-Off Slough, with the NOP Narrow and Equilibrium alternatives displaying slightly higher salinity concentrations than the original 2015 NOP alternative.

5.4 Fish Passage Assessment

Although there are no specific fish passage design requirements for tide gates, the National Marine Fisheries Service, Southwest Region (NMFS, 2001) and California Department of Fish and Game (CDFG, 2002) have published guidelines for the design of stream crossings to aid upstream and downstream passage of migrating fish and assist the recovery of threatened and endangered salmon species. These guidelines specify minimum water depths and flow velocities through culverts for adult and juvenile salmonids (see Table 5). For purposes of this study, upstream and downstream fish passage through new and existing culverts was assessed using 2015 NOP Equilibrium alternative hydrodynamic model simulation results for the 2005 summer and 2014/15 winter storm periods in comparison to the NMFS/CDFG guidelines. Apart from the seasonal differences in hydrologic conditions during these two simulation periods, project operations allow muted tide levels to reach a maximum elevation of 5.0-feet NAVD88 during the summer, while restricting tidal exchange to 2.5-feet in elevation during the winter.

Throughout each simulation period, NMFS/CDFG minimum passage water depths were satisfied at all culverts as depths never dropped below 1-foot. The minimum depth criteria was satisfied primarily because the new/existing culvert inverts are set at such low elevations, well below the lowest simulated water surface. Thus, only the NMFS/CDFG velocity guidelines were required to determine the percentage of time fish can pass through the culverts for simulated periods.

TABLE 5: CDFG and NMFS Fisheries fish passage criteria applied to hydrodynamic model simulation results for existing and new tide gate structures.

Salmonid Life Stage	Minimum Water Depth*	Maximum Water Velocity
Adult Salmon and Steelhead	1.0 feet (ft)	6.0 feet per second (ft/s)
Juvenile Salmon and Steelhead	0.5 feet (ft)	2.0 feet per second (ft/s)

* Simulated water depths is all structures exceeded 1.0-foot. Therefore, insufficient water depth did not limit fish passage – only periods of excessive velocity precluded passage.

5.4.1 Passage through Existing Tide Gates

Table 6 present the results of the upstream and downstream fish passage assessment through the existing tide gates for the summer (2005) and winter (2014/15) simulation periods, respectively. The percent of time available for passage through the existing top-hinge tide gates are presented.

For purposes of this study, it is assumed that a minimum positive flow of 2.0 ft/s is required to generate sufficient force and opening through the existing wooden flap gates to allow upstream passage of adult salmonids. Similarly, it is assumed that an outflow of 1.5 ft/s will provide sufficient opening for juvenile salmonid passage[7]. Taken in combination with NMFS/CDFG guidelines, this means adult upstream migration only occurs at ebb flow velocities through the structure between 2.0- and 6.0-ft/s and juvenile upstream migration is restricted to ebb flow velocities between 1.5- and 2.0-ft/s. Based on analysis of simulated structure velocities, upstream adult and juvenile passage was restricted to 1.5% and 3.0% of the time during the 2014/15 winter period, respectively. There was no upstream salmonid passage during the 2005 summer tidally-dominated period. Downstream passage of both adults and juveniles occurs during both the summer and winter simulation periods as indicated in Tables 6.

5.4.2 Passage through Project Tide Gate Structure

Table 7 present the results of the upstream and downstream fish passage assessment through the proposed project tide gate structure for the summer (2005) and winter (2014/15) simulation periods, respectively. The percent of time of available passage through each of the two culvert types that comprise this structure is presented. Both new gate-types increase up- and downstream passage opportunities for both adult and juvenile salmonids over existing conditions.

- New Muted Tide Regulator (MTR): The proposed MTR provides significant opportunities for both upstream and downstream passage of adult and juvenile salmonids during both summer and winter periods. The higher winter period passage percentages are primarily due to lower structure velocities. During winter, the head differential between the up- and down-stream sides of structure are smaller than the summer period, yielding lower flow velocity through the structure and increasing the frequency and duration for passage.
- New Side-Hinge (One-Way) tide gates: The side-hinge tide gates open to sufficient width to allow fish passage at much lower velocities than the existing top-hinge gates. It is assumed that these gates open during even the lowest ebb flow. Thus, these gates

[7] These assumptions are based on review of flap gate tilt data and calculated bottom opening widths collected by the Wildlands Conservancy staff at the existing tide gates in March and April 2014. No simulated structure velocity data is available for this period due to lack of concomitant estuary or outer Cut-Off Slough water level data. However, analysis of these data indicate the bottom of the flap gates open as much as 3.0 feet during peak runoff events.

provide an increased opportunity for fish passage over the existing gates, especially in the upstream direction.

TABLE 6: Estimated upstream and downstream Salmonid passage through existing tide gates during 2005 summer and 2014/15 winter periods.

a) 2005 Summer Period

	Percent Time Passable
	Existing Top-Hinge Tide Gates
Percent Time Gates Open	18%
Upstream Fish Passage	
Adults	0%[1]
Juveniles	0%[1]
Downstream Fish Passage	
Adults	18%
Juveniles	18%

b) 2014/15 Winter Period

	Percent Time Passable
	Existing Top-Hinge Tide Gates
Percent Time Gates Open	30%
Upstream Fish Passage	
Adults	1.50%
Juveniles	3%
Downstream Fish Passage	
Adults	30%
Juveniles	30%

Notes:
[1] Simulated maximum velocities of 0.7 ft/s are not high enough to open existing top-hinge flap-gates sufficiently to provide fish passage.

TABLE 7: Estimated upstream and downstream Salmonid passage through the Project tide gate structure during 2005 summer and 2014/15 winter periods.

a) 2005 Summer Period

	Percent Time Passable	
	New Tide Gates	
	MTR	Side-Hinge One-way
Percent Time Gates Open	100%	37%
Upstream Fish Passage		
Adults	97%	34%[2]
Juveniles	76%	13%[2]
Downstream Fish Passage		
Adults	62%	37%
Juveniles	42%	37%

b) 2014/15 Winter Period

	Percent Time Passable	
	New Tide Gates	
	MTR	Side-Hinge One-way
Percent Time Gates Open	25%	17%
Upstream Fish Passage		
Adults	24%	17%
Juveniles	16%	9%
Downstream Fish Passage		
Adults	25%	17%
Juveniles	19%	17%

Notes:
[2] Side-hinge tide gates assumed to open sufficiently under low velocities to provide fish passage.

5.4.2 Passage through Project Auxiliary Door

Table 8 present the results of the upstream and downstream fish passage assessment through the proposed project auxiliary door for the summer (2005) and winter (2014/15) simulation periods, respectively. The percent of time of passage through the auxiliary door is presented.

To accommodate the auxiliary door, one flap gate on the existing structure would be replaced with a new side-hinge gate. The auxiliary door would be installed within the new side-hinge gate. The 1-square meter sized opening remains completely submerged (invert elevation of -3.94 feet NAVD88) and passage into/out of the door is only restricted by elevated velocity.

TABLE 8: Estimated upstream and downstream Salmonid passage through the auxiliary door during 2005 summer and 2014/15 winter periods.

a) 2005 Summer Period

	Percent Time Passable
	Auxiliary Opening
Percent Time Gates Open	100%
Upstream Fish Passage	
Adults	100%
Juveniles	97%
Downstream Fish Passage	
Adults	99%
Juveniles	87%

b) 2014/15 Winter Period

	Percent Time Passable
	Auxiliary Opening
Percent Time Gates Open	100%
Upstream Fish Passage	
Adults	100%[3]
Juveniles	99%
Downstream Fish Passage	
Adults	52%
Juveniles	33%

Notes:

[3] Simulated maximum velocities of 3.9 ft/s. Assumes velocity of 2.0- to 6.0-ft/s or greater sufficient to open top-hinge gates to provide adult passage and 1.5- to 2.0-ft/s sufficient to generate opening for juvenile passage.

5.5 Predicted Project Wetland Habitat Distribution

Work by HT Harvey (HTH, 2010) and Ericsson et al. (2008) within and surrounding the Eel River estuary has identified local vegetation communities within non-leveed areas outside of the Project Area and their relationship to tidal elevations. For purposes of this report, it is assumed that the distribution of vegetation communities identified by HTH and Ericsson represents an equilibrium marsh that is in a stable and mature state of development. The variation in the types of vegetation communities are primarily controlled by hydrology (Mitsch & Gosselink, 1993), tides/salinity, soil type/salinity, and marsh plain elevation. Given that the Project Area and outer equilibrium marsh consist of similar soil type and generally experience the same seasonal (winter) freshwater conditions, it is assumed that tidal inundation and marsh topography will be the dominant driver in determining where and what type of vegetation communities will evolve within the Project Area.

The upper and lower graphs in Figure 49 each present the same pair of inundation duration curves derived from monitoring data at the Eel River Estuary and outer Cut-Off slough tide gauges and represent the tidal conditions within the local un-diked equilibrium marsh. The upper graph plots these curves in relationship to calculated estuary tidal datums while the lower graph plots them in relation to vegetation communities as described by HTH and Ericsson et al. and associated marsh habitat zones. The marsh habitat zone (lower) graph presents the range of inundation durations that bracket the water level elevations for distinct marsh vegetation communities.

The inundation duration percentages presented in Figure 49 can be used to predict where similar tidal datums and marsh habitat zones will occur under project conditions. Figure 50 plot summer period inundation duration curves for the Inner Marsh and Centerville Slough corridor for each of the simulated project alternatives in comparison to tidal datums (upper graphic) and marsh habitat zones (lower graph). Again, we assume the summer period tidal inundation duration periods control the distribution of vegetation community zones because both the leveed and unleveed areas within the Project vicinity experience very similar freshwater flooding and salinity conditions. The intersection of the inundation duration curves with a tidal datum or marsh habitat zone boundary (defined by exceedance probability) indicate the associated elevation these transitions will occur for any given alternative. It is important to note that this simplified conceptual model for predicting the future distribution of marsh vegetation communities does not take into account the change in seasonal project operations where maximum dry-season muted tide levels are 5.0-feet NAVD88 and wet-season maximum tidal levels are restricted to 2.5-feet NAVD88 in the Project Area. Thus, the change in seasonal muted tide operations introduces some uncertainty in predicting Project marsh plain habitats.

Assuming that dry-period tidal conditions is the primary driver in predicting the distribution of vegetation communities, comparison of the Existing Condition inundation duration curve to all

others presented in Figure 50 suggests that Project alternatives will increase the distribution of marsh habitat zones across a larger elevation range. The estimated amount of increase in marsh habitat is tied directly to the amount/amplitude of tidal exchange permitted under any given alternative. To better quantify the possible change in predicted habitat zones under selected alternatives, simulated flooded area and potential tidal prism[8] hydrographs and associated exceedance probability curves for the 2005 summer period simulations are presented in Figure 51. Marsh habitat zones are plotted on the flooded area exceedance probability plot (upper right graphic). Notable findings from this analysis include: a) the Full Tidal exchange alternative clearly results in the largest increase in marsh habitat when compared to Existing Conditions; b) the original 2015 NOP alternative yields a significant increase in mud flat/open channel habitat due to the much larger channel sizes than other alternatives and also displays the largest increase in low to high marsh habitats of the 2015 NOP alternatives; c) the 2015 NOP Narrow and Equilibrium alternatives nearly double the existing low to high marsh habitat without significantly increasing the area of mud flat/open channel habitat zone; and d) the volume of potential tidal prism exchanged during summer periods is increased by at least 10-fold under all alternatives.

5.6 Changes in Drainage and Flood Storage

Model simulations indicate that there is no change in the rate of drainage of the Project Area between Existing and Project conditions. The main control over the rate of drainage from the Project Area is downstream water levels in outer Cut-Off Slough and the estuary. The existing and proposed Project tide gates provide sufficient flow conveyance to maximize/optimize drainage. Model analyses demonstrated that the addition of more culverts won't speed up the rate of drainage from the Project Area.

The new project channels introduce redundancy in drainage that will alleviate the impacts of beach sand filling the Western Drainage Ditch. The SMAs will reduce sediment loads to internal channels. Similarly, the new culverts also provide redundancy and will provide needed drainage in the event the existing tide gates are impaired for some reason. Finally, the MMP and Adaptive Management Plans will provide mechanism to identify and address future impacts/changes that reduce hydraulic function within the Project Area.

The earthwork associated with all the 2014 and 2015 NOP project alternatives results in a net increase in available flood water storage above an elevation of 2.5-feet. Any excavation below the 2.5-foot elevation datum does not yield increases in flood storage because these newly created depressions are assumed to fill with groundwater. Figure 52 plots stage-volume curves for the Existing Condition and 2015 NOP alternatives above the 2.5-foot elevation. The alternatives with the largest channel dimensions and excavation volumes yield the largest increase in flood storage above an elevation datum of 2.5-feet. Table 9 presents the cumulative increase in 2015 NOP alternative flood storage volumes (in acre-feet) over Existing Conditions

[8] Potential diurnal tidal prism is defined as the volume of water in a marsh system between Mean Higher High Water (MHHW) and Mean Lower Low Water (MLLW) tidal datums.

at half-foot intervals above the 2.5-foot elevation. These values were derived by comparison of digital terrain models (DTM) in CAD for each of the selected 2015 NOP alternatives to the Existing Conditions DTM. Converting the cumulative storage volumes in Table 9 from acre-feet to cubic yards (multiple acre-feet by 1613.33) provides a general estimate of the net cumulative excavation that would occur under each alternative.

It is important to note that the stage-volume curves presented in Figure 52 (and volumes presented in Table 8) were developed based on project grading plans that include construction of proposed internal berm features as described in the NOP project description. However, these curves do not include a full accounting of sediment reuse in that the balance of excavated material not used in internal berm construction is not capture in the curves. However, these curves and volume estimates can be used during final project design to guide how much fill can be placed without reducing project flood storage below existing flood storage volumes at any given elevation.

5.7 Effects on Off-Site Channels

As indicated in the lower graphics of Figure 51, the project will result in a significant increase in tidal prism exchange with lower Cut-Off Slough and the Salt River located north or downstream of existing tide gates. This results is significantly higher flow rates through outer Cut-Off Slough channel. The increase in these flow rates is demonstrated in Figure 53, which plots cumulative simulated discharge through new and existing culverts for the Existing Condition and 2015 NOP Equilibrium project alternatives. The cumulative discharge under Existing Conditions includes just the flow through the existing tide gates, while the cumulative discharge under project conditions includes this discharge plus that through the new Inner Marsh tide gates, MTR and single auxiliary door installed in the new side-hinge tide gate that will replace one of the existing structure flap gates.

There is a positive correlation between the tidal prism flowing through a channel and the width and depth of the channel. Increases in tidal prism create greater flow rates and energy through associated tidal channels. This increase in energy erodes and maintains channel geometry to a state of equilibrium with the associated tidal prism volumes. As indicated by the data and trends presented in Appendix I, increases in tidal prism yield progressively larger channels. Just as the Salt River channel has decreased in width and depth with the elimination of tidal prism exchange due to historic land conversion by diking and draining of tidal wetlands, increases in potential tidal prism exchange associated with the Project may result in the widening/deepening of channels downstream of the project area.

TABLE 9: Difference in flood storage volume (AF) for 2015 NOP alternatives (vs. Existing Conditions) above elevation of 2.5-feet NAVD88.

Elevation (ft NAVD88)	2015 NOP	2015 NOP Narrow	2015 NOP Equilibrium
2.5	0	0	0
3.0	19	11	7
3.5	38	22	13
4.0	57	33	20
4.5	74	42	25
5.0	94	56	35
5.5	110	67	44
6.0	134	86	61
6.5	156	105	78
7.0	181	127	98
7.5	196	139	110
8.0	208	148	118
8.5	214	152	121
9.0	219	154	123
9.5	222	155	124
10.0	225	156	125
10.5	228	157	126
11.0	231	158	127
11.5	234	159	128
12.0	236	160	129
12.5	239	160	130
13.0	242	161	131
13.5	245	161	132
14.0	248	162	132
14.5	250	162	133
15.0	253	163	133
15.5	255	163	134
16.0	257	163	134
16.5	259	163	134
17.0	261	164	135
17.5	263	164	135
18.0	265	164	135
18.5	267	164	135
19.0	269	164	135
19.5	271	164	135
20.0	273	163	135

The model domain/geometry of the hydrodynamic models developed and used to evaluate Eel River Estuary and Centerville Slough Enhancement Project alternatives do not extend beyond a short reach of Cut-Off Slough downstream (north) of the existing tide gates (see Figures through 8). However, as part of the Salt River Ecosystem Restoration Project, KHE developed a full Salt River watershed MIKE11 hydrodynamic model that integrates the final Salt River Project and the existing Eel River Estuary and Centerville Slough Enhancement Project area (KHE, 2012). In order to evaluate potential project impacts on the lower Cut-Off Slough and Salt River channels downstream of the project area, KHE integrated the Eel River Estuary cumulative 2005 summer period inflow/outflow hydrographs for the Existing Conditions and 2015 NOP Equilibrium alternatives into the Salt River model (Figure 53). A full description of the Salt River project model is provided in KHE 2012.

In order to evaluate how the Project would affect downstream channels, the modified Salt River model was used to simulate water levels and flow velocity at four locations on Lower Cut-Off Slough and Salt River. Locations of simulation results are indicted on Figure 54 and include: A) Cut-Off Slough downstream of the existing tide gates at the confluence with Mill Creek; B) Cut-Off Slough immediately above confluence with Salt River; C) Salt River mid-way between Cut-Off and Jack Sloughs; and D) Salt River downstream of Jack Slough. Simulation water level and velocity results for these locations are provided in Figures 55 a-d and 56 a-d, respectively.

Simulated pre- and post-project water levels in Cut-Off Slough are very similar and do not indicate any significant change (Figures 55a and 55b). Similarly, simulated water levels on the lower Salt River (Figures 55c and 55d) only differ in that minimum levels are slightly higher (approximately 0.25-feet) under the 2015 NOP Equilibrium alternative than existing conditions.

Simulated project velocities in lower Cut-Off Slough increase notably under project conditions, with maximum values approaching 1.0 ft/s at both locations during ebb tides and -1.5 ft/s[9] during flood tides (Figures 56a and 56b). On the lower Salt River between Cutoff and Jack Sloughs, both ebb and flood daily peak project velocities increase by 0.5-ft/s on top of existing spring ebb tide velocities of 2.0 ft/s and existing spring peak flood velocities of -1.5 ft/s (Figure 56c). Further downstream of Jack Slough, Salt River flow velocity increases diminish, with daily peak project flow velocities increasing between 0.1- and 0.2-ft/s during both ebb and flood tides (Figure 56d). Flow velocities on the Salt River increase in a downstream direction with maximum ebb and flood velocities at or approaching 4.0- and -4.0-ft/s at the downstream-most location.

The increase in post-project tidal prism and flow energy through lower Cut-Off Slough and Salt River will increase the sediment transport capacity through downstream reaches. This change will enhance and better sustain a primary objective of enhanced sediment transport for the Salt

[9] A negative flow velocity indicates a flood tide while a positive velocity value indicates an ebb tide.

River Ecosystem Restoration Project. Enhanced water and sediment flow through the downstream reaches will also better maintain the restoration efforts associated with the Eel River Estuary and Centerville Slough Enhancement Project.

Increased tidal prism and flow energy through the receiving reaches also has the potential to increase channel geometries. The increases and resulting magnitude of channel velocity and increased scour potential in lower Cut-Off Slough and Salt River is not large, but could lead to minor channel widening and/or deepening. This potential change will not be a long-term or chronic condition as any increase in channel geometry associated with increased tidal prism exchange will reach a stable and equilibrated condition. The overall time frame of evolution to equilibrium geometry is uncertain, but would initiate immediately upon construction of the project. Under tidal exchange, material mobilized and scoured from the lower Cut-Off Slough and Salt River channels would be transported to the Eel River estuary during short duration pulses that occur primarily during spring tidal events when the tidal prism and flow velocity is maximized, leading to short periods of highest channel scour potential. Very little change (channel evolution) can be expected during neap tidal periods, when velocities are below the limits of scour and transport. Given the small amounts of channel material that would be mobilized during the necessary tidal periods, no discernable impacts associated with increased turbidity or sediment transport would occur over natural occurring and existing levels.

As indicated above, historic land development in the lower Salt River watershed has significantly reduced tidal prism leading to sedimentation and reductions in channel size of lower Cut-Off Slough and Salt River. Any project-related channel expansion would occur within and be restricted to the current/historic channel alignments and easements. As indicated in the lower graphics of Figure 51, project potential tidal prism will increase notably relative to Existing Conditions, however, nowhere close to the magnitude of historic (i.e., Full Tidal alternative) conditions that sustained a much larger channel width than current conditions. Thus, given the strong correlation between channel geometry and tidal prism exchange, project channel expansion and resulting equilibrium widths will continue to be smaller than historic conditions and not expand beyond the historic channel footprint and easement.

Chapter 6: Sediment Management Area Analysis

The proposed 2015 NOP alternative includes at least three (3) primary sediment management areas (SMA) that can be utilized as intentional or consequential sediment deposition areas. The location of the SMAs, labeled SMA-1 through -3, are indicated in Figure 57. SMA-1 is located near the current outfall of Russ Creek on the TWC property and is the site of current and active sediment deposition. The creation of SMA-1 would require some minor grading to enhance a broad and shallow capture area. SMA-2 and SMA-3 occur in a low lying area located between Russ Creek and Angels Camp. These sediment capture areas would be created by the construction/enhancement of the guide berms indicated on Figure 57 – no excavation is required to create these two SMAs. SMA-2 and -3 are likely locations of sediment deposition if Russ Creek avulses westward out of the current channel alignment. Proposed sediment management actions in these areas are provided in the 2015 NOP project description (GHD, 2015).

The purpose of this analysis is to estimate the potential sediment storage volume of each SMA as well as the anticipated period of time it would take to fill the SMAs based on 100-percent capture of estimated sediment yield rates presented in Appendix H[10]. Sediment available storage volumes were estimated off of the 2015 NOP alternative terrain model and are presented in Table 10. Note that elevation increments in Table 10 only span the operational storage range for each basin, that is the elevation range between the bottom of a SMA and crest elevation of surrounding grade or berm. The final column in Table 10 presents the estimated amount of time it would take to fill each SMA at half-foot increments up to the maximum capacity. These individual basin fill durations were calculated assuming all of Russ Creek sediment was directed into any given basin and the annual sediment yield available for capture and deposition is 17,943 CY (median or 50% probability annual sediment yield value presented in Appendix H). Extreme flood events produce much higher annual sediment yields that could significantly reduce the storage capacity and basin fill duration over those estimated using a median annual sediment yield rate. For example, a very wet winter displaying an annual flow probability of 1% has an estimated annual sediment yield of over 127,000 CY (Appendix H), which could potentially fill any single SMA basin during that very wet year. These volume and fill duration estimates will assist in the development of a long-term Sediment Management Plan, especially with the planning for sediment reuse options.

[10] The actual percentage of material captured during any given storm or winter season is highly variable depending on the proportion of flow that actually reaches any given basin and what proportion of sediment remains in suspension as it passes through a SMA. A 100-percent capture rate is a conservative estimate used as a way to compare potential sediment storage between SMAs.

TABLE 10: Elevation-Volume-Area relationships for proposed Sediment Management Areas (SMA). Right-hand column presents years to fill to a given elevation assuming annual median sediment yield rate. See Figure 57 for SMA locations.

Basin	Elevation	Cumulative Storage Volume (CY)	Cumulative Storage Volume (AF)	Yrs Sediment Storage
SMA-1	4.0	0	0.0	0.0
SMA-1	4.5	115	0.1	0.0
SMA-1	5.0	349	0.2	0.0
SMA-1	5.5	5,671	3.5	0.3
SMA-1	6.0	14,634	9.1	0.8
SMA-1	6.5	43,257	26.8	2.4
SMA-1	7.0	77,171	47.8	4.3
SMA-1	7.5	118,080	73.2	6.6
SMA-2	4.0	0	0.0	0.0
SMA-2	4.5	320	0.2	0.0
SMA-2	5.0	7,591	4.7	0.4
SMA-2	5.5	20,318	12.6	1.1
SMA-2	6.0	44,087	27.3	2.5
SMA-2	6.5	82,496	51.1	4.6
SMA-2	7.0	129,411	80.2	7.2
SMA-3	4.0	0	0.0	0.0
SMA-3	4.5	380	0.2	0.0
SMA-3	5.0	1,950	1.2	0.1
SMA-3	5.5	9,377	5.8	0.5
SMA-3	6.0	20,423	12.7	1.1
SMA-3	6.5	39,524	24.5	2.2
SMA-3	7.0	63,338	39.3	3.5
SMA-3	7.5	96,044	59.5	5.4
SMA-3	8.0	132,944	82.4	7.4

Chapter 7: Conclusions

Significant findings and conclusions from this study and the numerical modeling results include the following.

1. KHE was able to develop, calibrate and validate a hydrodynamic and advection-dispersion model that accurately simulates water levels, flow rates and salinity within the project area. This model served as the foundation for development of separate numerical models representing the NOP and Full Tidal alternatives. The Existing Conditions model provides output that serves as a baseline for comparison to all other alternatives.
2. During winter and spring high flow periods, the 2015 NOP alternatives result in equal to lower maximum and median (50% exceedance) water levels and equal to reduced corresponding inundation areas when compared to Existing Conditions in the following areas: a) Angels Camp; b) RR&T property east of the new Project berm (i.e. outside of the enhance Centerville Slough corridor); c) Cut-Off Slough north of the EREP bridge; and d) ORF lands.
3. During winter and spring high flow periods, the 2015 NOP alternatives result in maximum water levels within the enhance wetland areas (i.e., Inner Marsh, EREP lands adjacent to the new lower Russ Creek channel, and the new Centerville Slough corridor between the EREP bridge and Angels Camp) that vary slightly higher and lower than maximum Existing Conditions water levels. Median water levels in the enhanced wetland areas are notably lower than Existing Conditions median levels.
4. During winter and spring high flow periods, the 2014 NOP alternatives result in median water levels that exceed the Existing Conditions median levels in the RR&T property east of the new Project berm and the ORF property. Although maximum flood levels remain equal or slightly lower than Existing Conditions on the RR&T property, they commonly exceed maximum Existing Conditions water levels on the ORF property.
5. During winter and spring high flow periods, the 2014 NOP alternatives result in maximum water levels within the enhance wetland areas that are equal to the Existing Conditions maximum water levels. However, median water levels in Angels Camp and the Inner Marsh are higher than Existing Conditions median levels.
6. In general, the 2015 NOP alternatives yield slightly smaller maximum inundation areas than the 2014 NOP alternatives for the entire Project Area.
7. During the summer, the NOP alternative water levels and inundated areas increase nearly two-fold over those experienced under Existing Conditions within the Project Area. The increased inundation areas and durations are associated with increased maximum and median water levels in Angels Camp, the enhanced Centerville Slough corridor, EREP property adjacent to the new lower Russ Creek channel and Inner Marsh. The increase in inundation area yields increased aquatic habitat area.

8. Model results of alternatives indicate that channel flow velocities for all but the Full Tidal alternative are low (less than 0.5 ft/s) throughout the site. Given velocity results and assumed critical velocities for site sediments, all NOP and Existing Condition alternative channels analyzed should not experience excessive erosion. However, simulated velocities are generally not high enough to transport the majority of Wildcat Tributary or dune sediments through the system.
9. The muted tidal exchange introduced by the NOP alternative reproduces more natural salinity variability, enhances circulation and reduces stagnant water quality conditions.
10. During the winter period, the magnitude of change in project area water levels due to SLR is greater under Existing Conditions than under the 2015 NOP Narrow alternative. Assuming 1-foot of SLR, Existing Conditions water levels in the lower Western Drainage ditch, Cut-Off Slough and Inner Marsh all increase by approximately 1.5- to 2.0-feet in elevation. SLR induced increases in project water levels under the 2015 NOP Narrow alternative appear to be generally 0.5- to 1.0-feet. The prolonged backwater effects and higher elevation of low tide elevations during winter storms combine to reduce the drainage efficiency of the project area drainage network under the Existing Conditions alternative, resulting in the accentuated maximum project water level increases under SLR conditions.
11. During the Summer, simulated water levels in Centerville Slough, Angels Camp and the Inner Marsh for both the Existing Conditions and 2015 NOP Narrow alternatives generally increase between 0.5- to 0.75-feet under 1-foot of SLR. Ditch water levels behind tide gates connected to the main project channels (e.g., ORF lands and RR&T property) also increase generally between 0.25- and 0.5-feet due to higher low-tide elevations and increased back-water effect.
12. Attempts at modeling wave overwash provide a better understanding of the process and key variables affecting site hydrology and water quality. However, better downstream boundary conditions and internal channel monitoring (i.e., water level monitoring concomitant with wave overwash) would help more accurately integrate wave overwash into the existing numerical models.
13. The proposed project includes the installation of a new tide gate structure connecting the Inner Marsh to outer Cut-Off Slough and consisting of a combination of one-way side-hinge tide gates and a muted tidal regulator (MTR). The project also includes retrofitting the existing tide gate structure by replacing at least one flap gate with a one-way side-hinge gate equipped with smaller auxiliary fish passage door.
14. The new tide gate structure and retrofitted existing structure would increase up- and down-stream passage opportunities for both adult and juvenile salmonids. The project would introduce upstream passage opportunities during summer, a period when passage does not currently occur. The project would increase year-round upstream and downstream fish passage by at least 300%.

15. The project will increase the area of marsh habitat across the site. The 2015 NOP Narrow and Equilibrium alternatives nearly double the existing low to high marsh habitat zones without significantly increasing the area of mud flat and open water channel.
16. The 2015 NOP alternatives result in a net increase in potential flood water storage ranging between approximately 118- (2015 NOP Equilibrium) and 208-AF (original 2015 NOP) between the elevations of 2.5- to 8.0-feet NAVD88. This estimate would be reduced depending on where and how excavated sediment is reused at the site.
17. The project will increase the amount of tidal prism exchange and flow velocity through the outer Cut-Off Slough and Salt River channels, which could potentially widen/deepen the channels downstream of the project area. However, this change will be temporary as any change in channel size reaches equilibrium with the added tidal prism and would not increase sediment loads to the estuary above naturally occurring and existing levels. Any channel expansion and resulting equilibrium width will be smaller than historic conditions and would be contained within the historic channel footprint.
18. The Sediment Management Areas identified in the 2015 NOP alternative have an average estimated fill duration of between 6 and 7 years each assuming a 100% capture rate of Russ Creek sediments. However, a winter of extreme storms and high flows has the potential to fill a single basin if all material is captured.
19. Based on the results of this study, the 2015 NOP Equilibrium alternative is the most economical (least amount of earthwork) alternative that satisfies project goals and objectives. The 2015 NOP suite of alternatives provide better flood storage conditions and greater habitat area and diversity than the 2014 NOP alternatives. Results also indicate that there is not a significant difference in the hydraulic performance between the 2015 NOP alternatives under existing and sea level rise conditions as each provide adequate flood storage and drainage as well as similar salinity structure, wetland habitat and fish passage improvements. Therefore, the 205 NOP Equilibrium alternative is recommended as it will require the least amount of excavation and disturbance and potential impacts to existing wetlands.

Chapter 8: References

American Society of Civil Engineers (ASCE), 1996, Hydrology handbook, second edition. ASCE Manuals and Reports on Engineering Practice No. 28, ASCE, New York, NY, 784p.

Berenbrock, Charles, and Tranmer, A.W., 2008, Simulation of flow, sediment transport, and sediment mobility of the Lower Coeur d'Alene River, Idaho: U.S. Geological Survey Scientific Investigations Report 2008–5093, 164 p.

CDFG (California Department of Fish and Game), 2002, Culvert Criteria for Fish Passage. CDFG white Paper. Revised May 2002.

Domenico, P.A. and Schwartz, F.W., 1990, Physical and chemical hydrogeology. John Wiley & Sons, New York, NY, 824p.

Driscoll, F.G., 1986, Groundwater and wells. Johnson Screens, St. Paul, MN, 1089p.

Ericsson, M., Dixon, L., Martel, D., Photos, C., and Klein, J., 2008, Delineation of aquatic resources using vegetation communities and fluvial surfaces within Salt River, selected tributaries and potential channel re-alignment areas, Humboldt County. U.S. Army Corps of Engineers, Engineering and Research Development Center (ERDC), Cold Regions Research and Engineering Laboratory (CRREL), and San Francisco District, May 8, 36p.

Freeze, A.R. and Cherry, J.A., 1979, Groundwater. Prentice Hall, Inc., Upper Saddle River, NJ, 604p.

GHD, 2015, Revised Notice of Preparation of Draft Environmental Impact Report for Eel River Estuary and Centerville Slough Enhancement Project, SCH# 2104122040. Prepared for: California State Coastal Conservancy, Lead Agency, November.

GHD, 201, Notice of Preparation of Draft Environmental Impact Report for Eel River Estuary Preserve Ecosystem Enhancement Project. Prepared for: California State Coastal Conservancy, Lead Agency, December.

Heath, R.C., 1987, Basic ground-water hydrology. U.S. Geological Survey (USGS) Water-Supply Paper 2220, 84p.

H.T. Harvey & Associates, 2010, Cross-sectional descriptions for Salt River Channel Restoration. January, 9p.

NHE (Northern Hydrology & Engineering), 2014, Humboldt Bay: Sea Level Rise, hydrodynamic modeling, and inundation vulnerability mapping. Prepared for: State Coastal Conservancy and Coastal Ecosystems Institute of Northern California, Final Report, April.

KHE (Kamman Hydrology & Engineering, Inc.), 2012, Basis of Design Report, Volume I – Salt River Ecosystem Restoration Project, Riverside Ranch Tidal Marsh Restoration and

Preliminary Salt River Channel Design. Prepared for: Humboldt County RCD and California State Coastal Conservancy, May, 236p.

KHE (Kamman Hydrology & Engineering, Inc.), 2015, Draft Eel River coastal plain dunes assessment and restoration feasibility analysis, Humboldt County, California. Prepared for: GHD, June, 124p.

Mitsch, W.J. and Gosselink, J.G., 2007, Wetlands. John Wiley & Sons, Hoboken, New Jersey, 4th Edition.

National Marine Fisheries Service (NMFS). 2001. Guidelines for Salmonid Passage at Stream Crossings. National Marine Fisheries Service – Southwest Region 14pp.

Noble, Northwest Hydraulic Consultants, and Sea Engineering, Inc., 2005, Hydrologic and hydraulic study – Phase I Draft Report Volume 1, baseline conditions and historical morphology of Novato Creek. Prepared for: U.S. Army Corps of Engineers, San Francisco District, June, 211p.

Partheniades, E., 1965, Erosion and Deposition of Cohesive Soils, Journal of the Hydraulics Division, Proceedings of the ASCE, vol. 91, no. HY I, January, pp. 105-1 39.

Vanoni, V.A., ed., 1975, Sedimentation Engineering, ASCE Task Committee for the Preparation of the Manual on Sedimentation of the Sedimentation Committee of the Hydraulics Division (reprinted 1977).

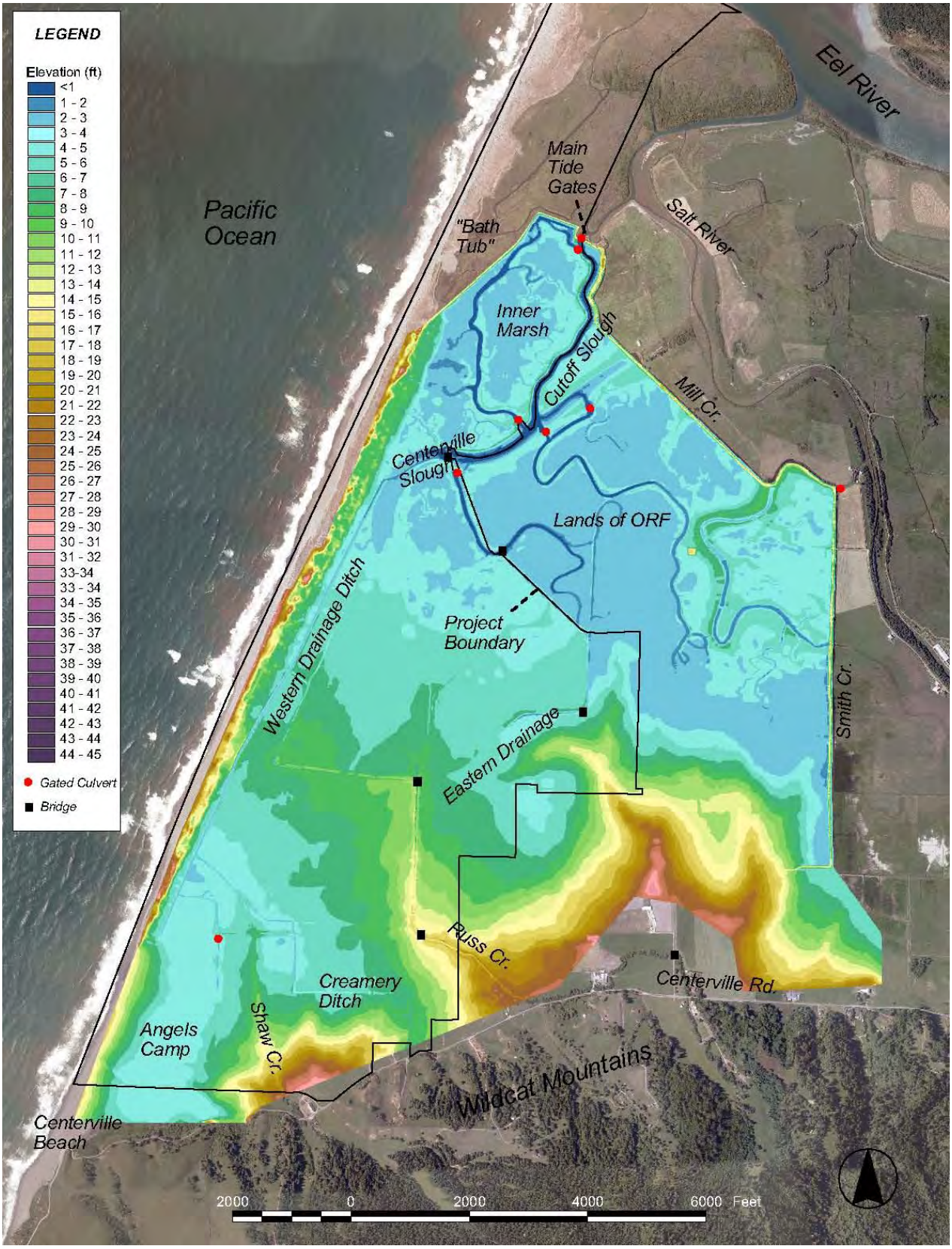


FIGURE 1: Project site map (circa 2012).

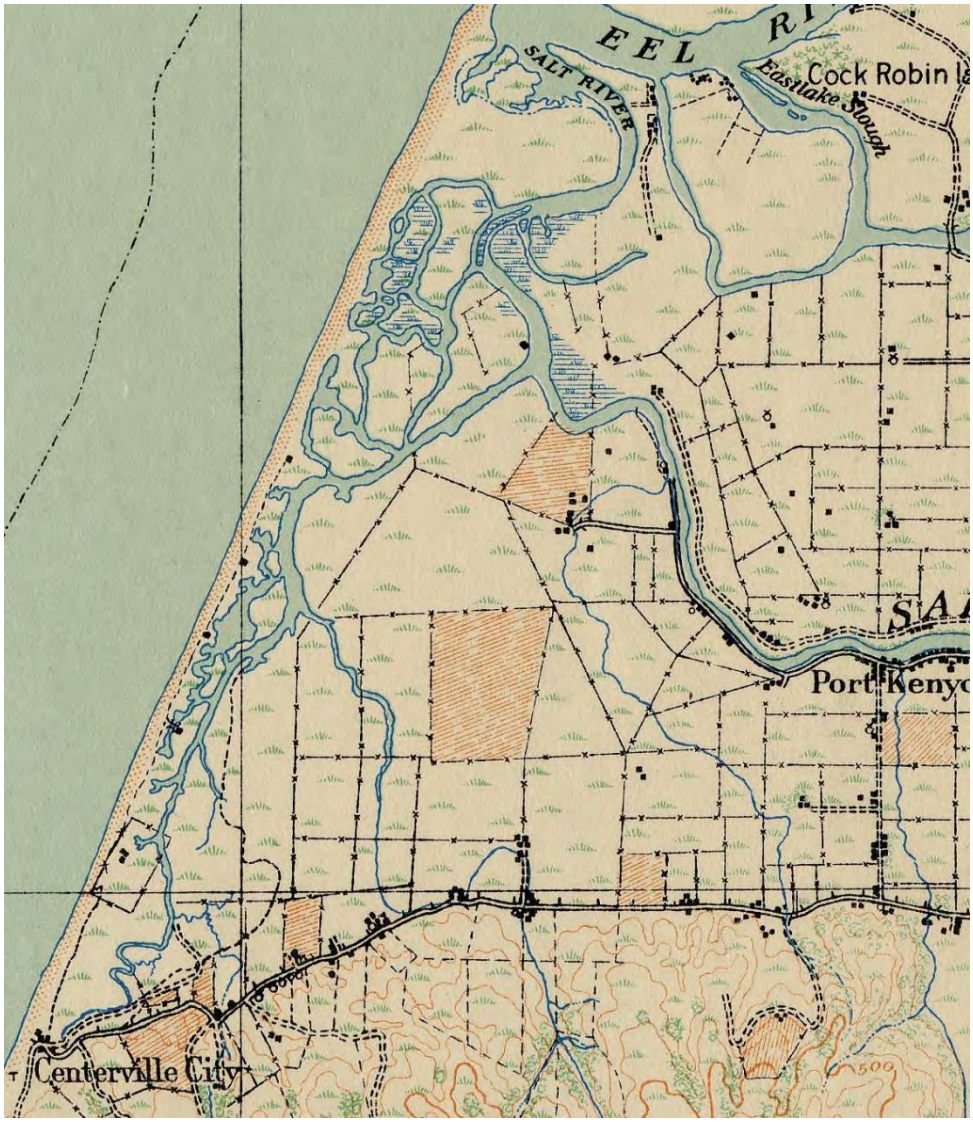


FIGURE 2: Historic site conditions (circa 1916). Source: USGS, Cape Fortuna 1:62,500 topographic map, 1919.

FIGURE 3: Cut-Off Slough tide gates (view looking north from inner Cut-Off Slough).

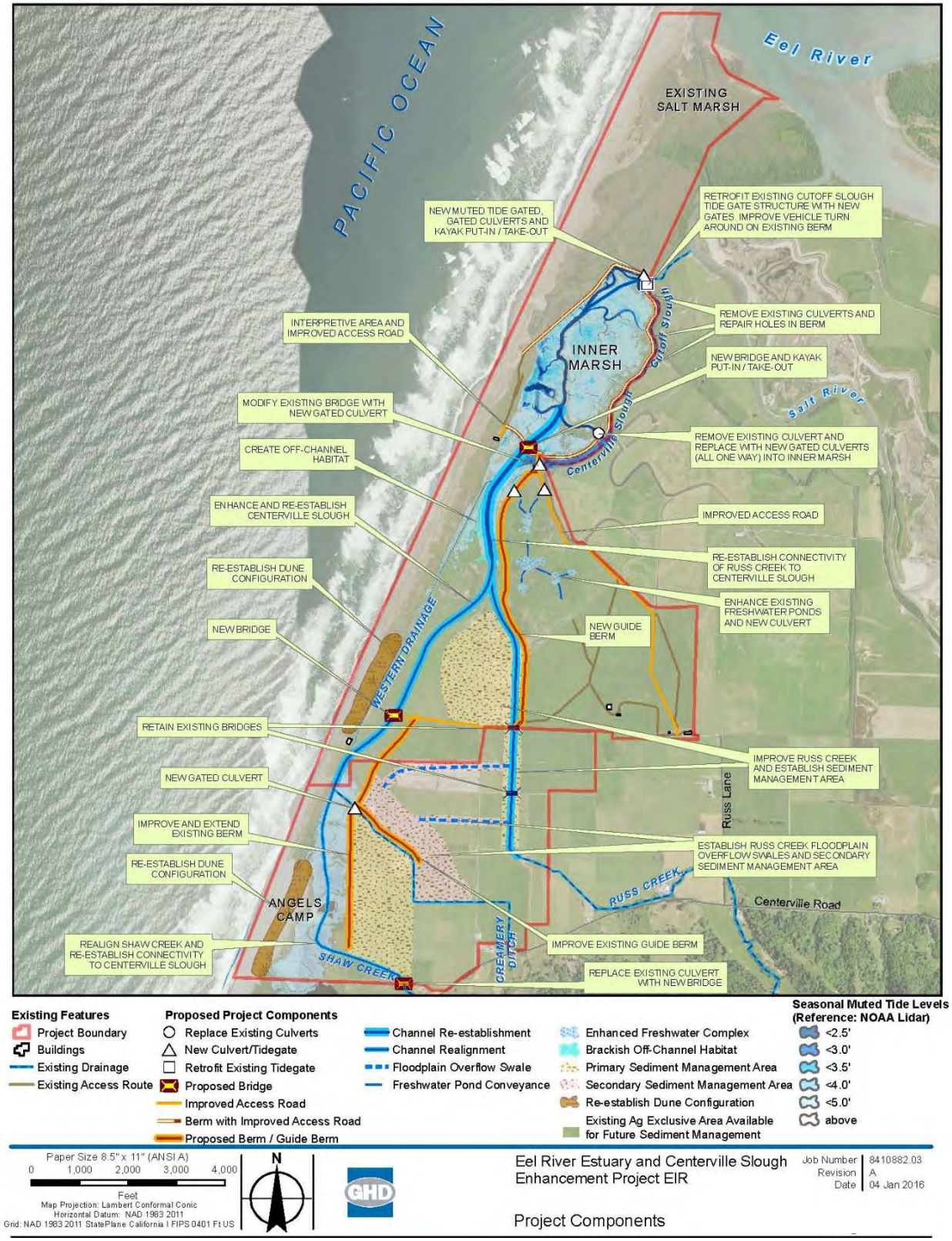


FIGURE 4: 2015 Revised NOP alternative components. Source: GHD, 2015.

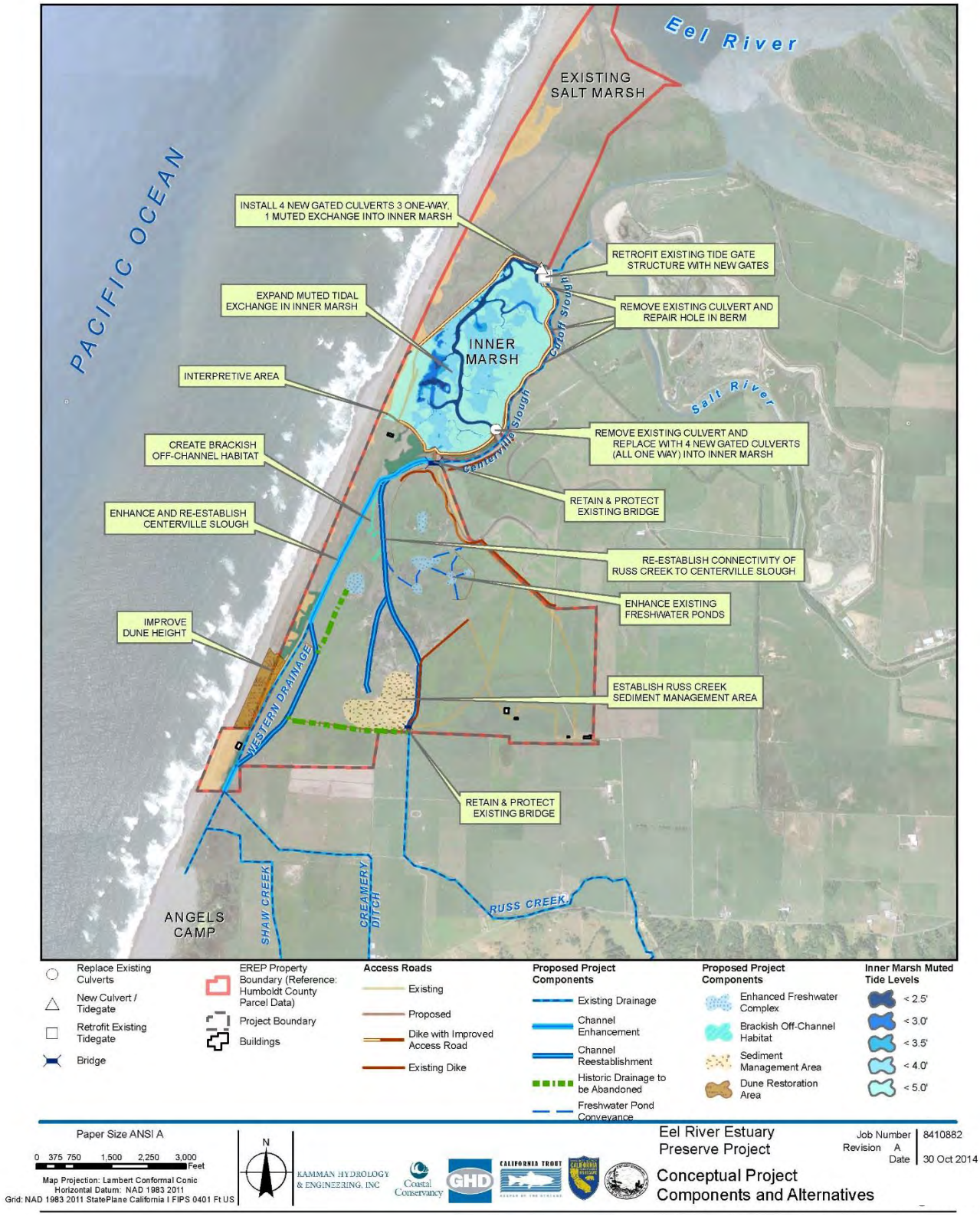


Figure 5: 2014 NOP alternative components. Source: GHD, 2014.

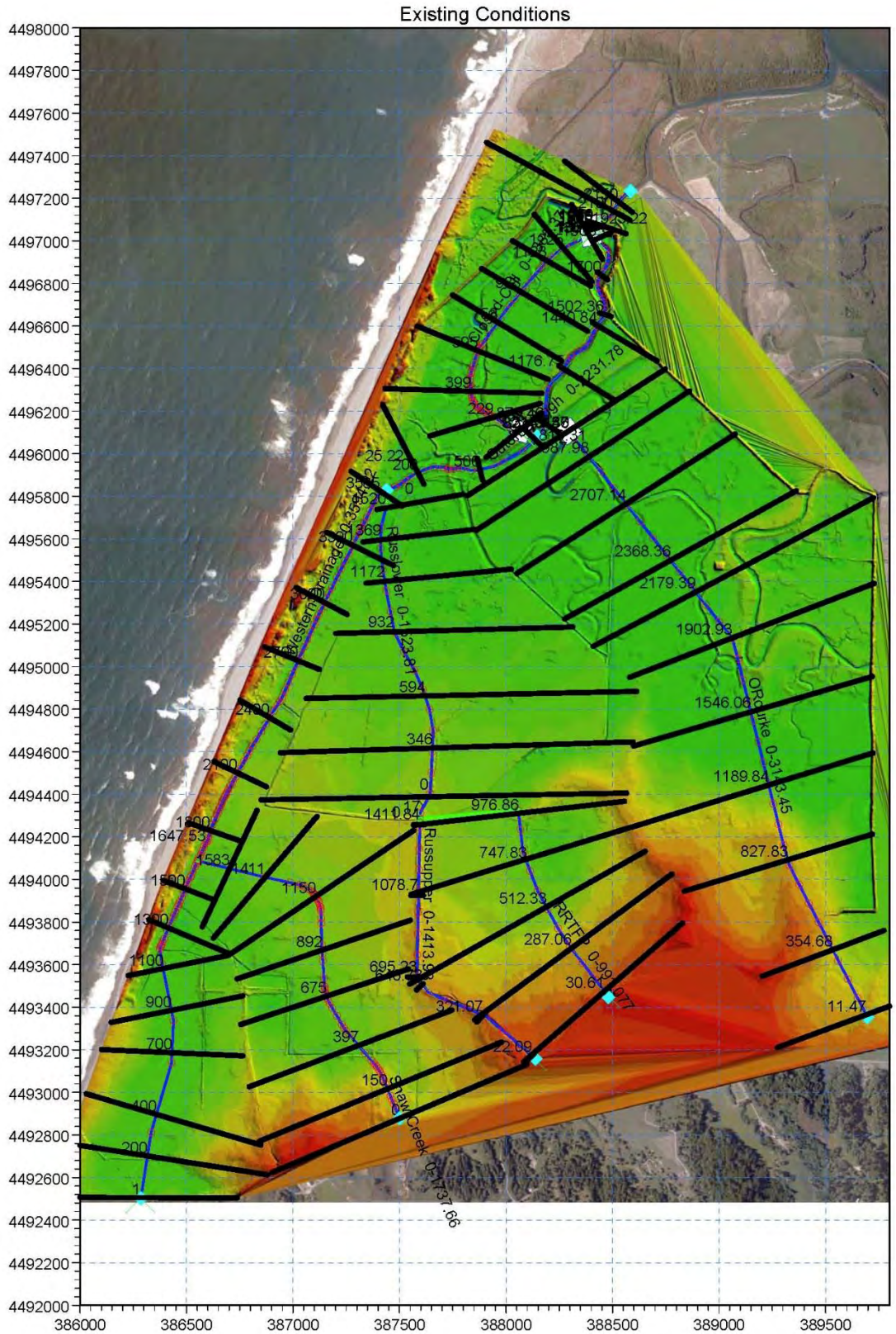


FIGURE 6: Existing Conditions and Full Tidal alternative hydrodynamic model geometry with shaded relief background.

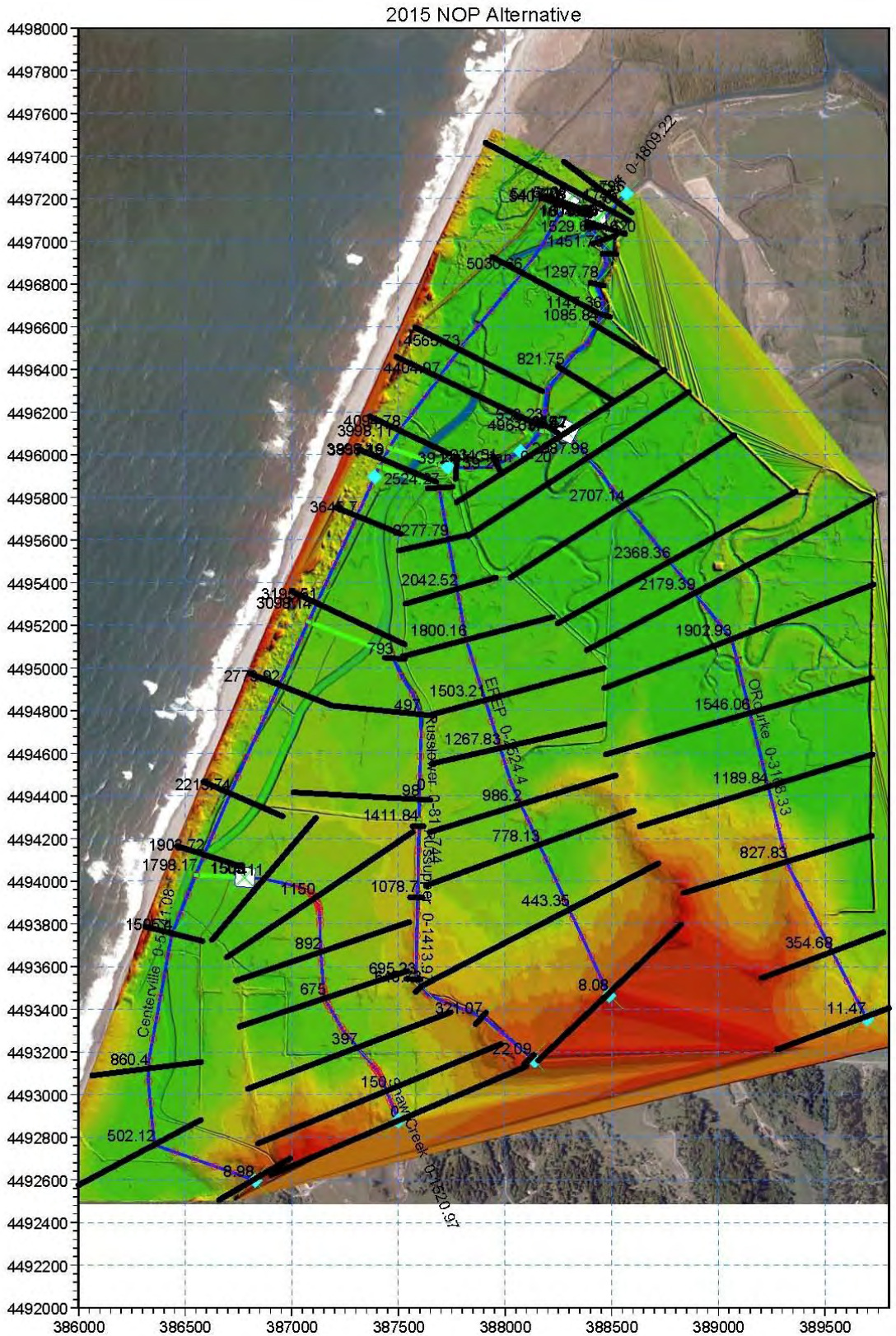


FIGURE 7: 2015 NOP alternative hydrodynamic model geometry with shaded relief background.

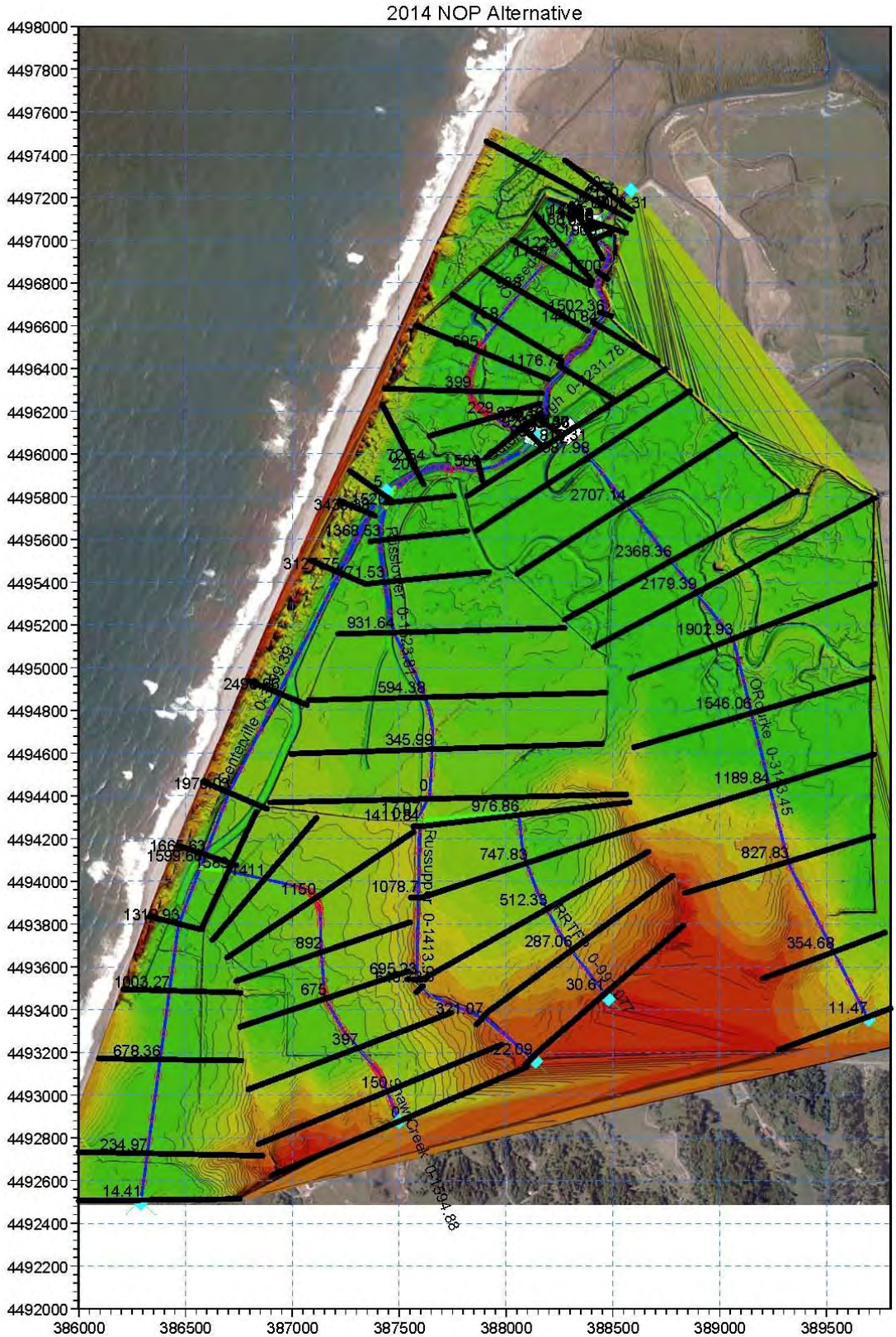


FIGURE 8: 2014 NOP alternative hydrodynamic model geometry with shaded relief background.

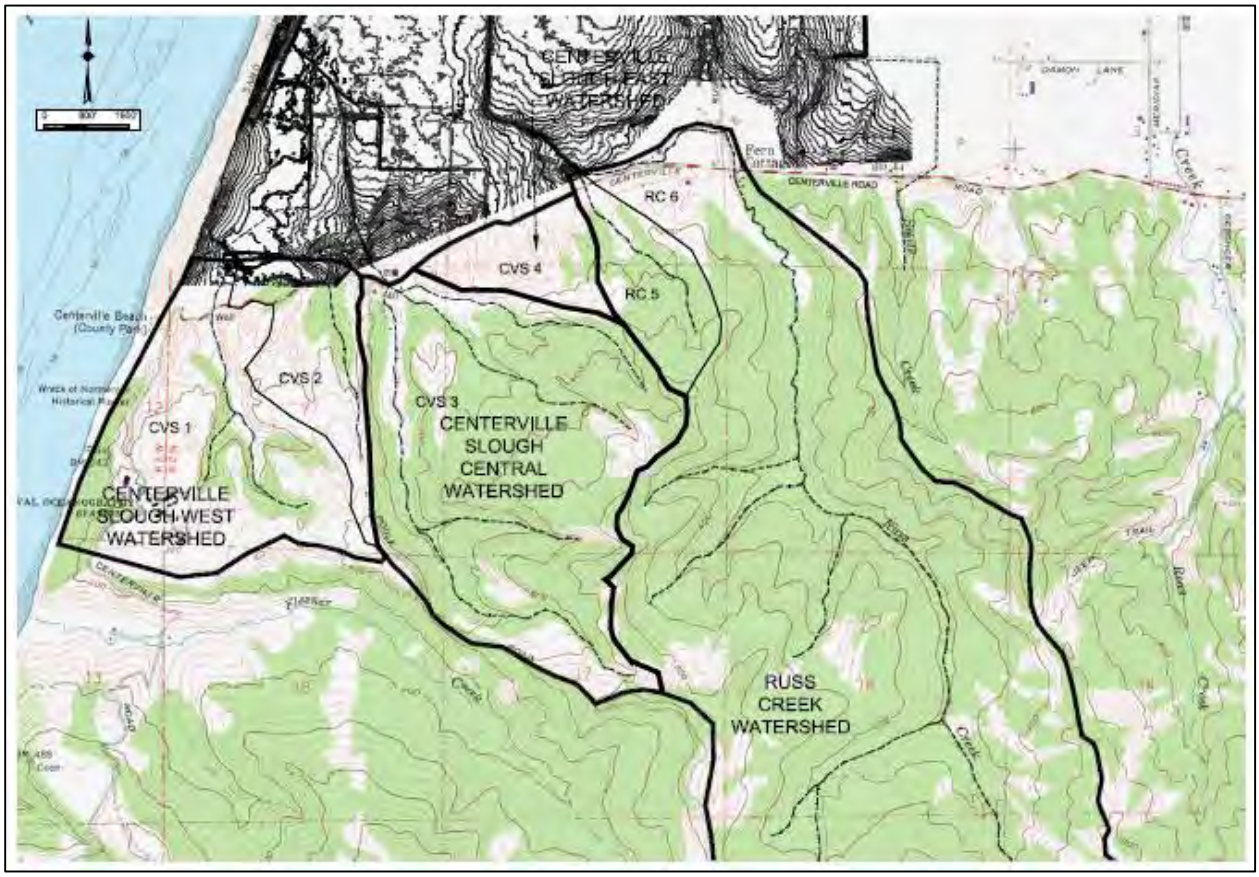


FIGURE 9: Wildcat Mountain tributary watersheds contributing runoff to the project area. Watesheds RC5 and RC6 contribute flow to Russ Creek, watershed CVS4 contributes to Creamery Ditch, watershed CVS 3 contributes to Shaw Creek, and sheds CVS1 and CVS2 contribute to Angels Camp and the Western Drainage ditch.

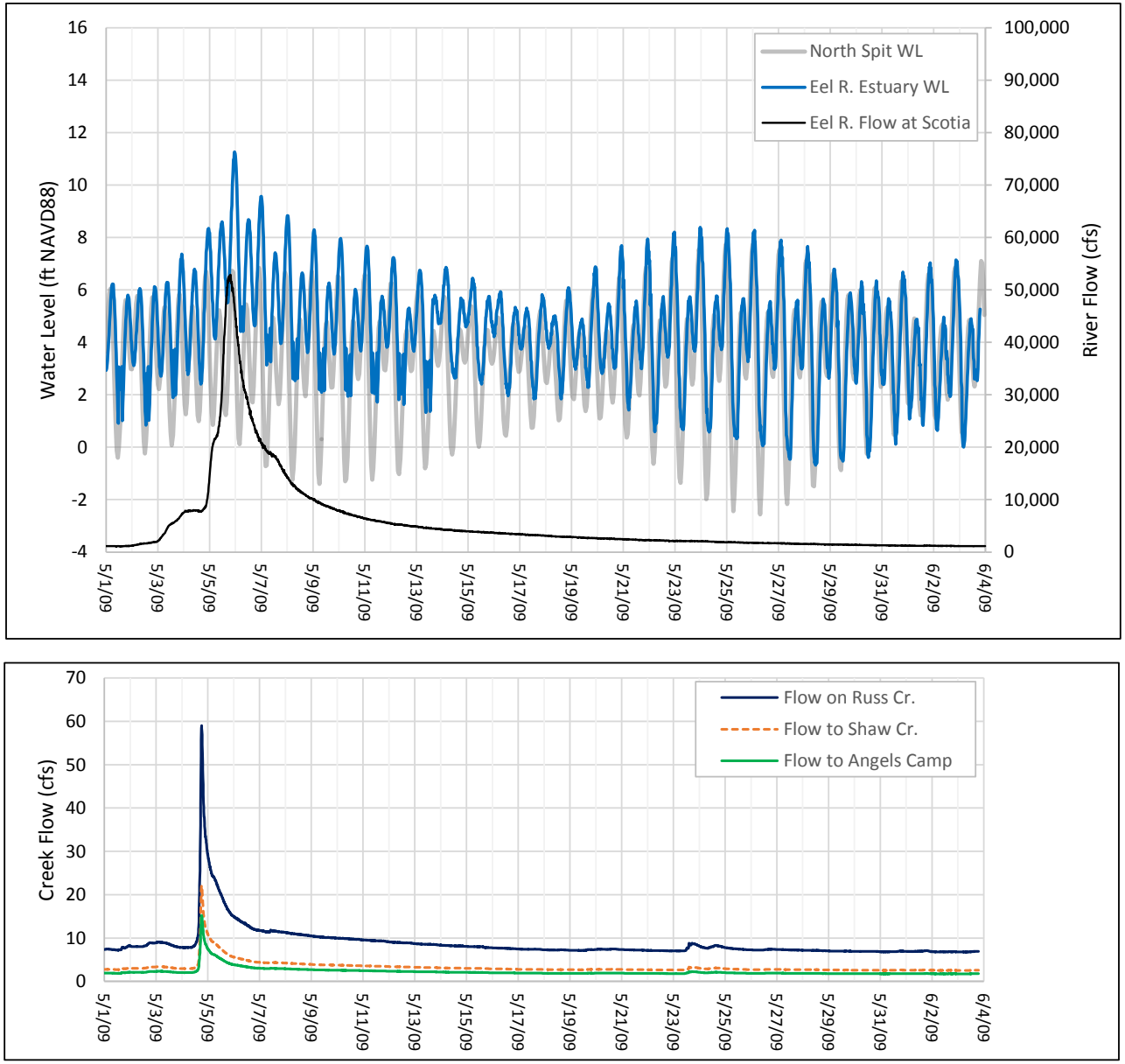


FIGURE 10: Tidal and flow model boundary conditions 5/1/09 - 6/4/09.

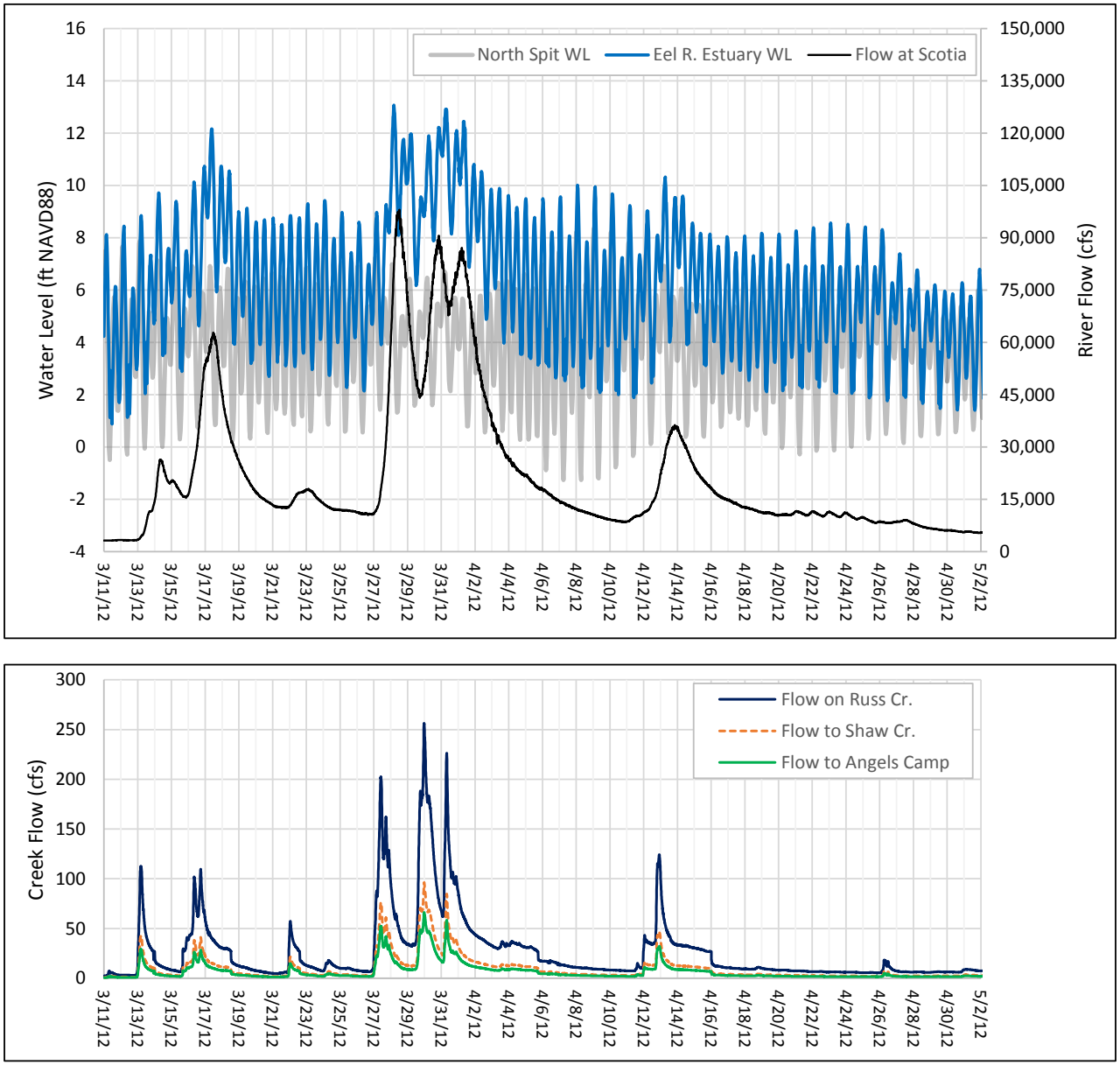


FIGURE 11: Tidal and flow model boundary conditions 3/11/12 – 5/2/12.

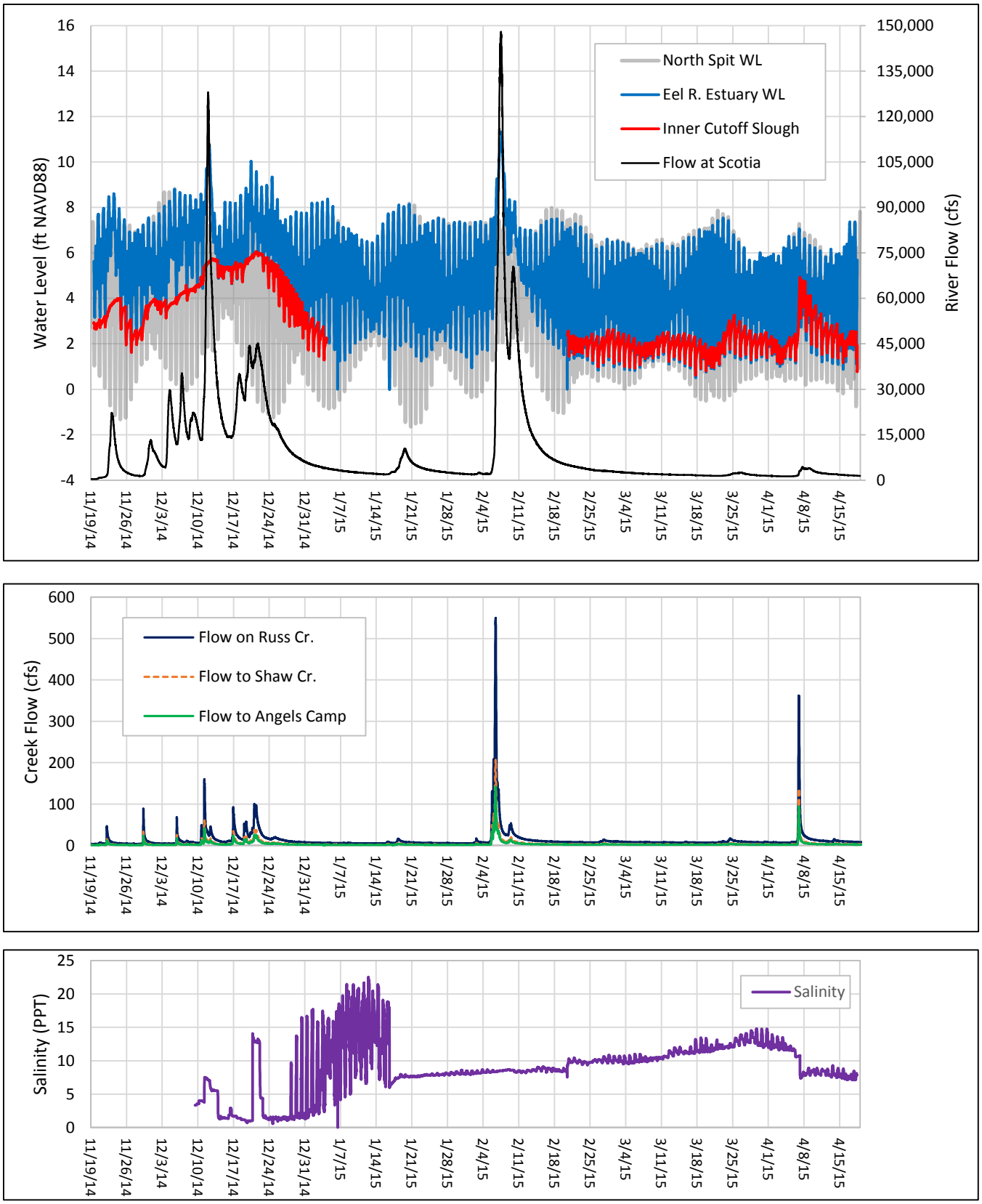


FIGURE 12: Tidal, flow and salinity model boundary conditions 11/19/14 – 4/15/15.

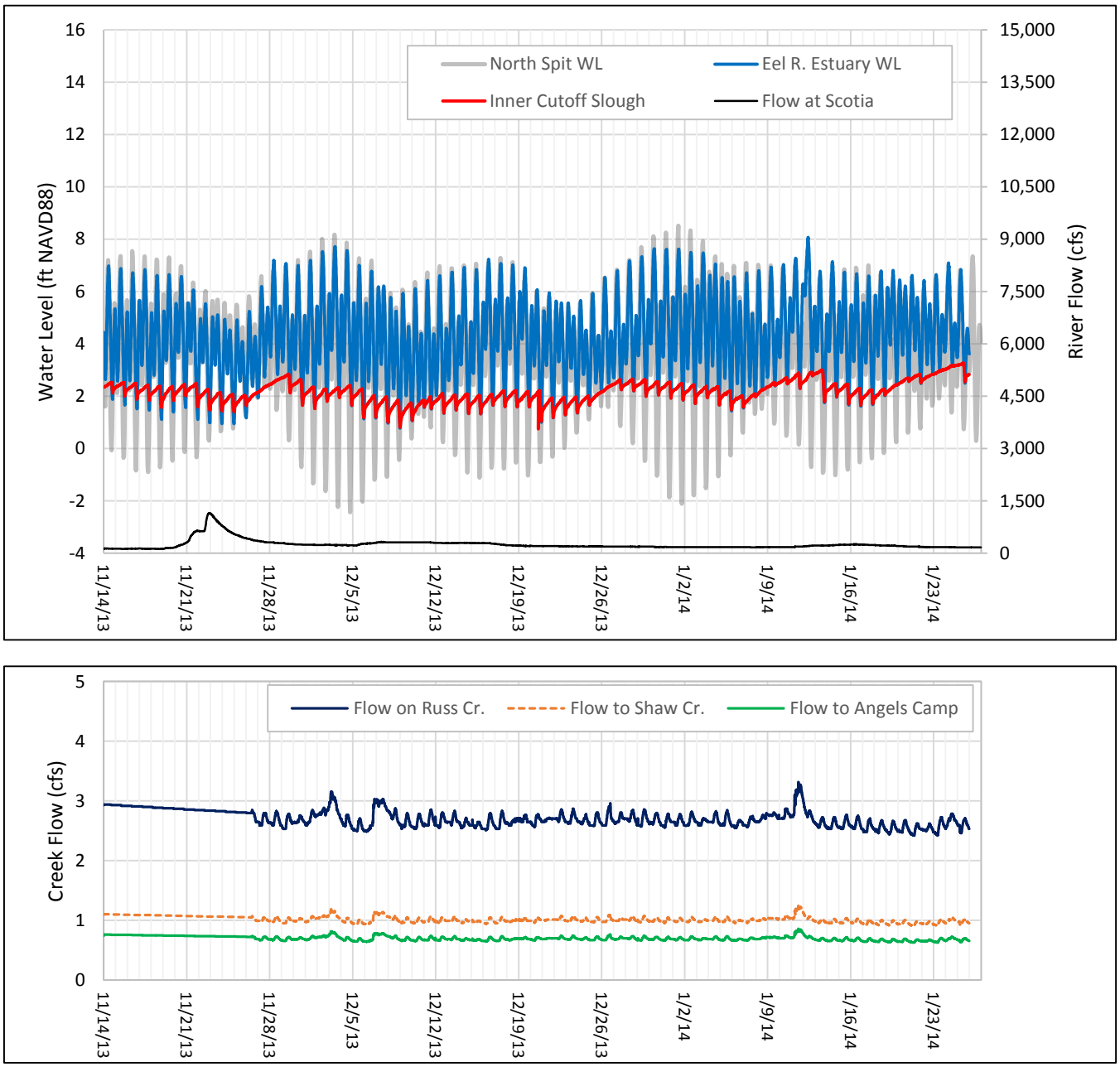


FIGURE 13: Tidal and flow model boundary conditions 11/14/13 – 1/26/14.

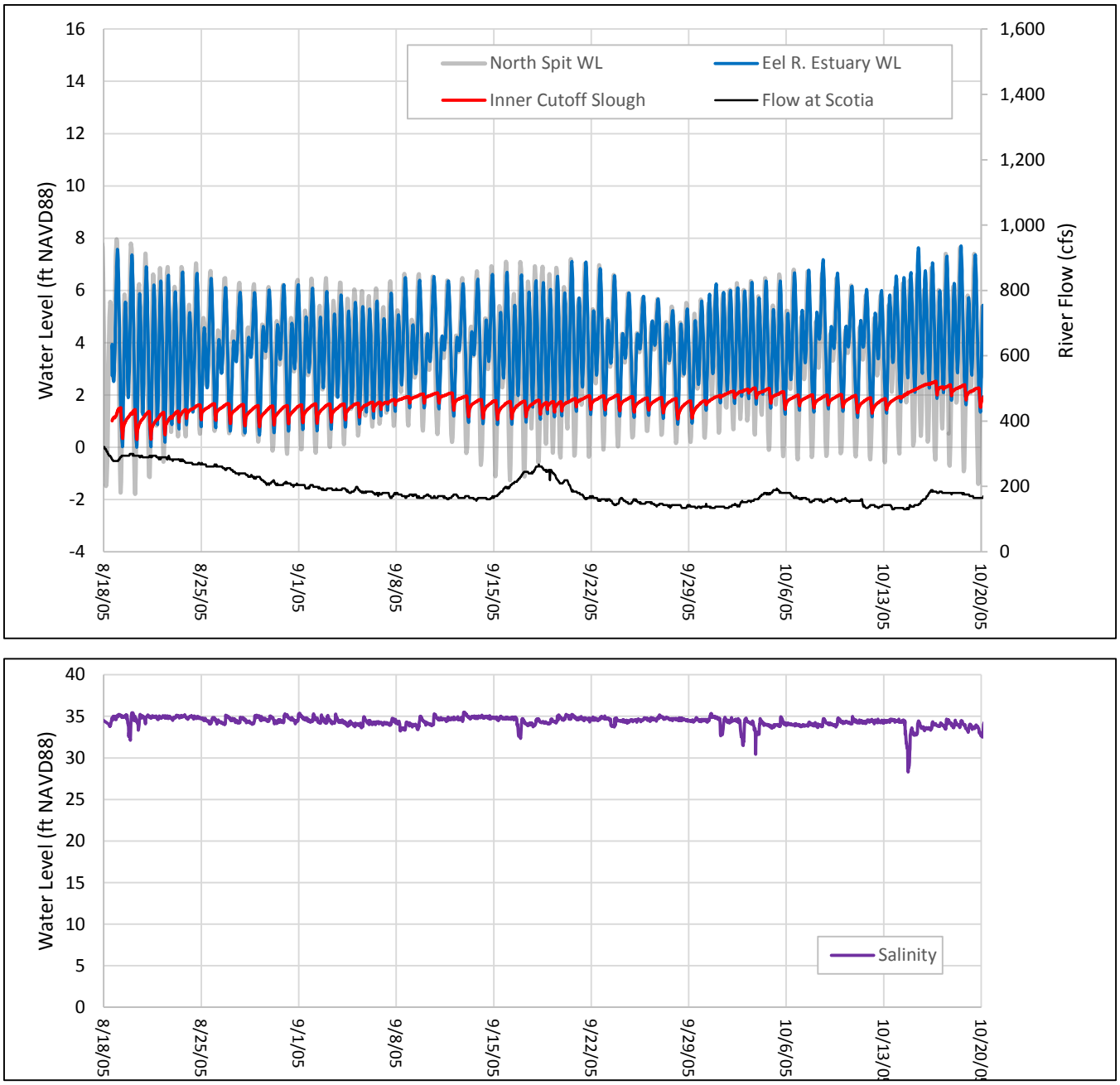


FIGURE 14: Tidal, flow and salinity model boundary conditions for summer period (6/23/05 - 10/22/05).

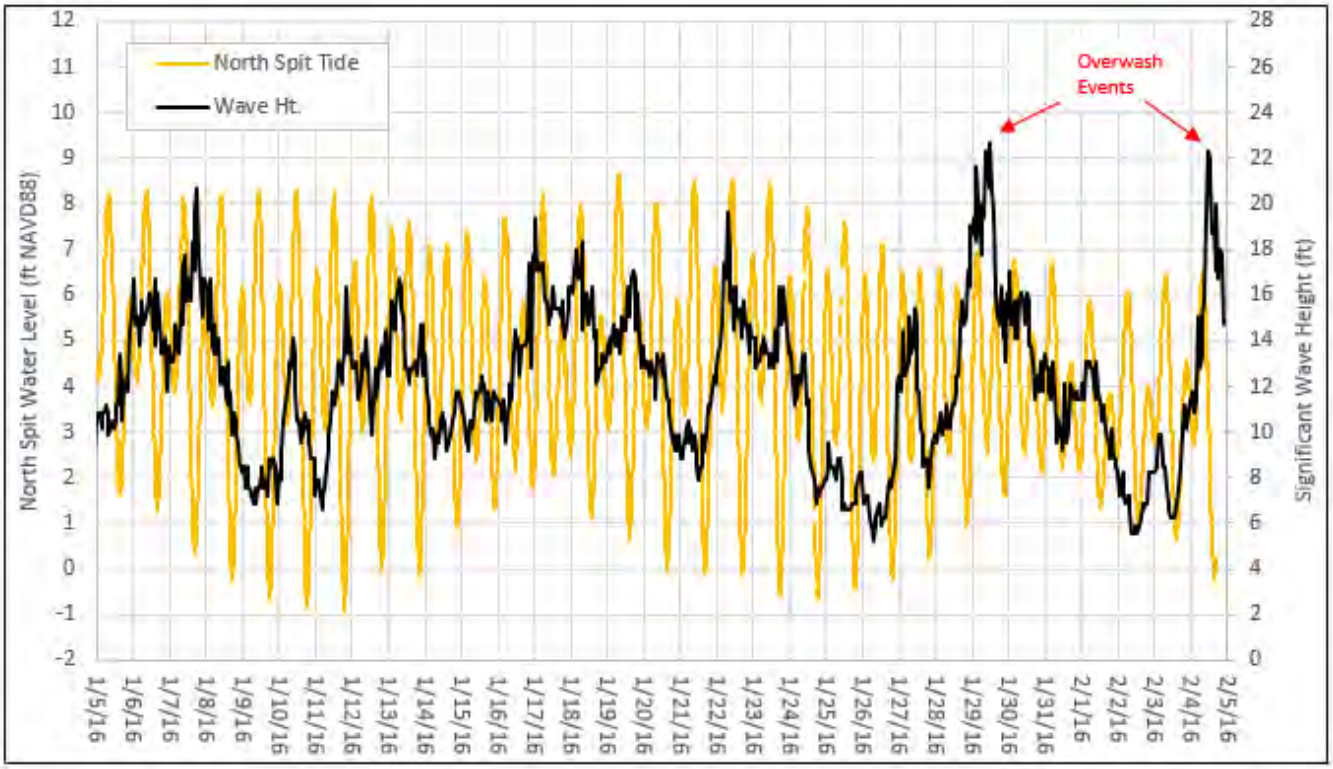


FIGURE 15: Coastal conditions during observed site dune overwash events on 1/29/16 and 2/4/16.

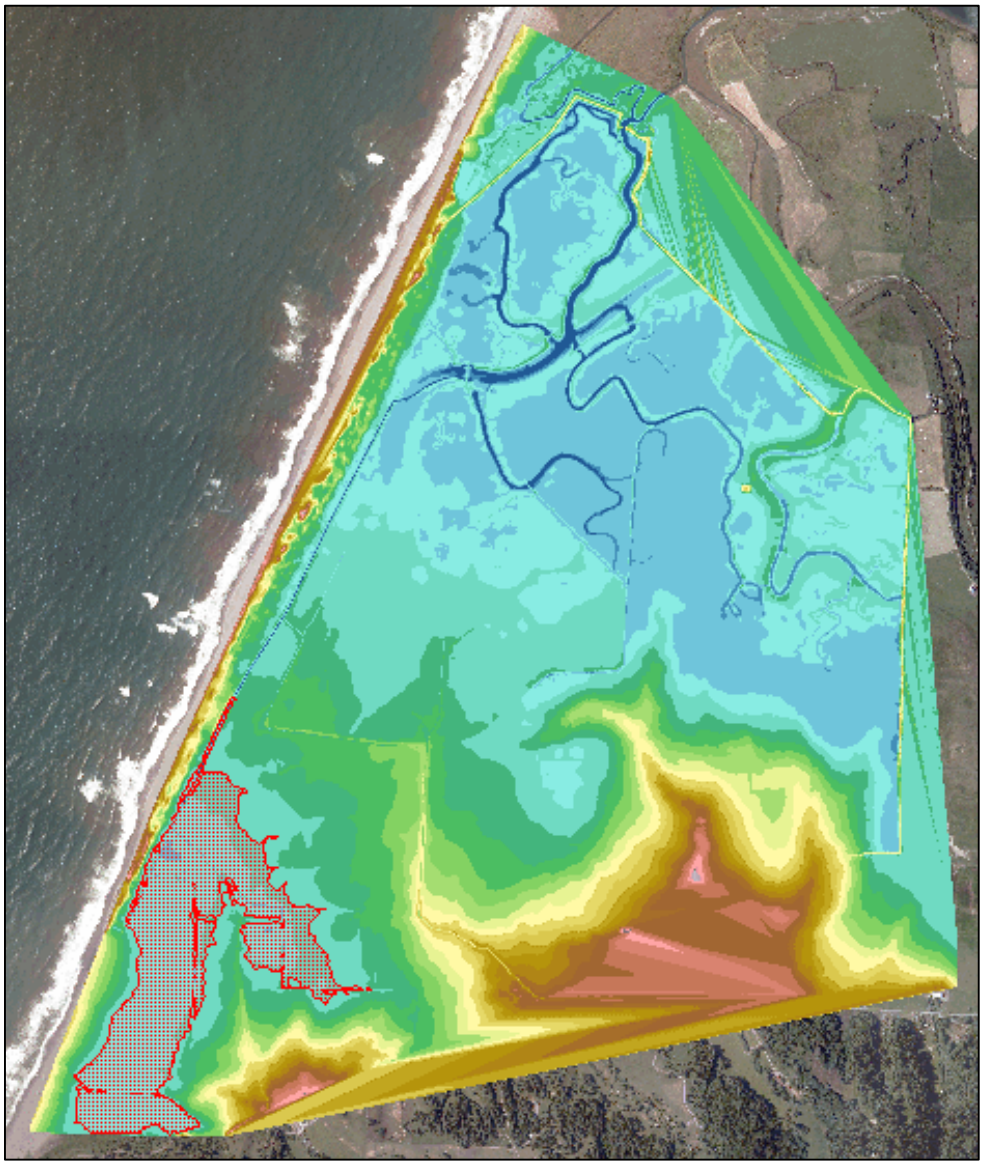


FIGURE 16: Estimated typical inundation area (180-acres) during wave overwash events; personal communication with Jay Russ, January 29, 2026.

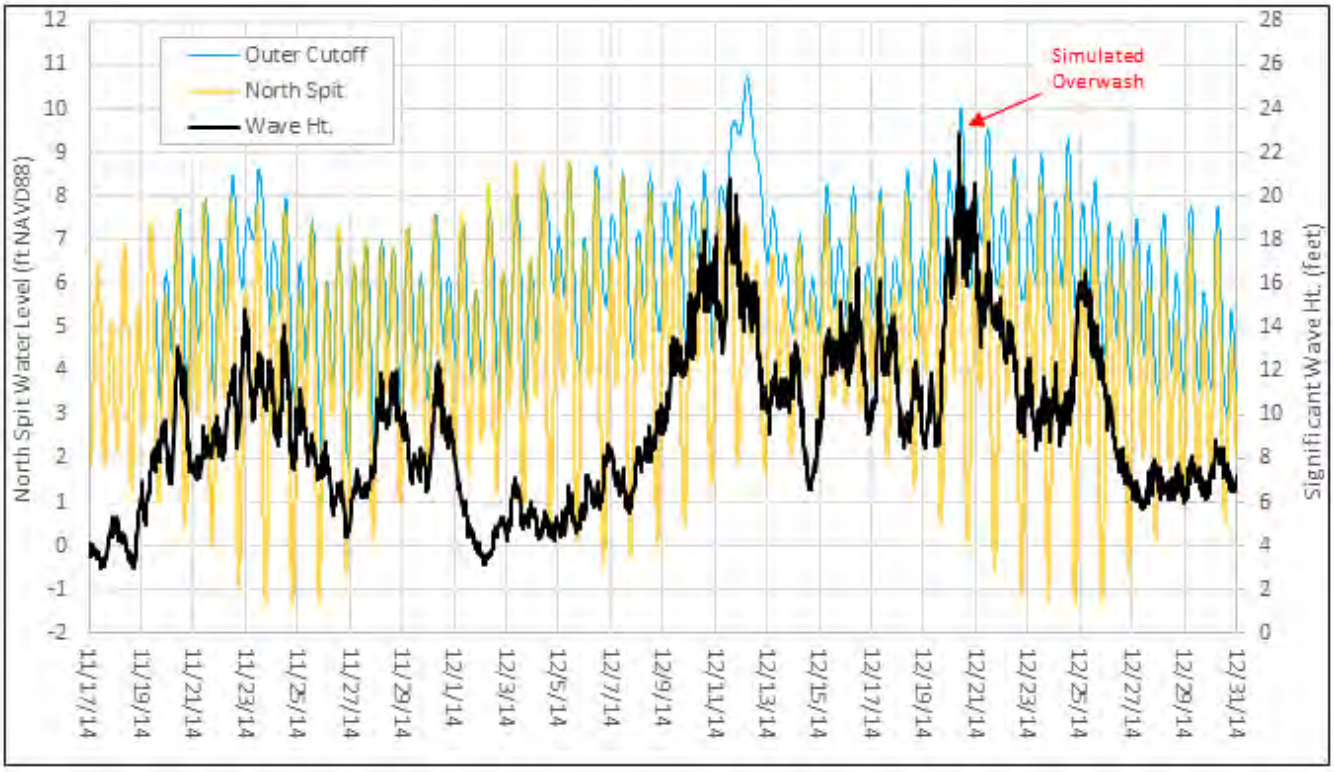


FIGURE 17: Coastal conditions during 11/17/14 – 12/31/14 simulation period. Overwash on 12/20/14 included in wave overwash simulation.

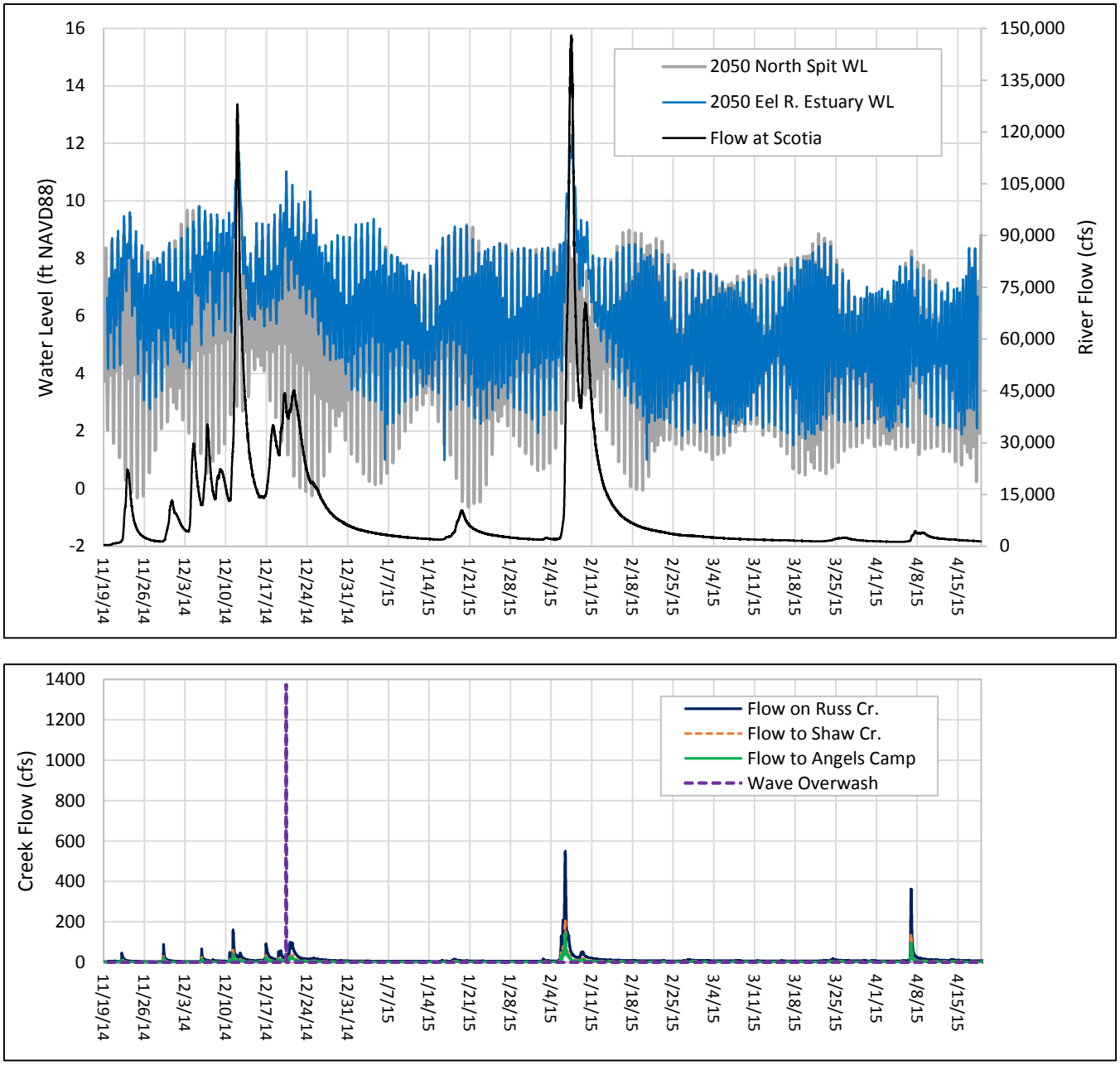


FIGURE 18: Sea level rise tidal and flow model boundary conditions 11/19/14 – 4/15/15.

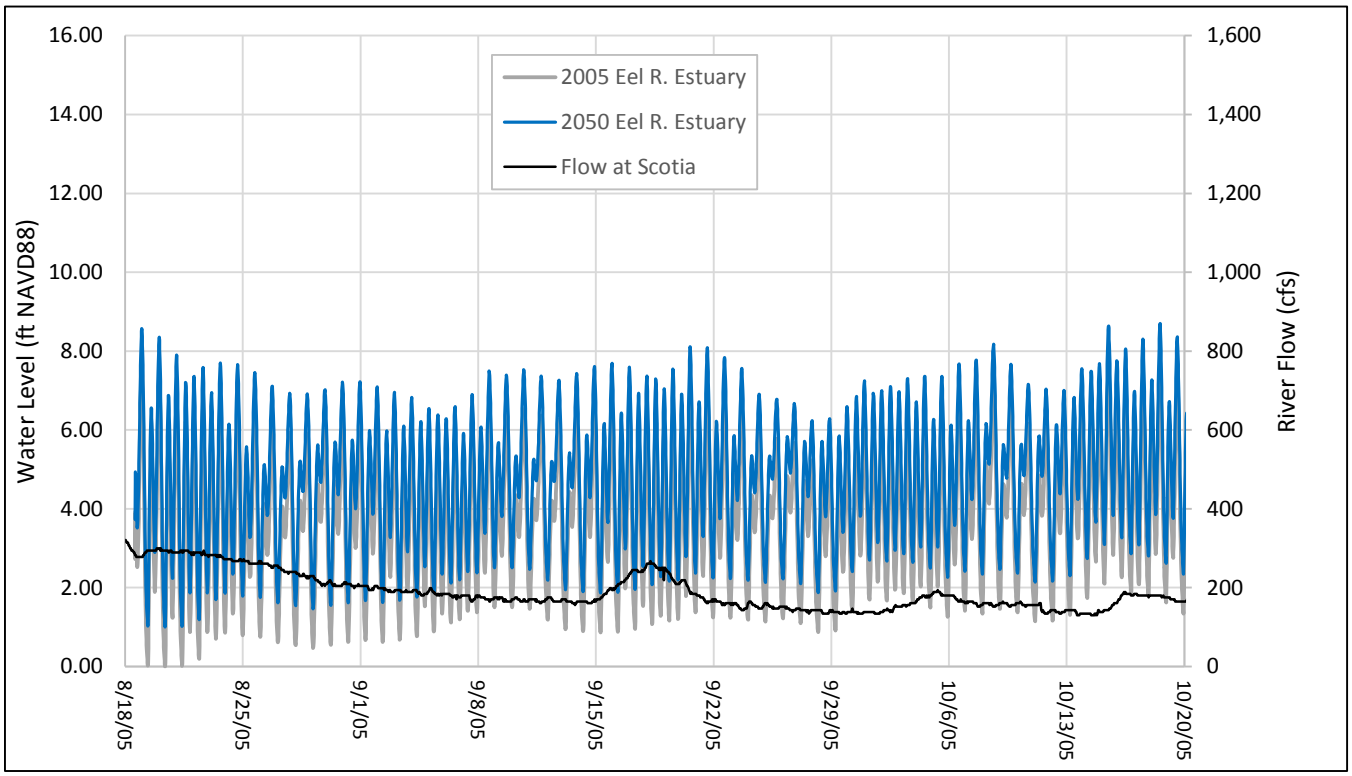


FIGURE 19: Sea level rise tidal and flow model boundary conditions 6/23/05 - 10/22/05. Note: no overwash assumed during summer period simulation.

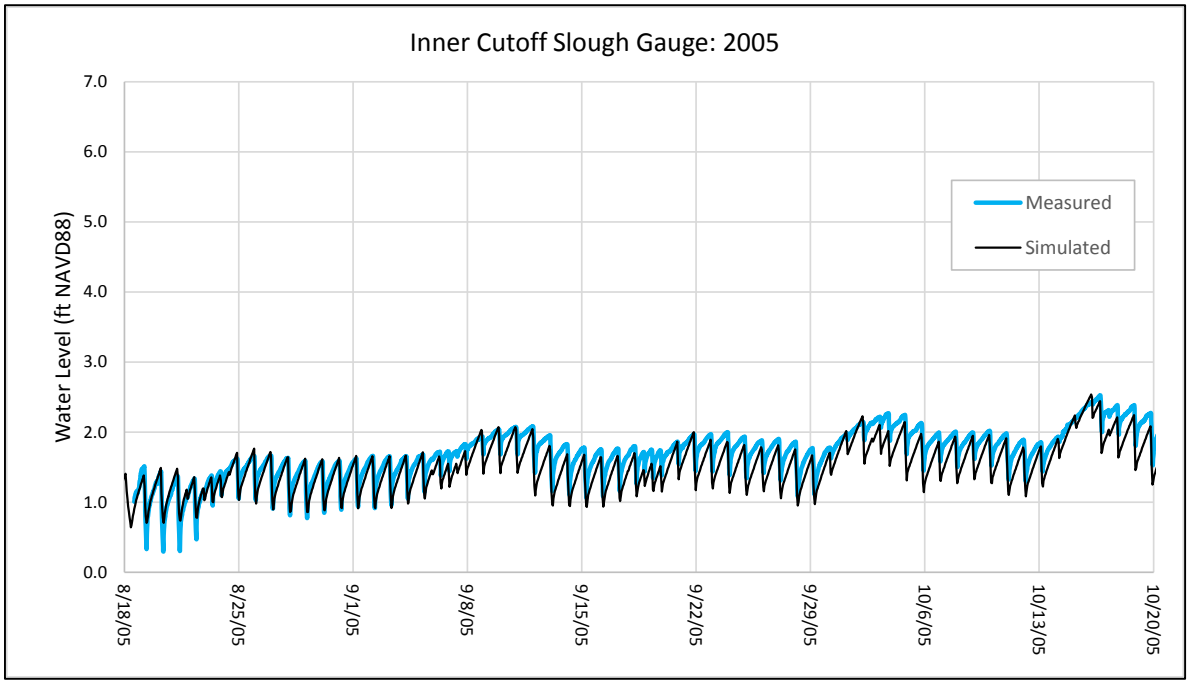


FIGURE 20: Model calibration results 8/18/05 – 10/20/05: comparison of simulated versus measured water levels at tide gauge within Cut-Off Slough immediately upstream of existing tide gates.

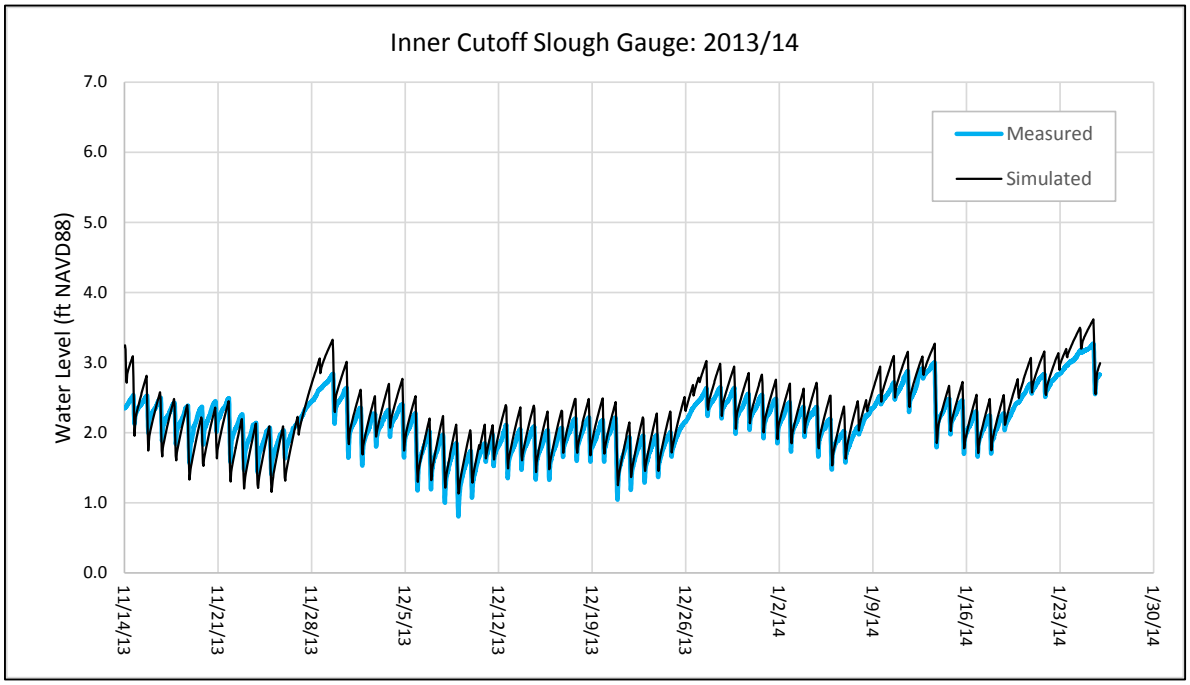


FIGURE 21: Model calibration results 11/14/13 – 1/30/14: comparison of simulated versus measured water levels at tide gauge within Cut-Off Slough immediately upstream of existing tide gates.

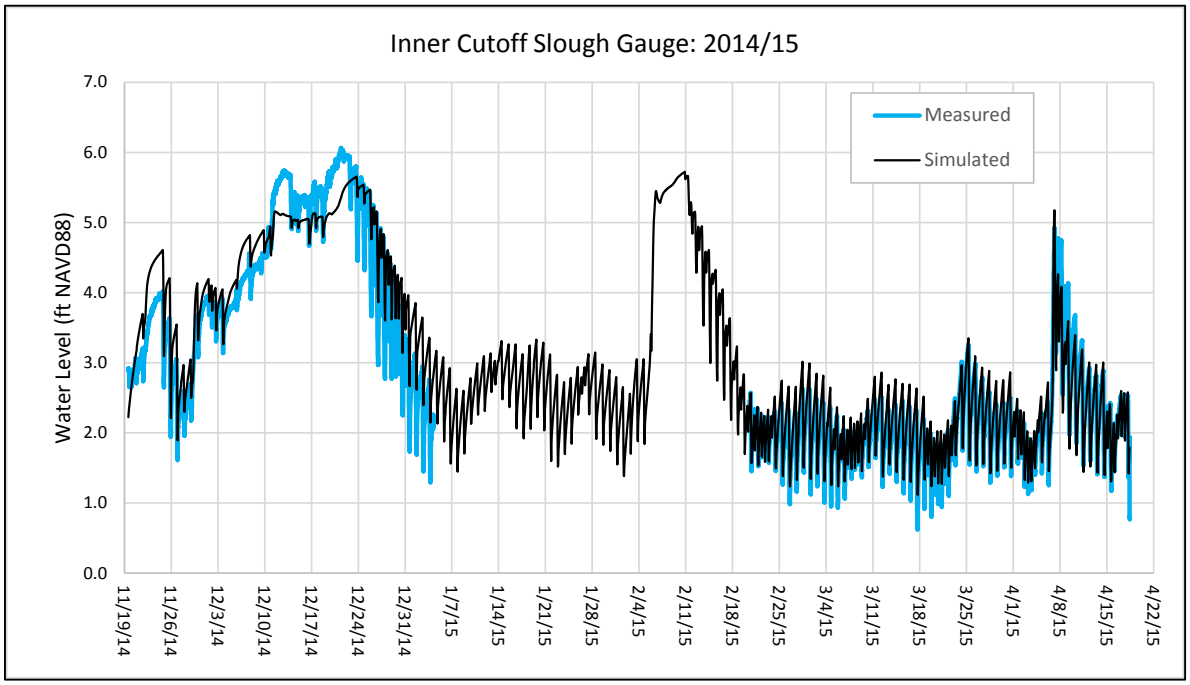


FIGURE 22: Model validation results 11/19/14 – 4/22/15: comparison of simulated versus measured water levels at tide gauge within Cut-Off Slough immediately upstream of existing tide gates.

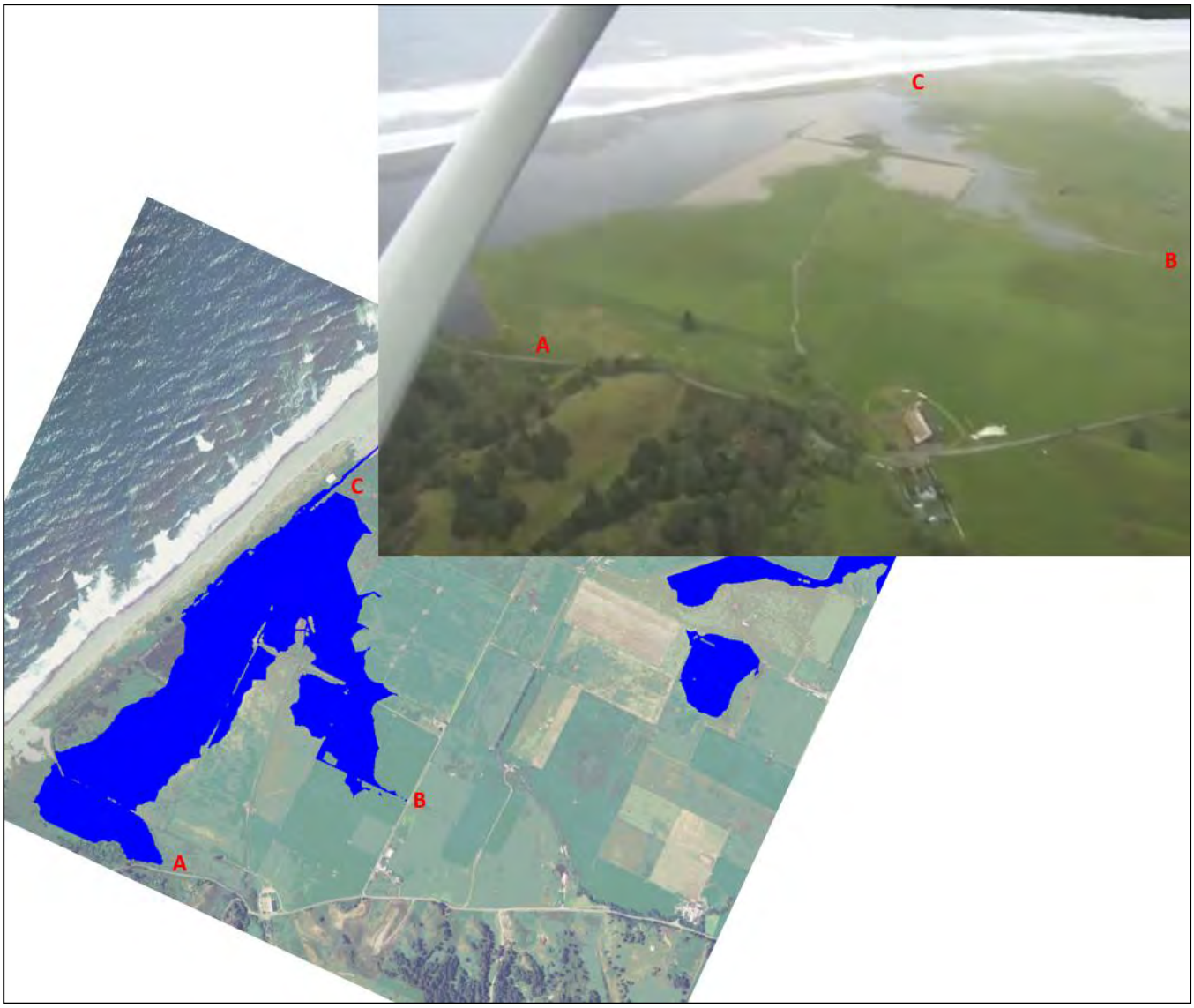


FIGURE 23: Simulated inundation area for April 1, 2012 storm compared to oblique aerial photograph: flooding on Russ properties. Letters indicate corresponding locations between inundation map and aerial photograph.

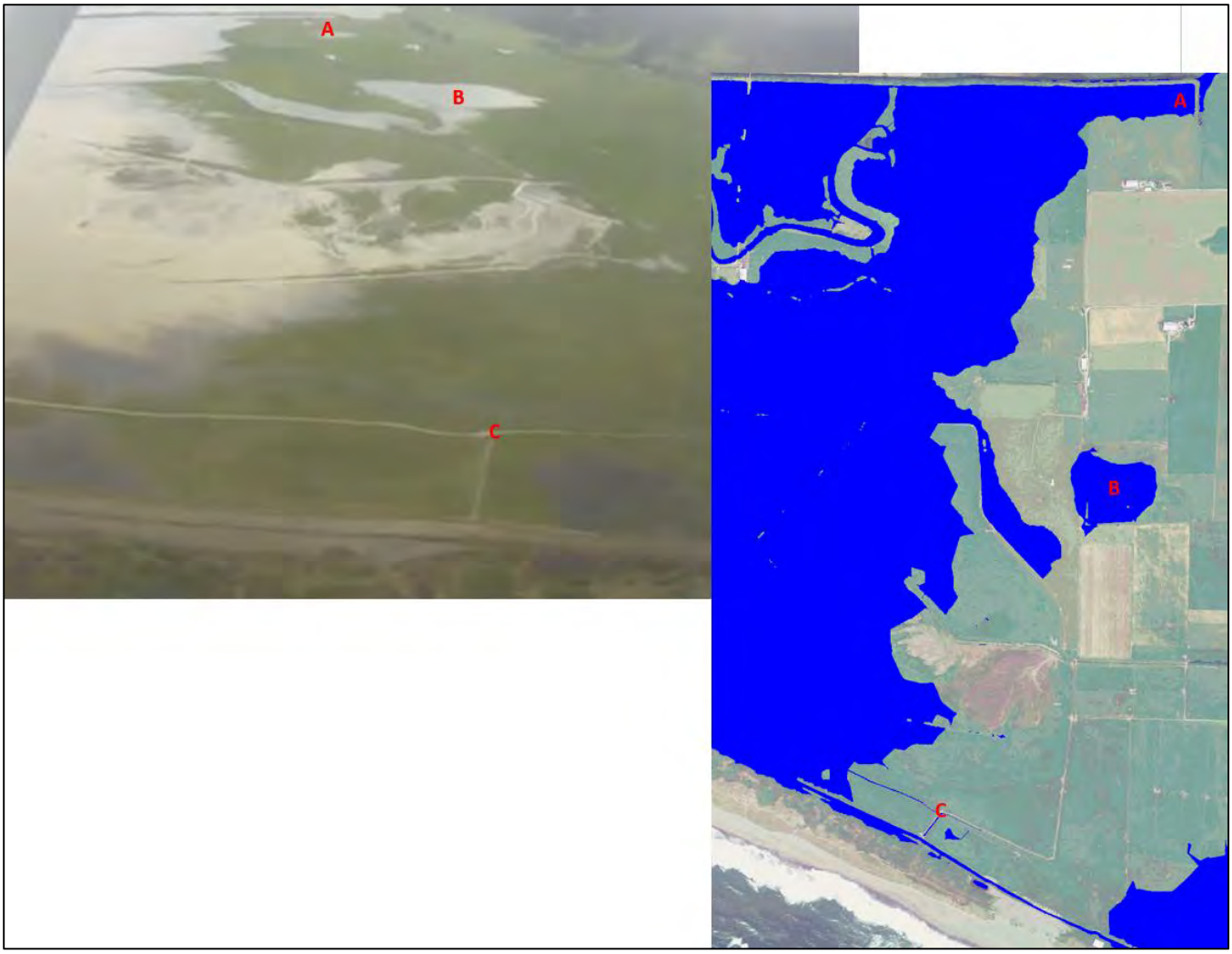


FIGURE 24: Simulated inundation area for April 1, 2012 storm compared to oblique aerial photograph: flooding on TWC parcel. Letters indicate corresponding locations between inundation map and aerial photograph.

FIGURE 25: Simulated inundation area for April 1, 2012 storm compared to oblique aerial photograph: flooding on TWC property (foreground) and O'Rourke Foundation parcels in background. Letters indicate corresponding locations between inundation map and aerial photograph.

FIGURE 26: Locations of measured (4/30/14 – 4/22/15) and simulated water quality results.

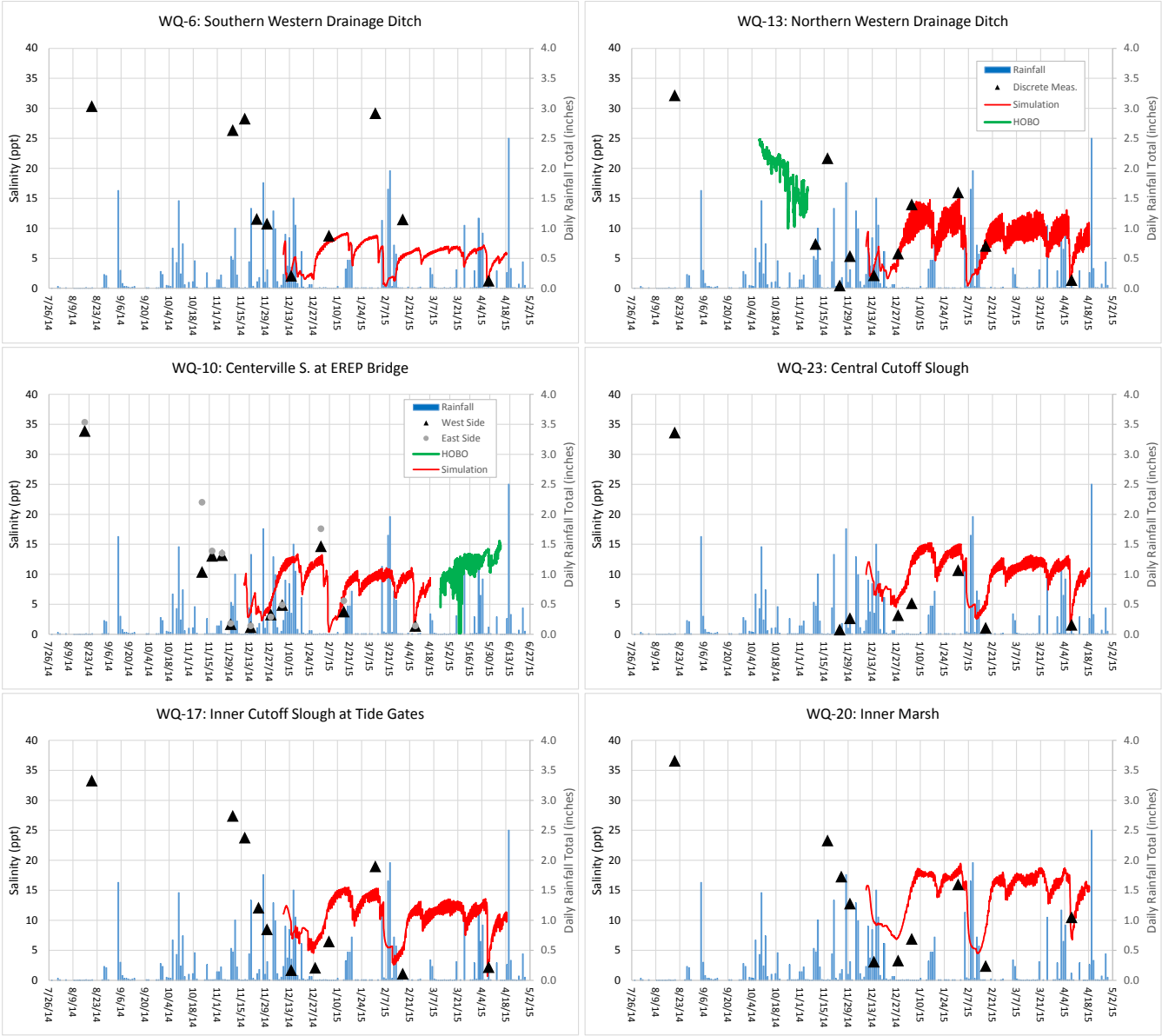


FIGURE 27: Comparison of simulated and measured salinity at selected monitoring locations (see Figure 26) during 11/19/14 – 4/22/15 period.

FIGURE 28: Locations of simulated water level results.

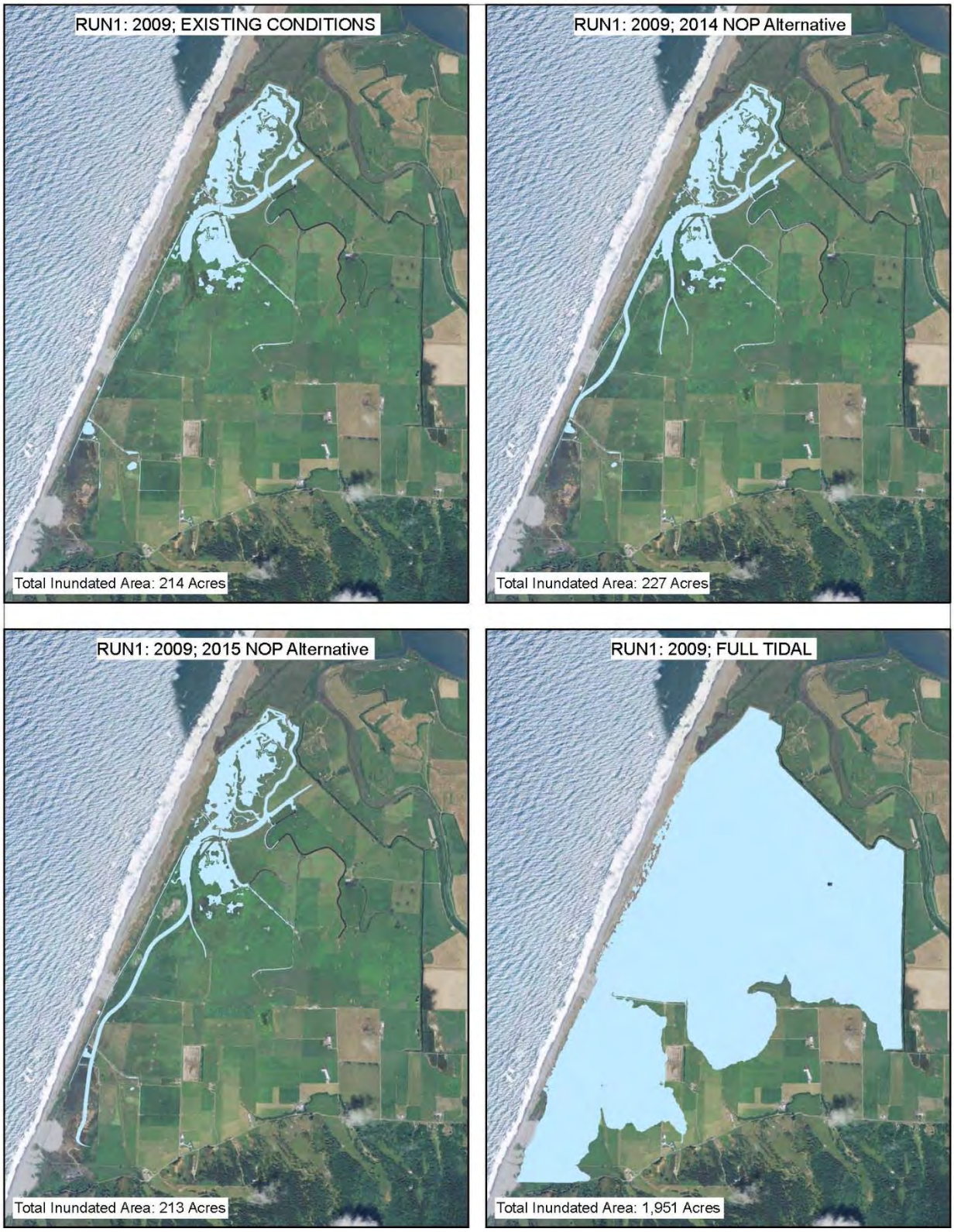


FIGURE 29a: Maximum inundation areas for each project alternative during 2009 spring storm.

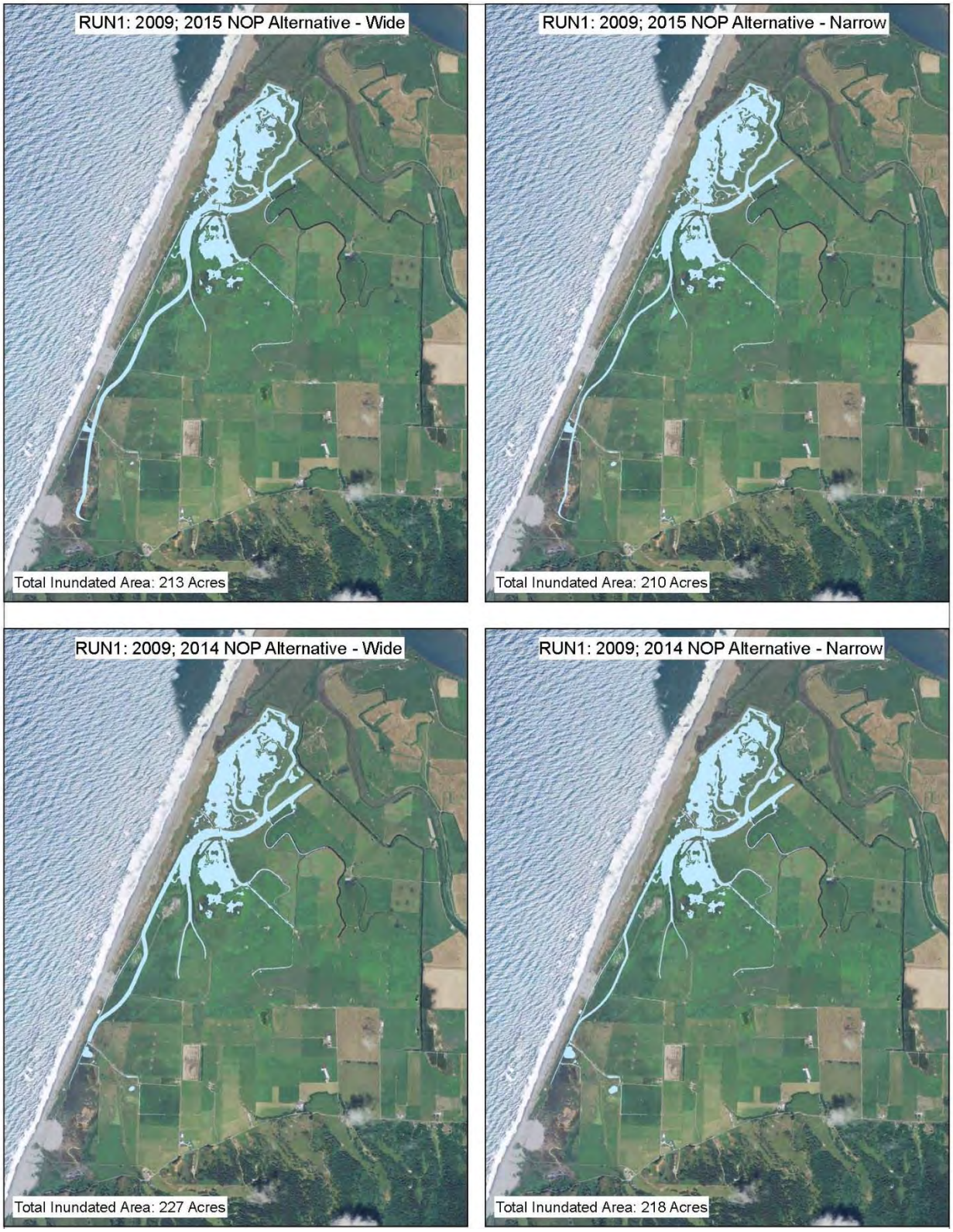


FIGURE 29b: Comparison of inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2009 spring storm.

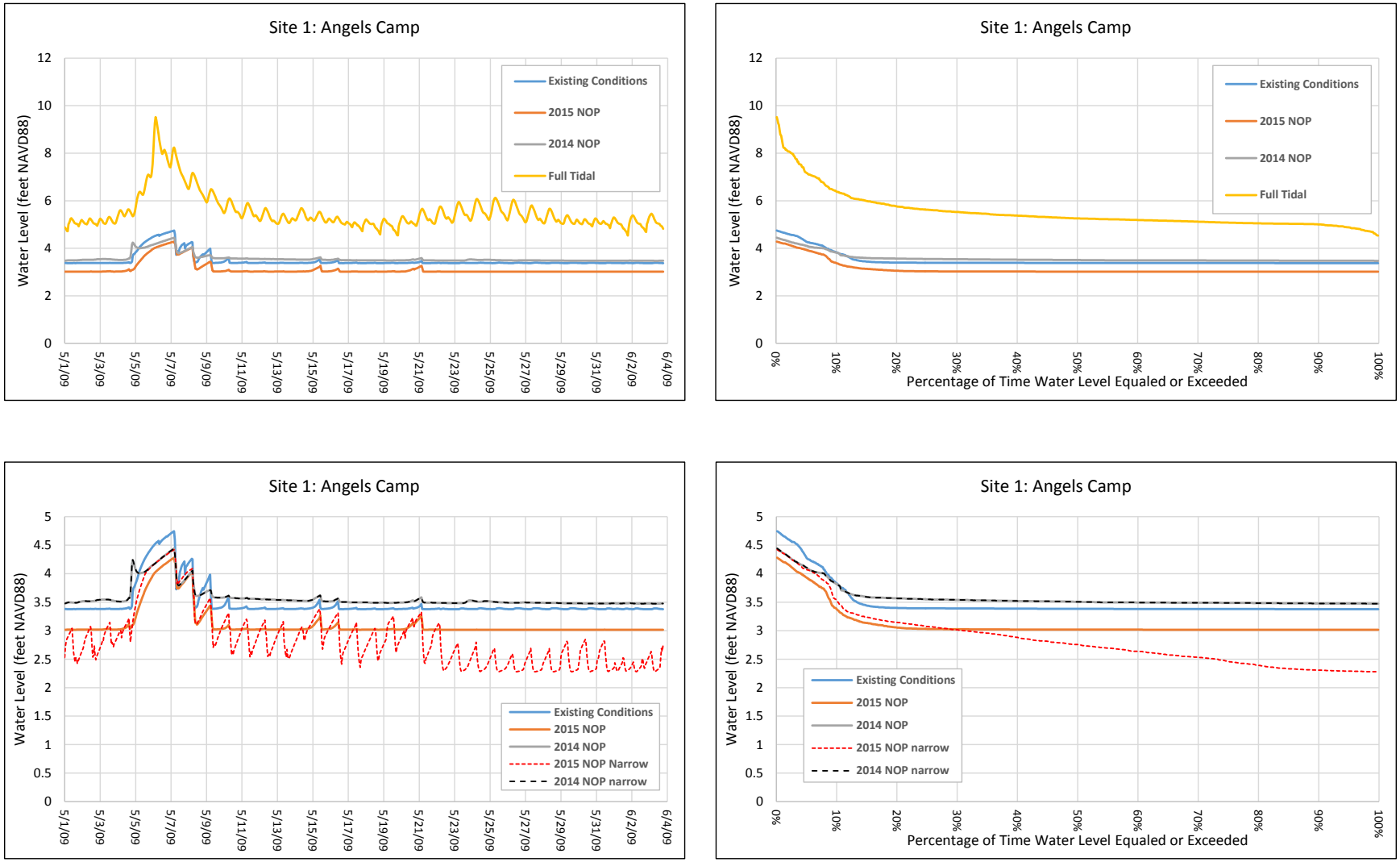


FIGURE 30a: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

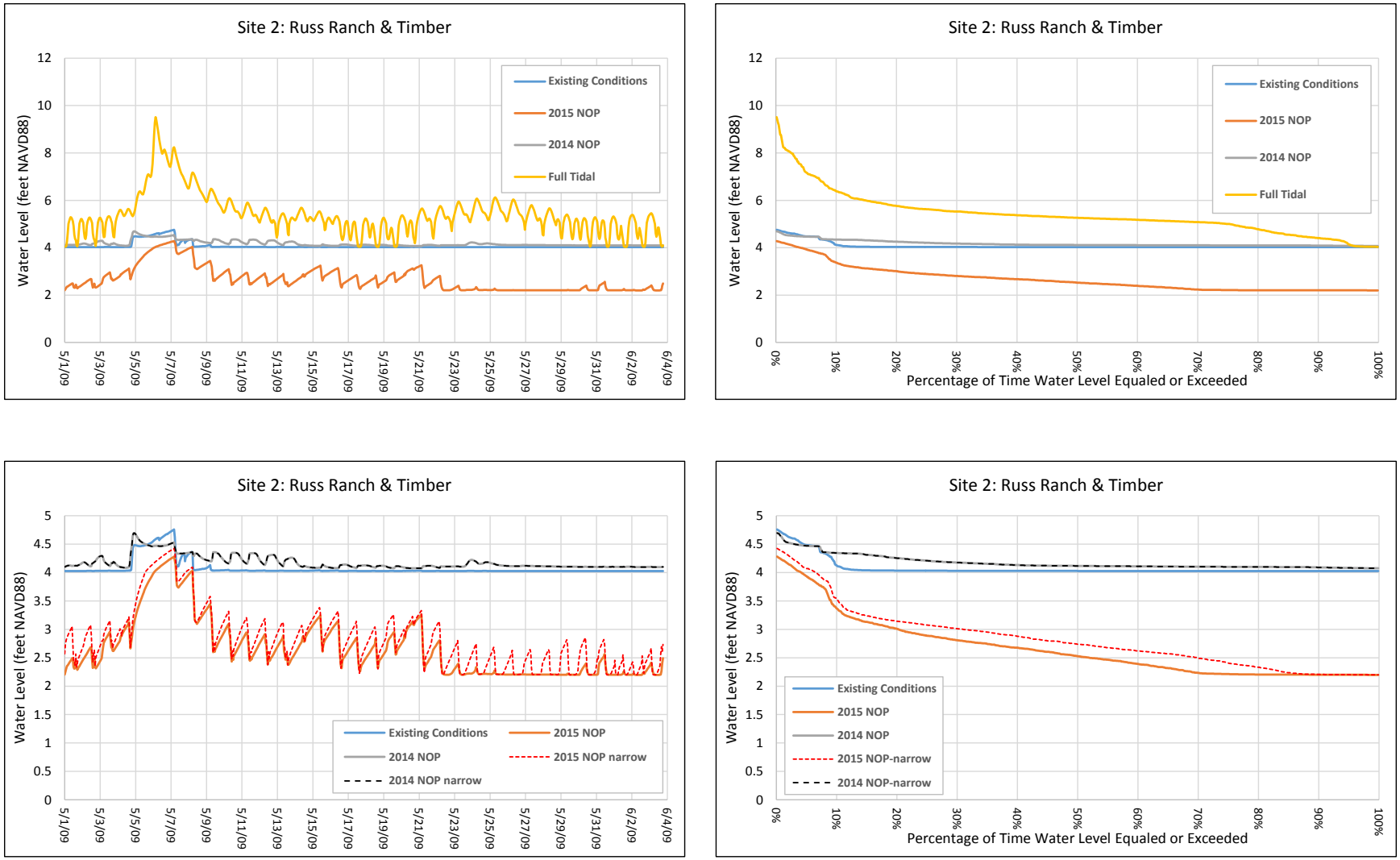


FIGURE 30b: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

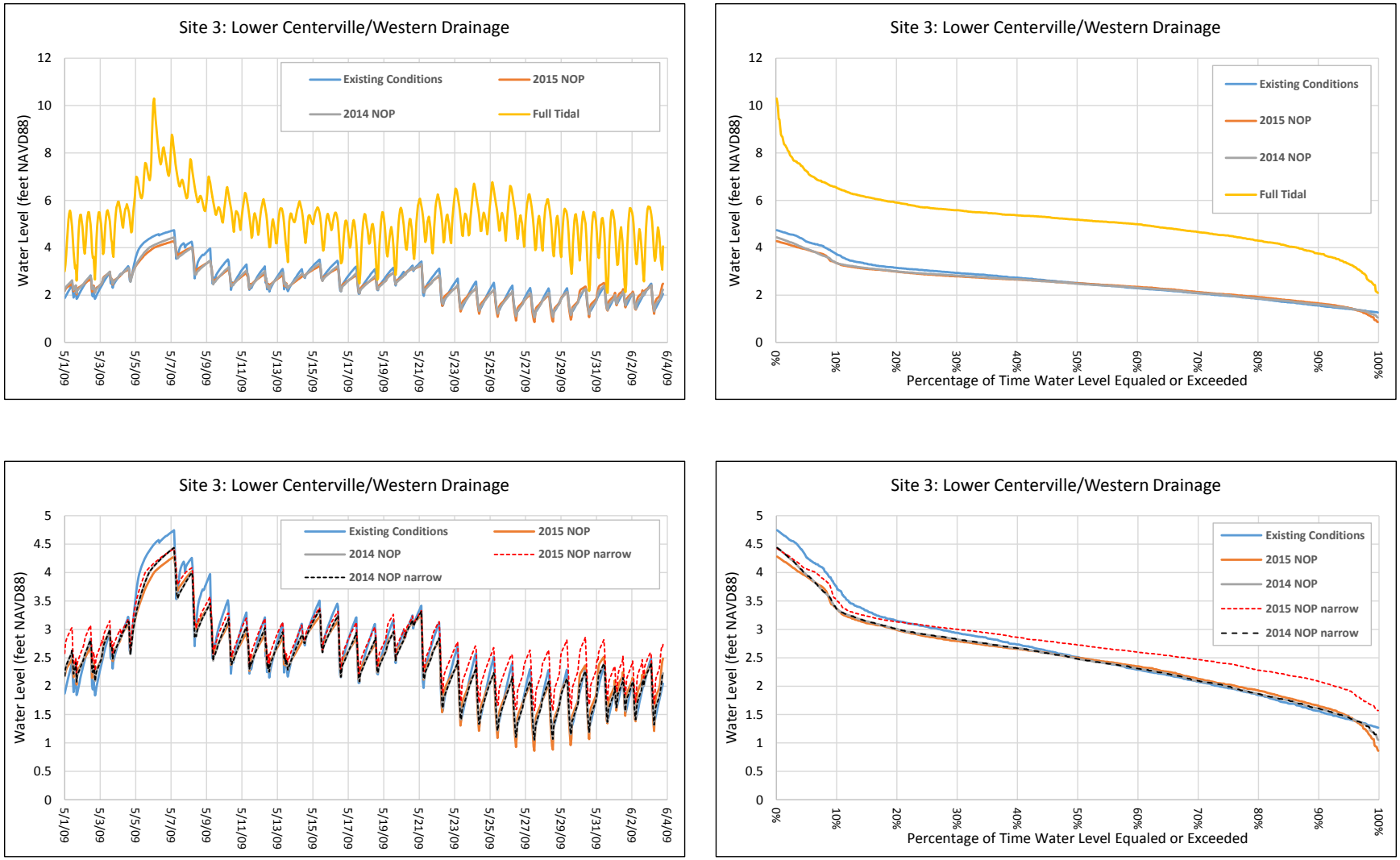


FIGURE 30c: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

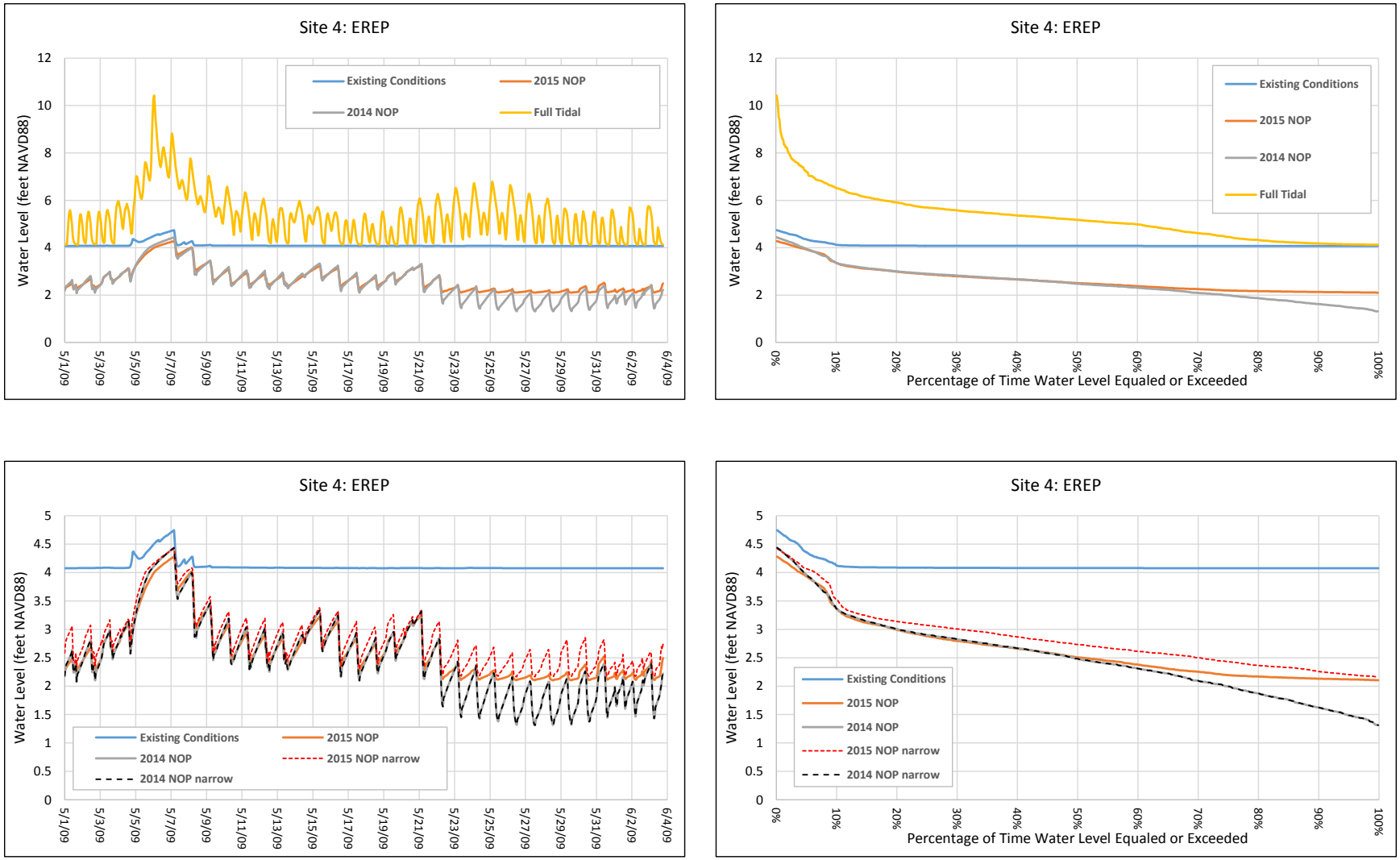


FIGURE 30d: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

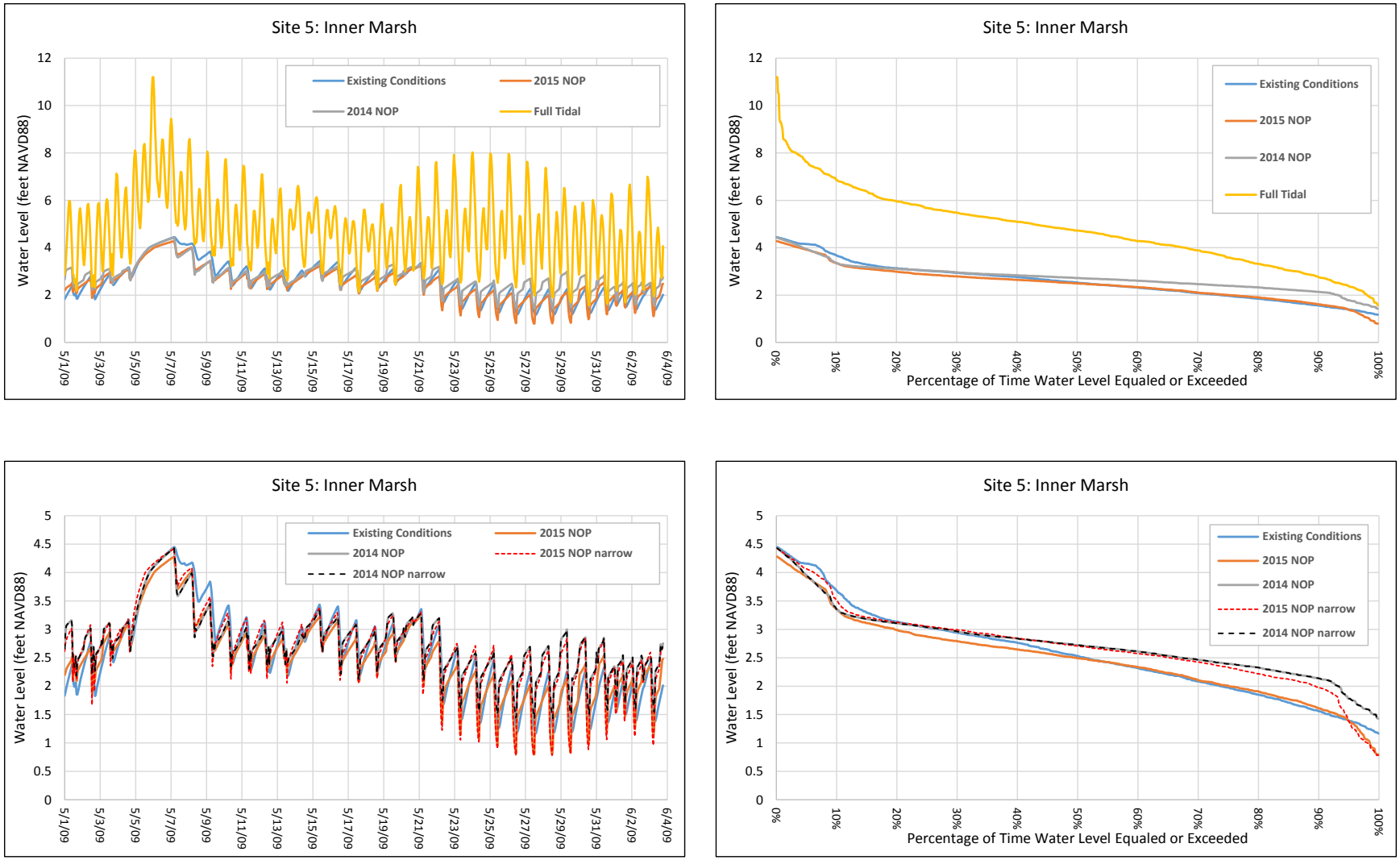


FIGURE 30e: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

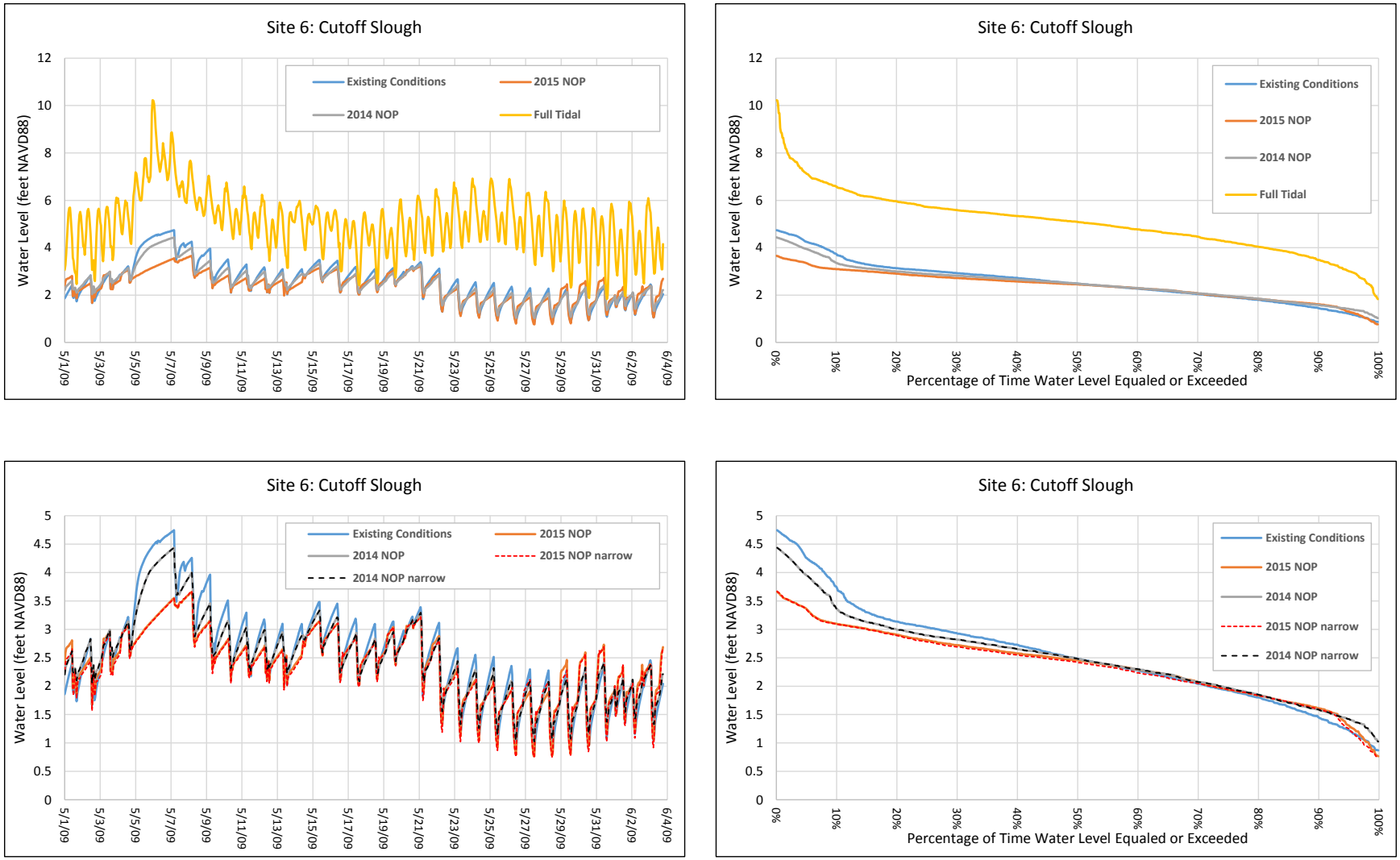


FIGURE 30f: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

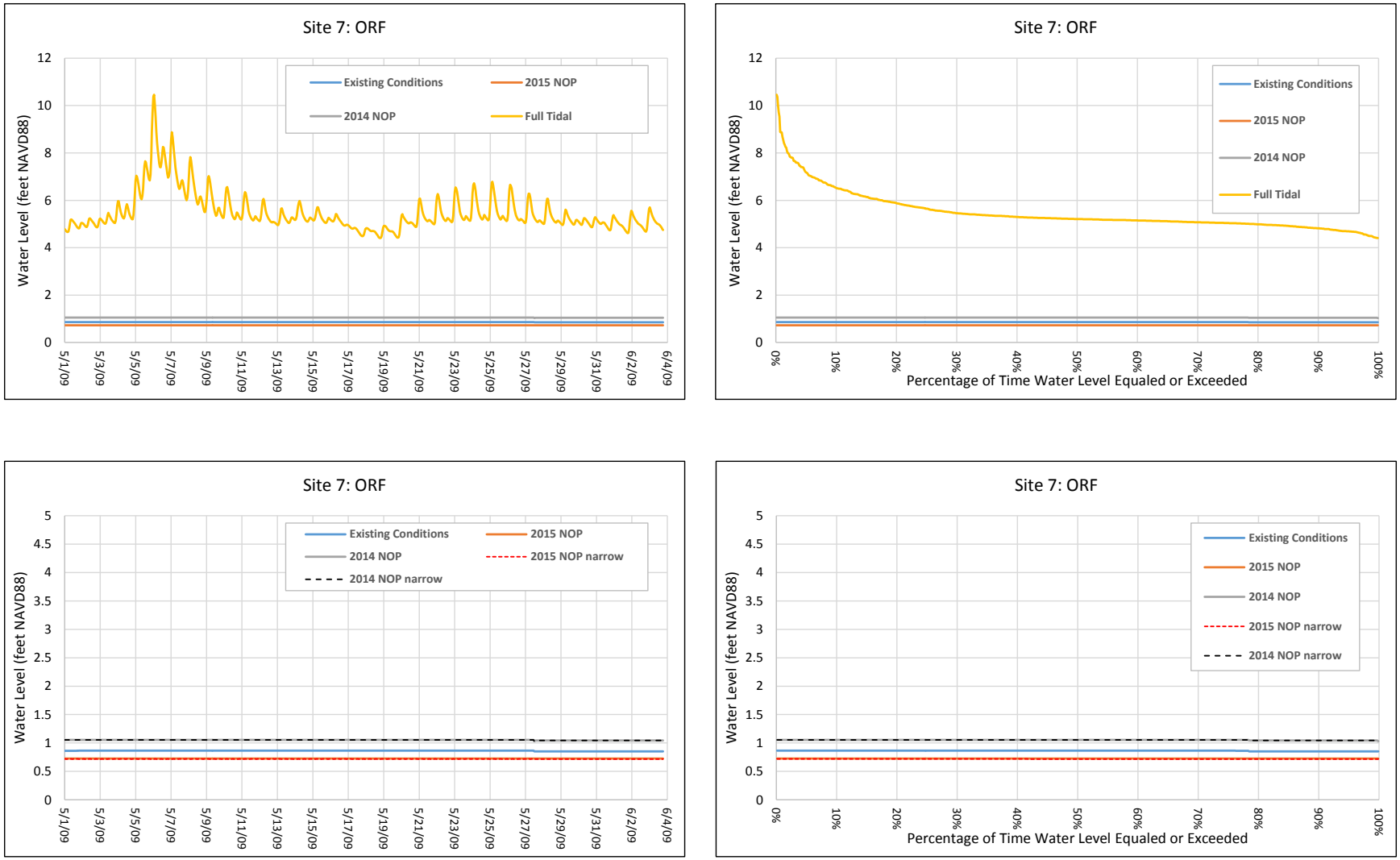


FIGURE 30g: Simulated water levels for the 2009 spring storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

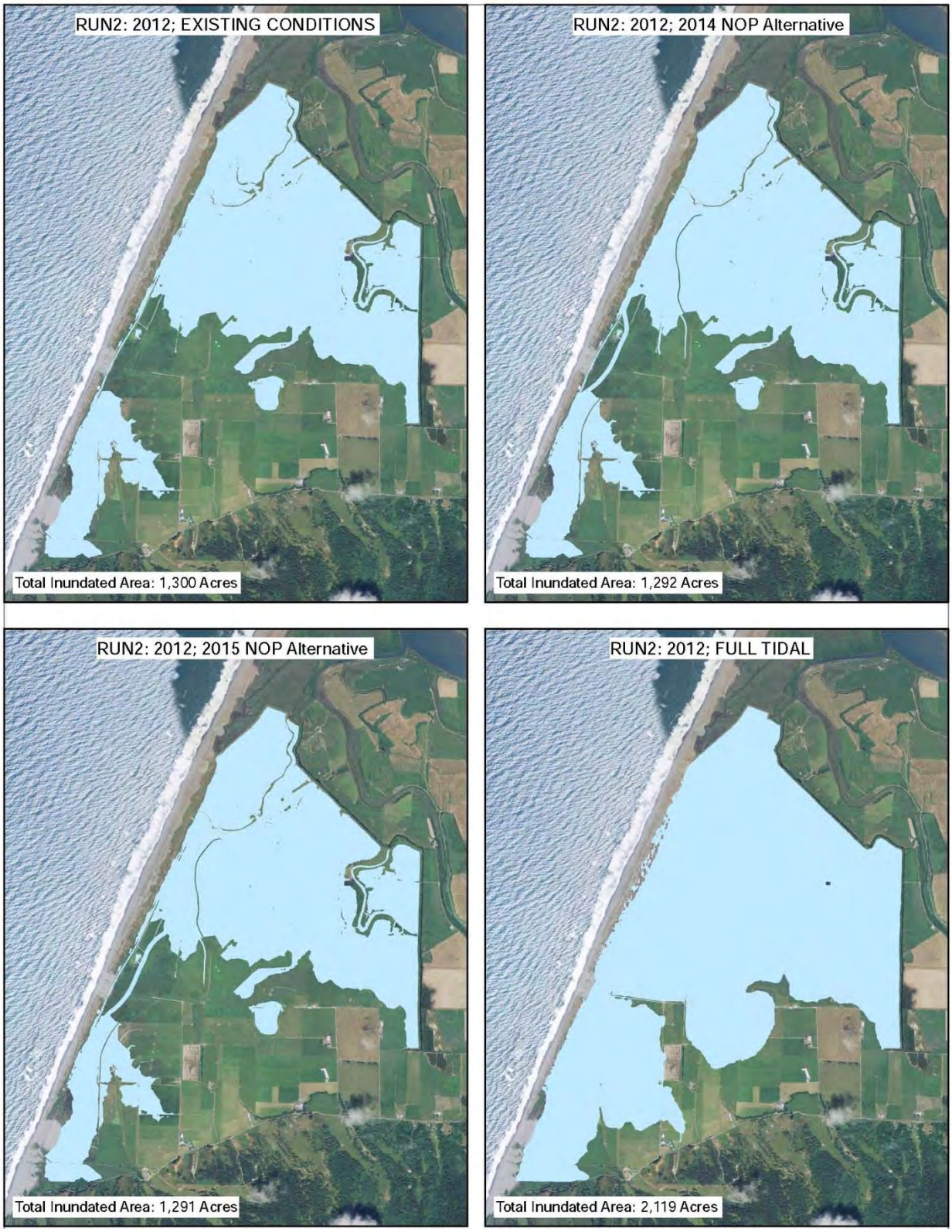


FIGURE 31a: Maximum inundation areas for each project alternative during 2012 winter storm.

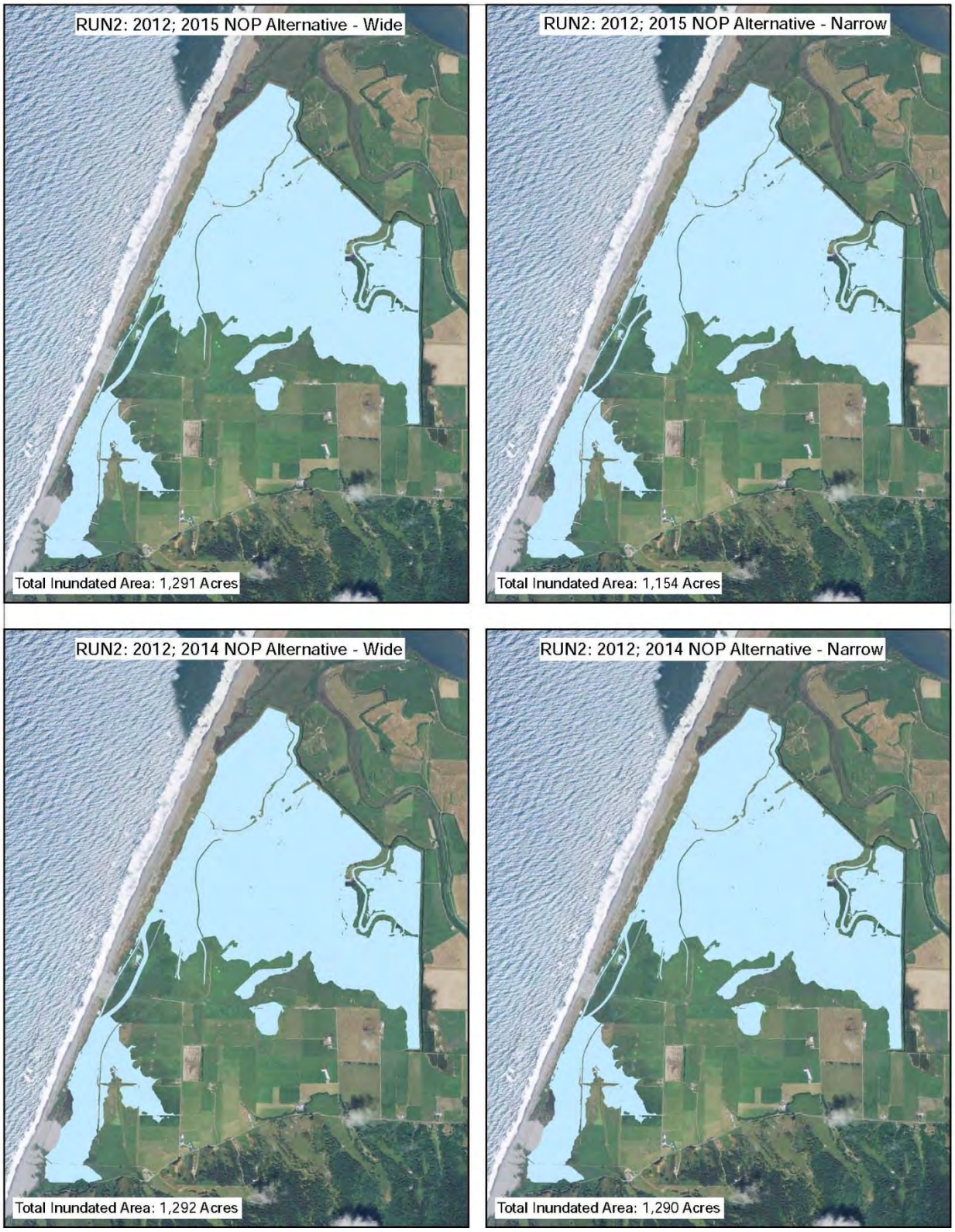


FIGURE 31b: Comparison of maximum inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2012 winter storm.

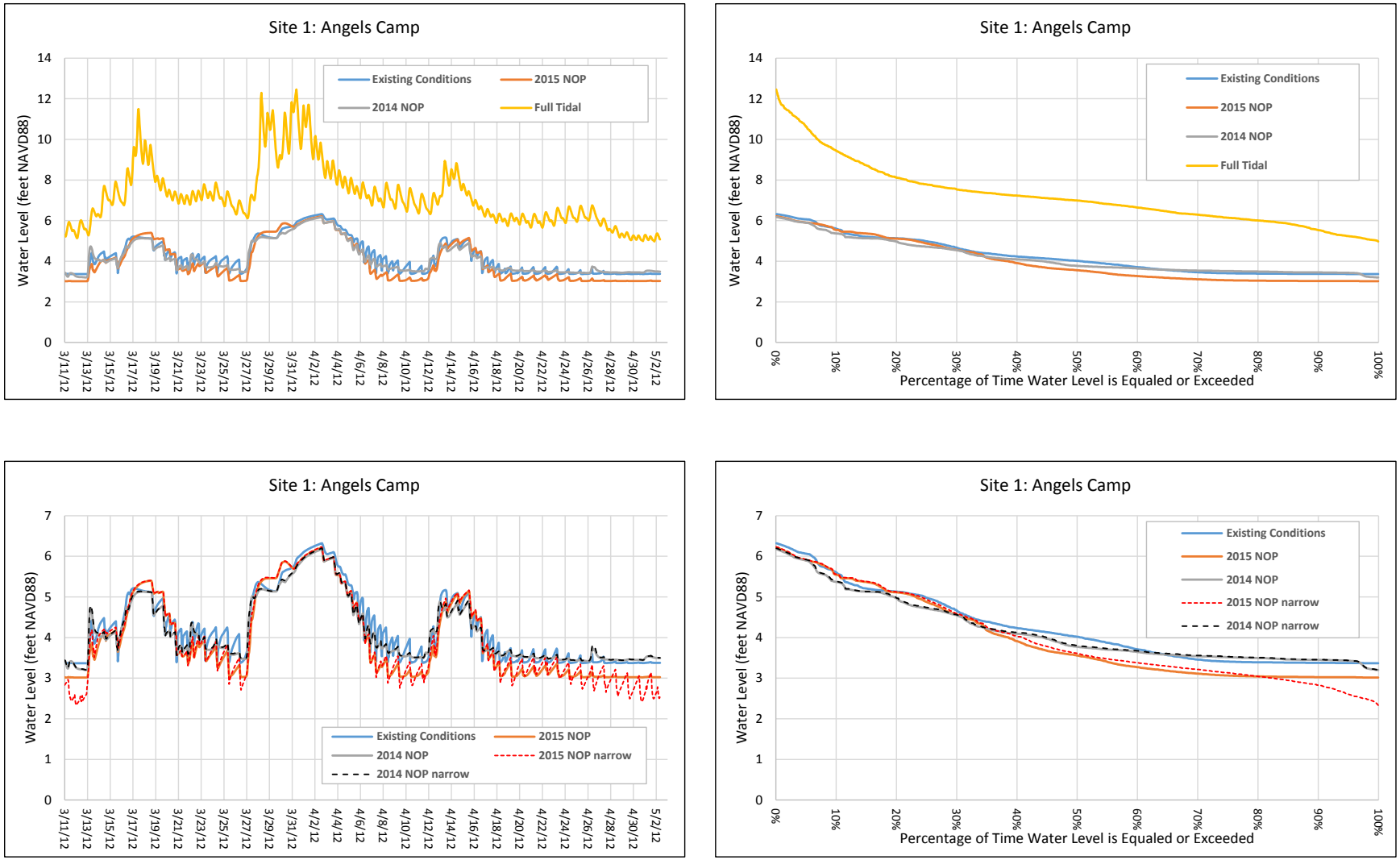


FIGURE 32a: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

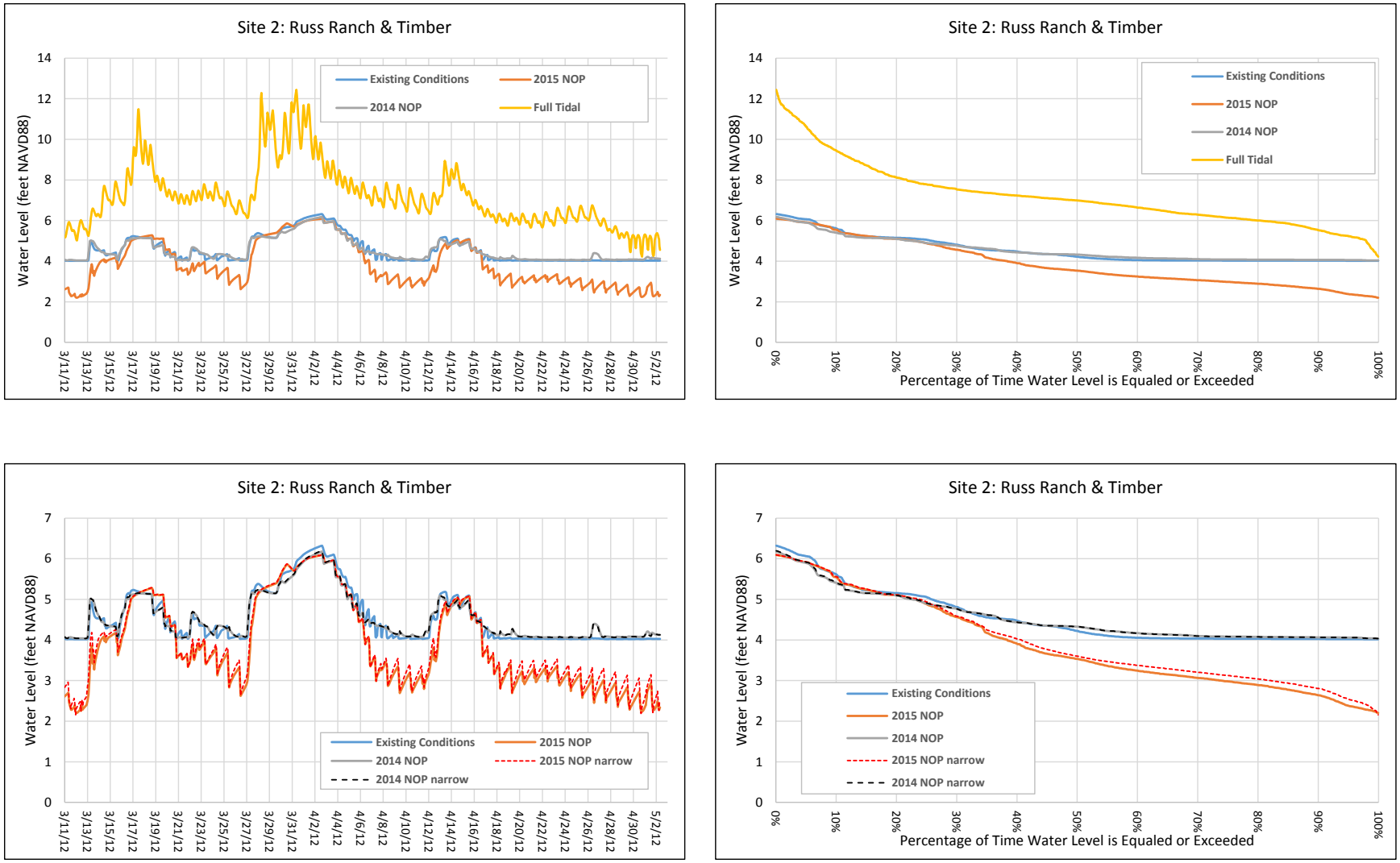


FIGURE 32b: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

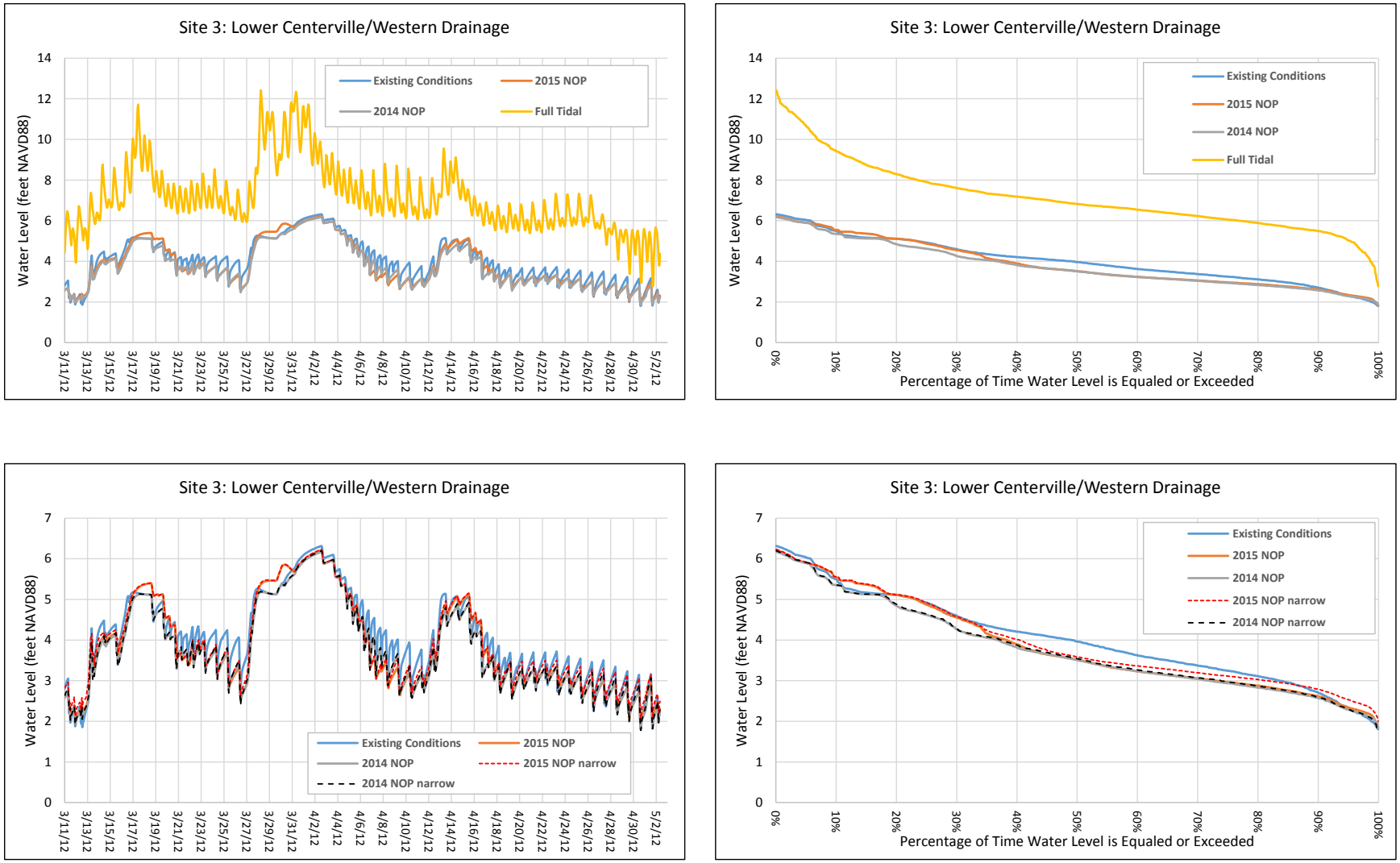


FIGURE 32c: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

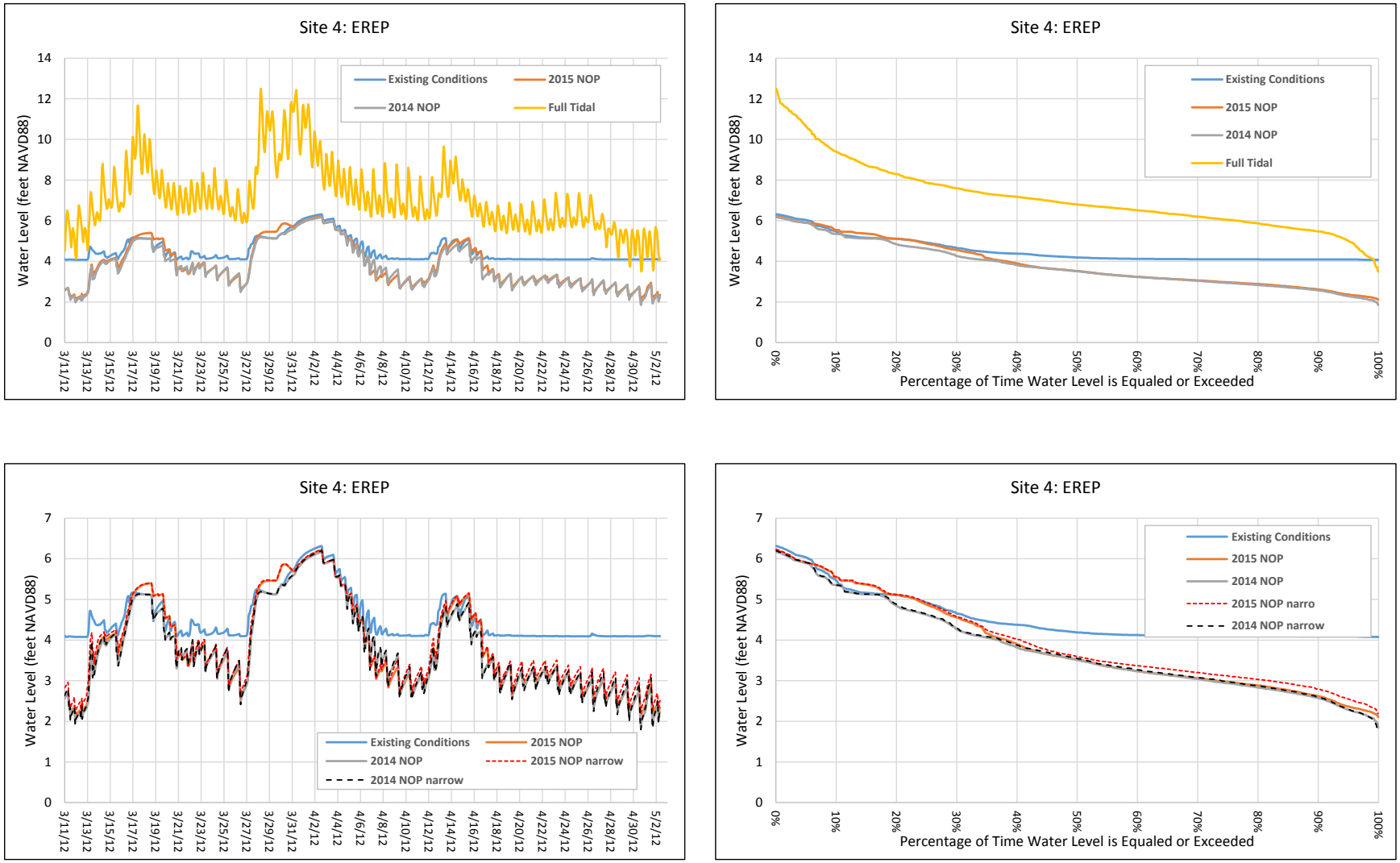


FIGURE 32d: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

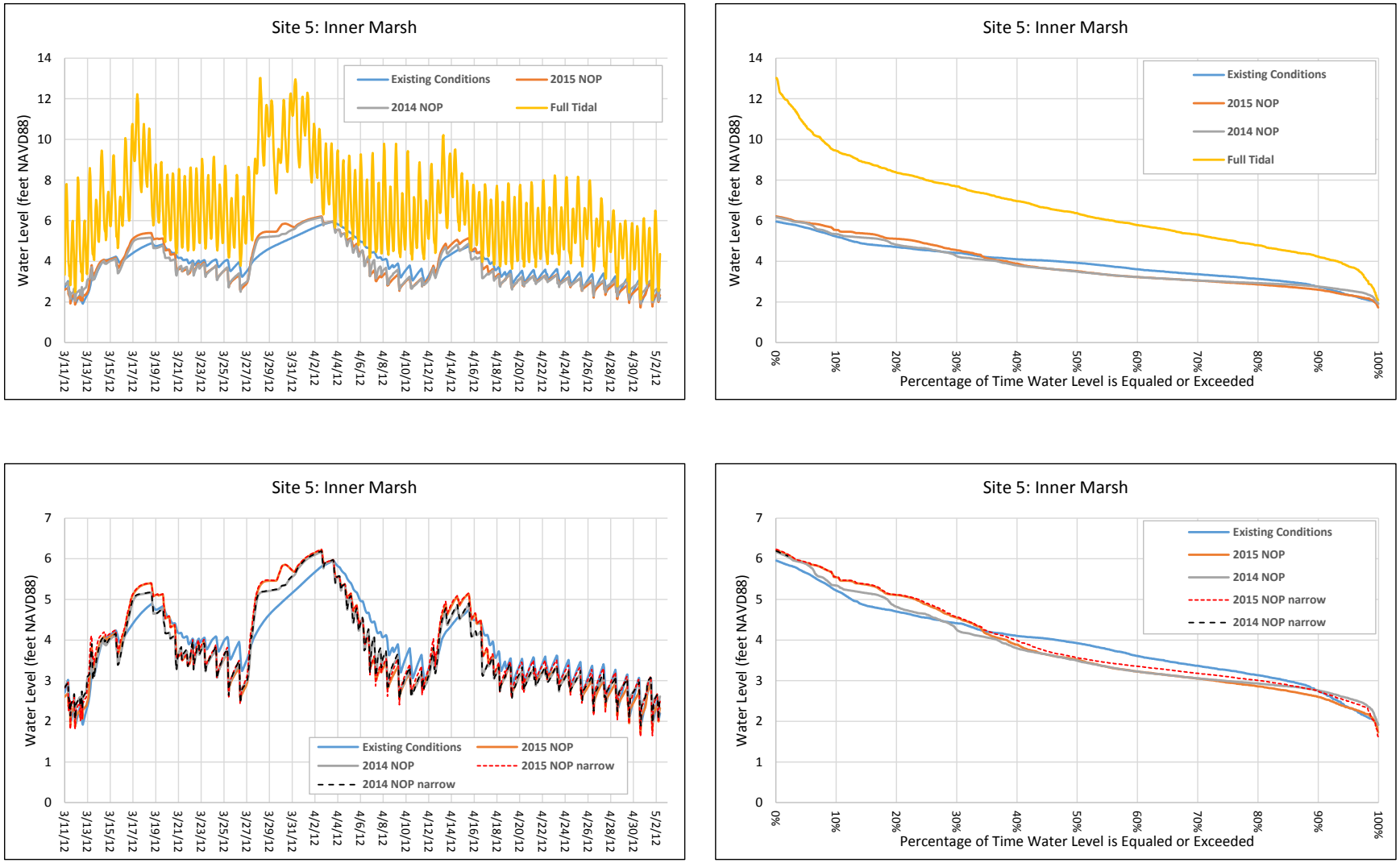


FIGURE 32e: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

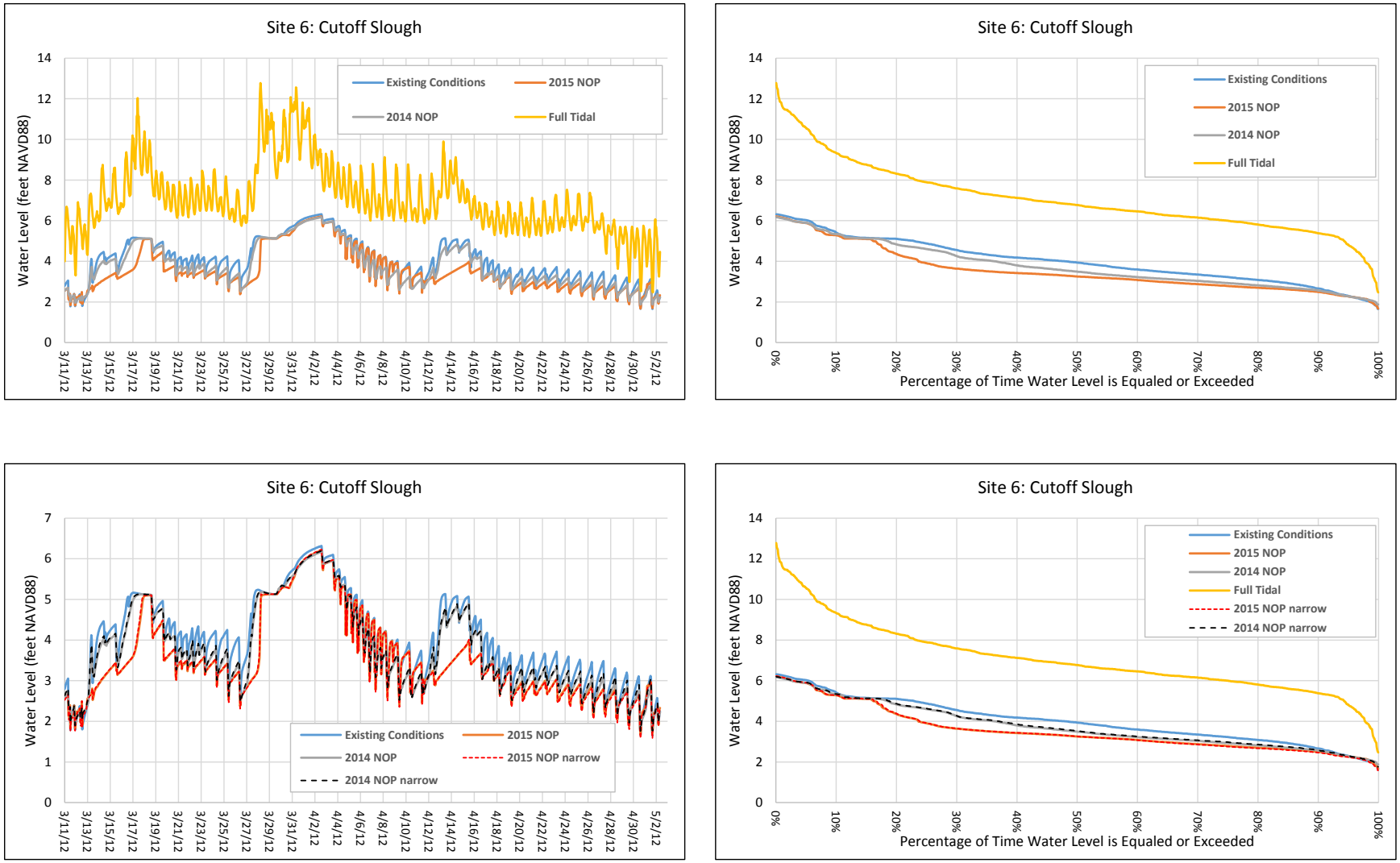


FIGURE 32f: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

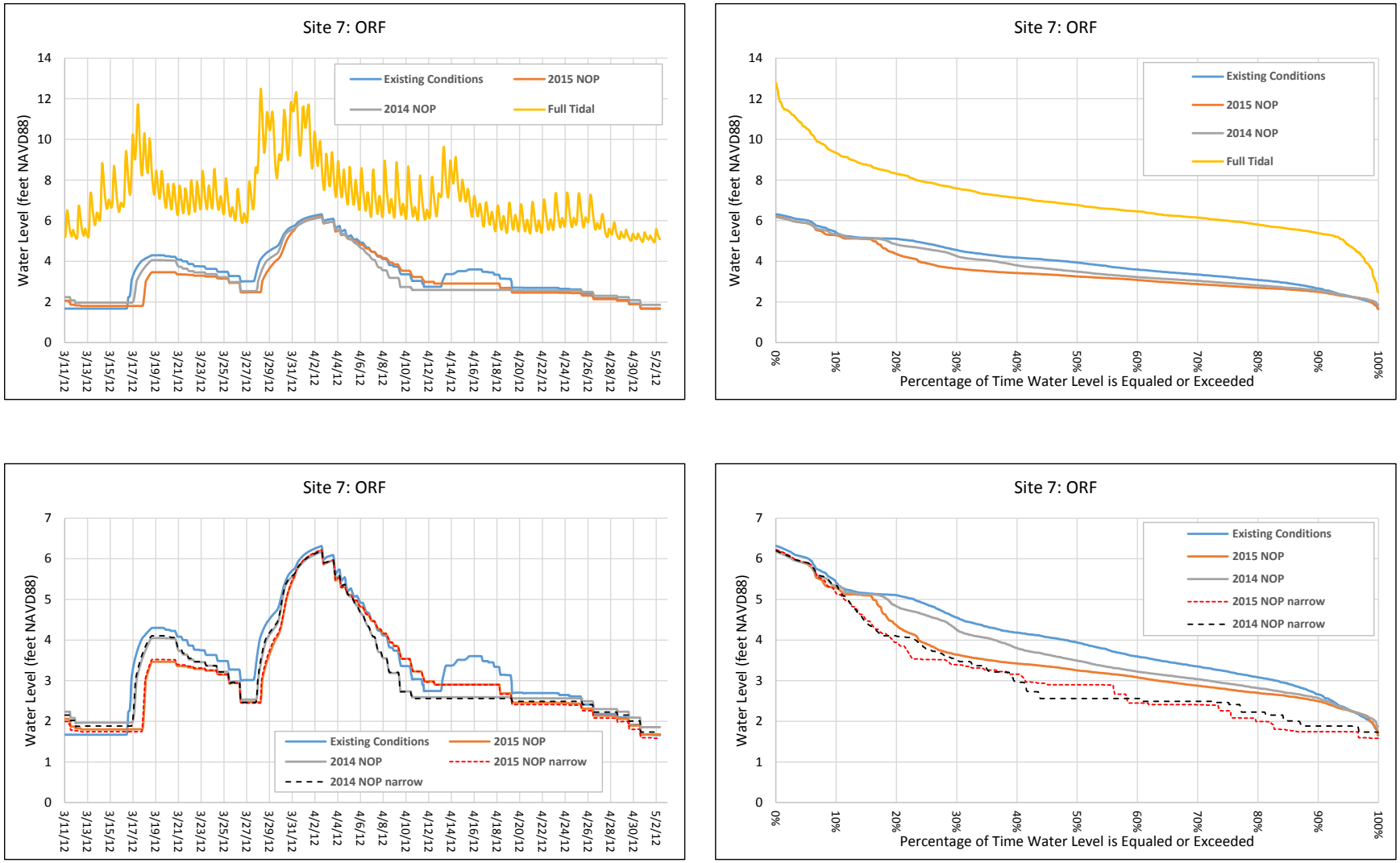


FIGURE 32g: Simulated water levels for the 2012 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

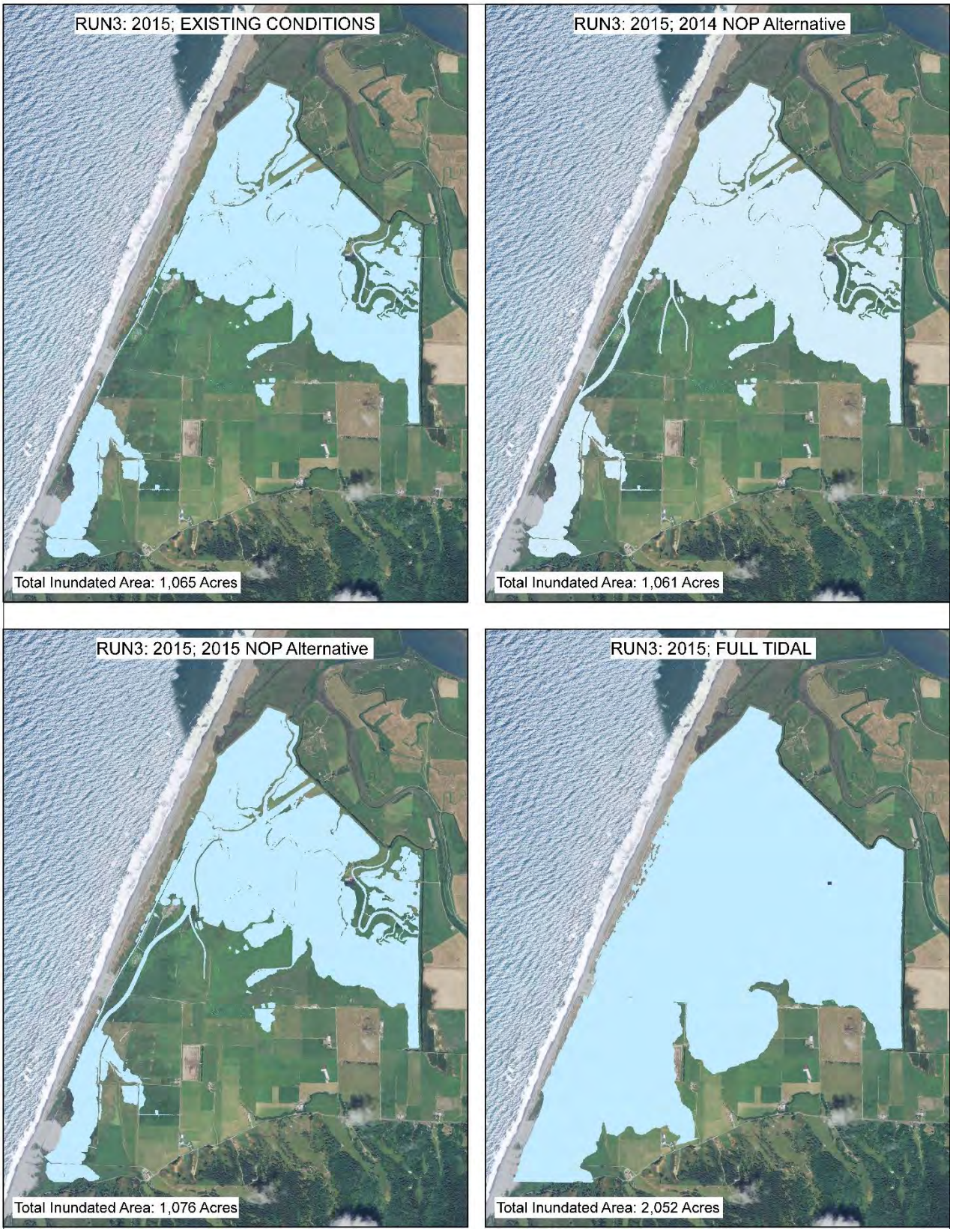


FIGURE 33a: Maximum inundation areas for each project alternative during 2014/15 winter storm.

FIGURE 33b: Comparison of maximum inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2014/15 winter storm.

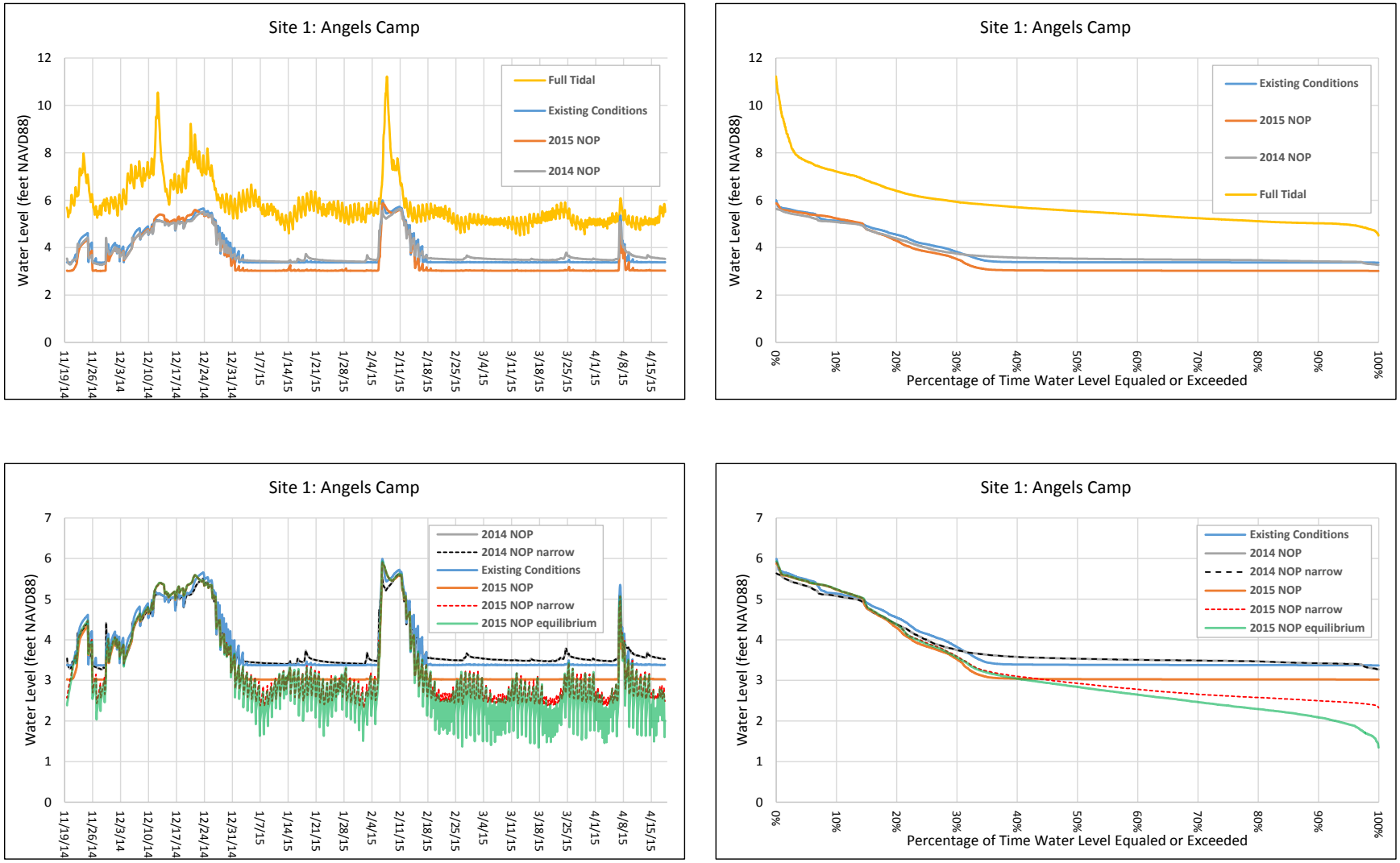


FIGURE 34a: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

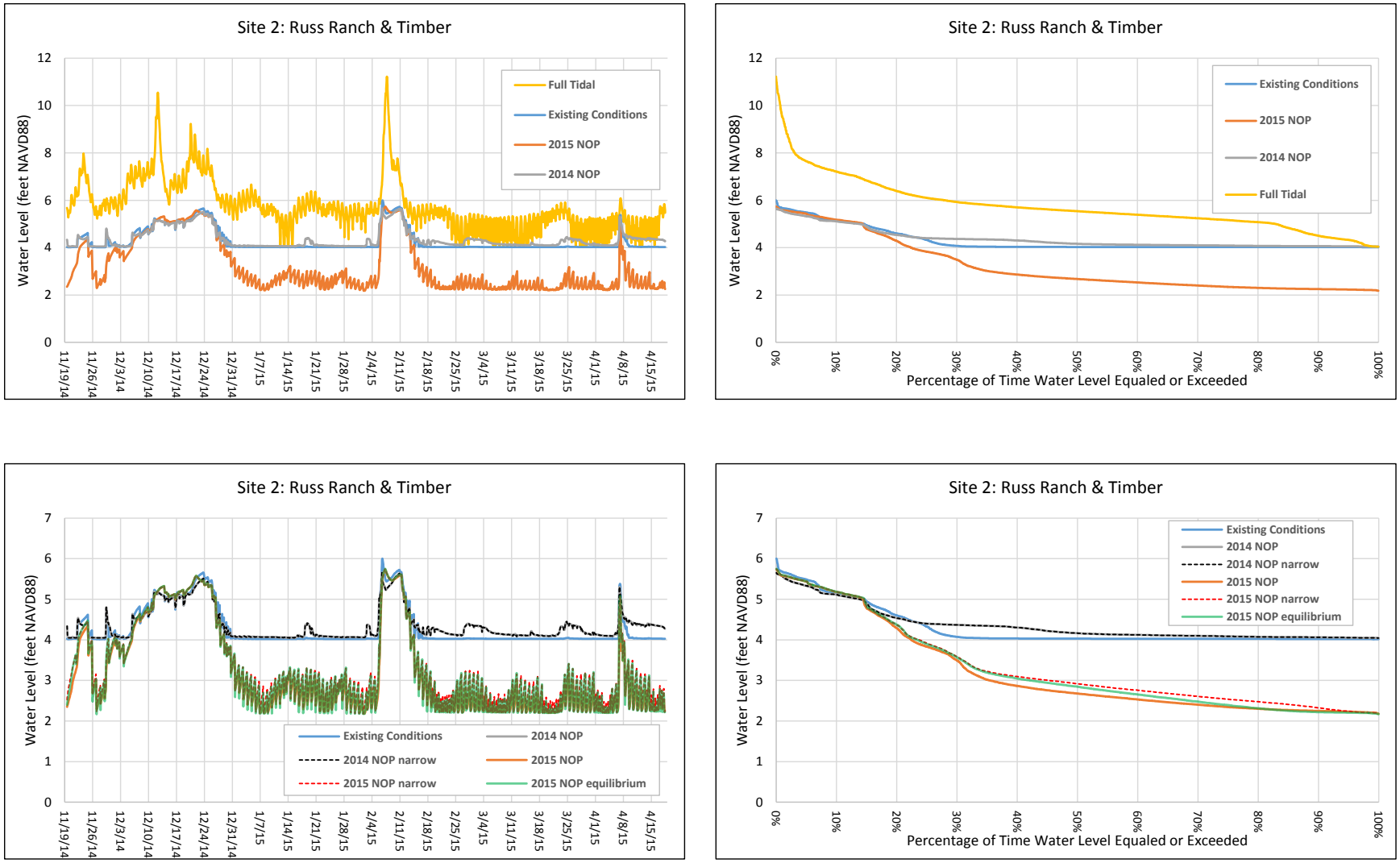


FIGURE 34b: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

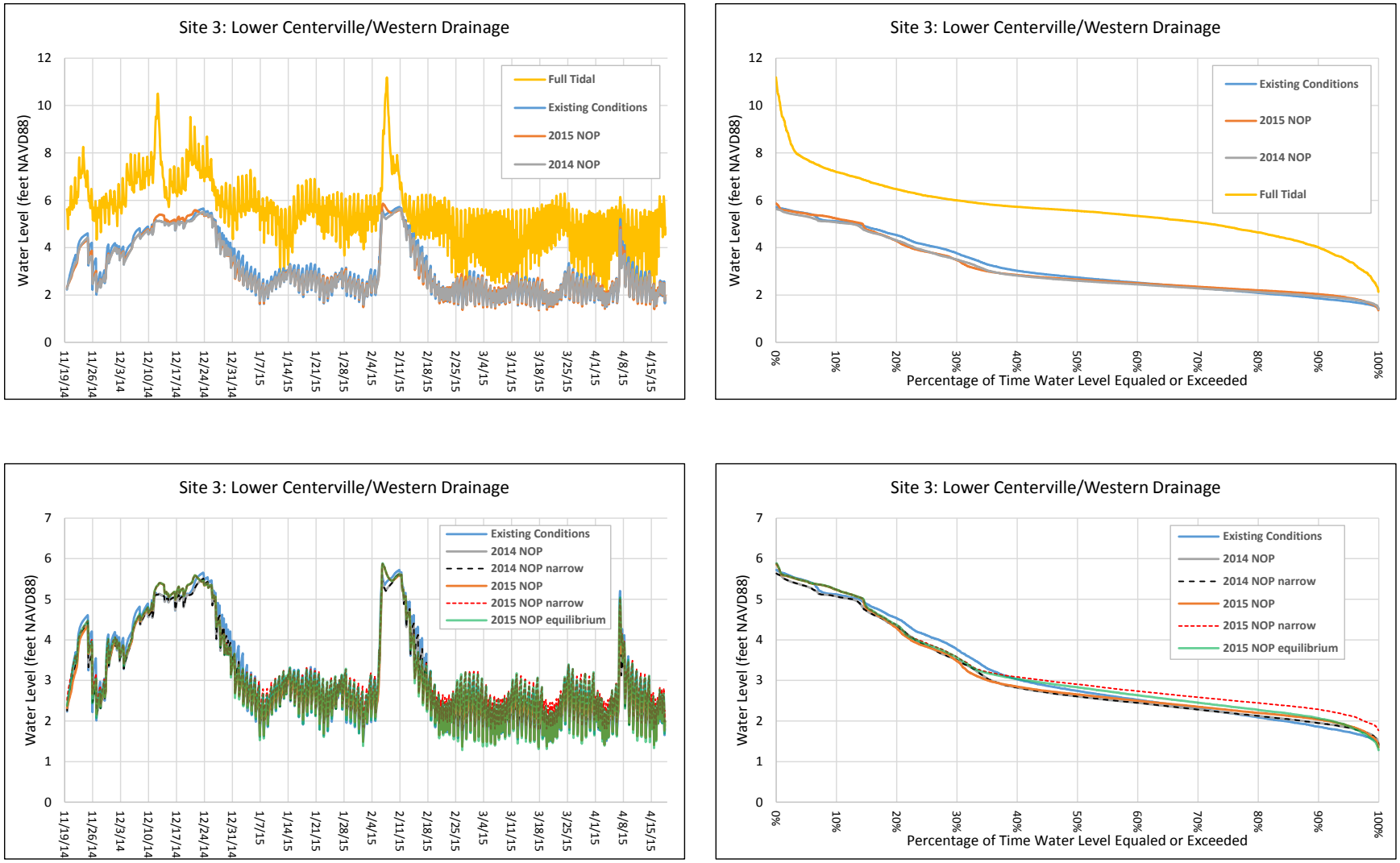


FIGURE 34c: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

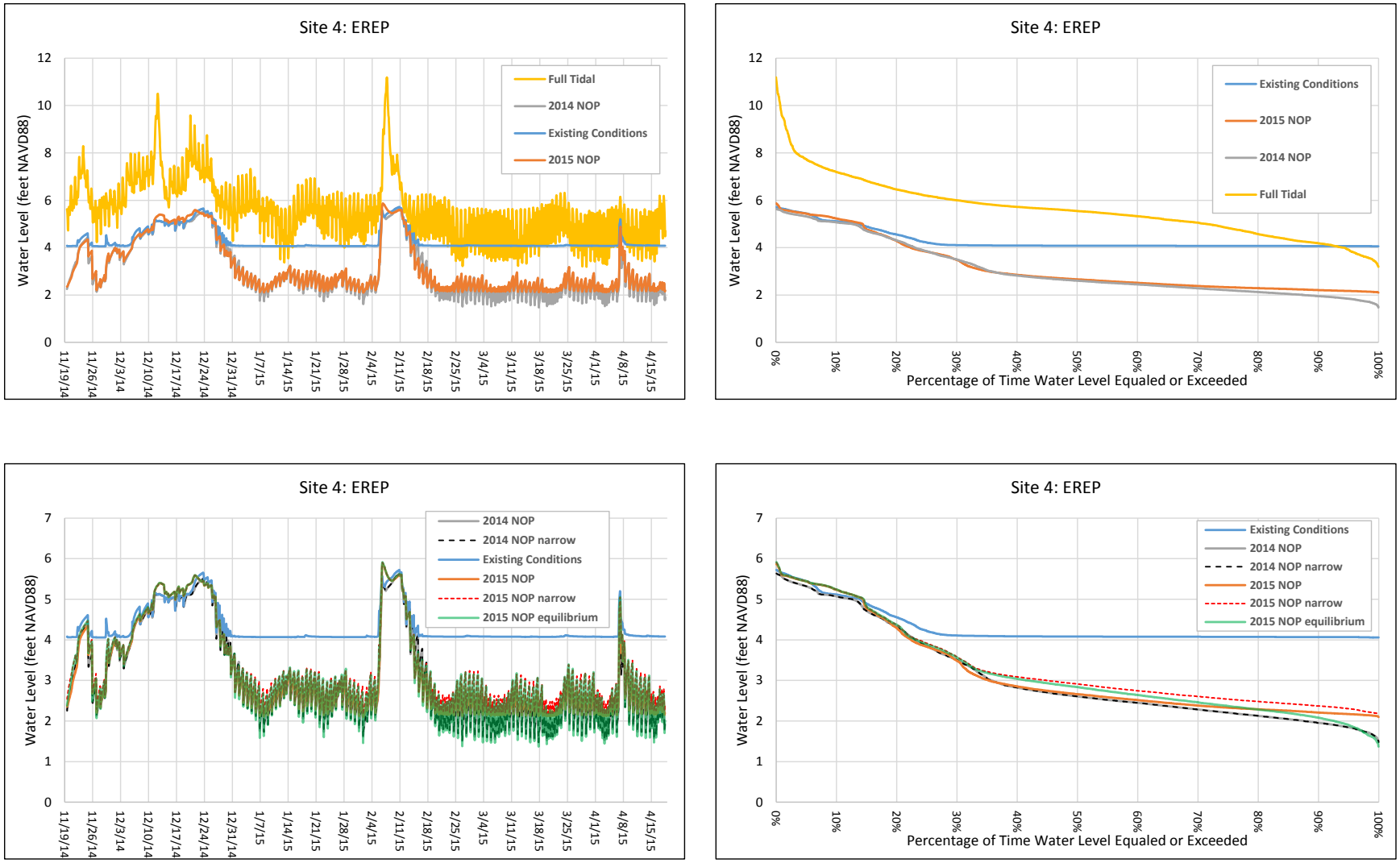


FIGURE 34d: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

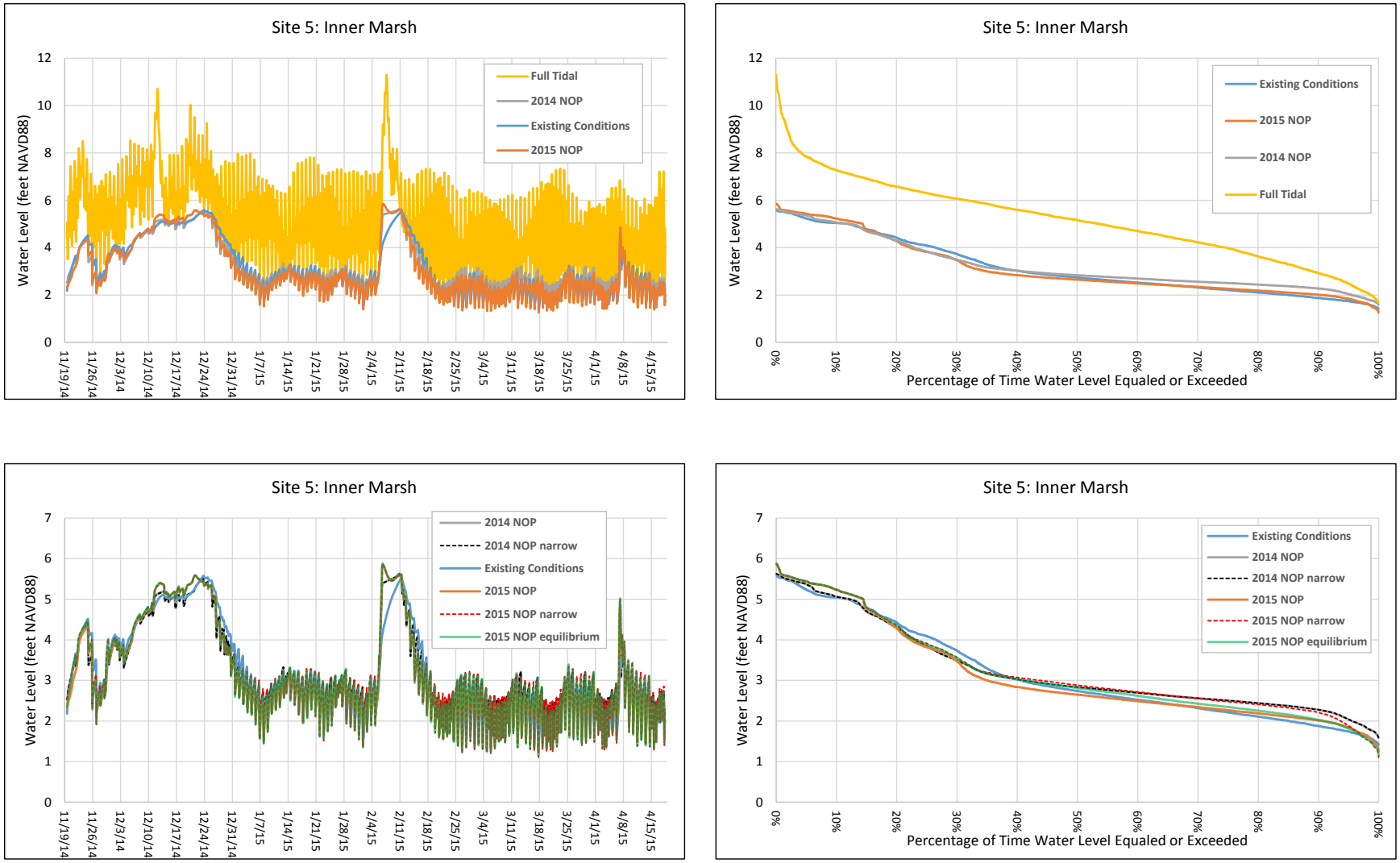


FIGURE 34e: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

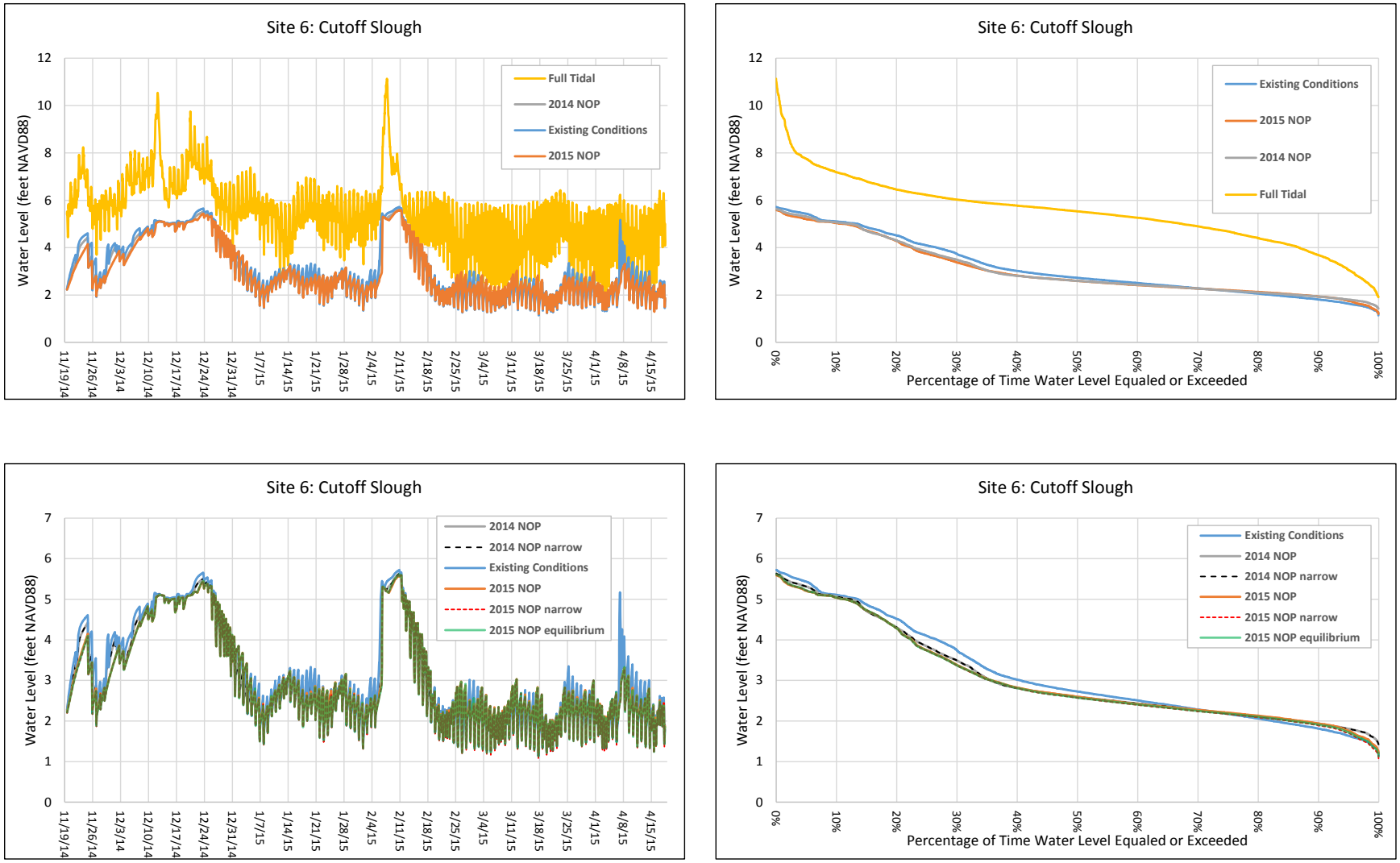


FIGURE 34f: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

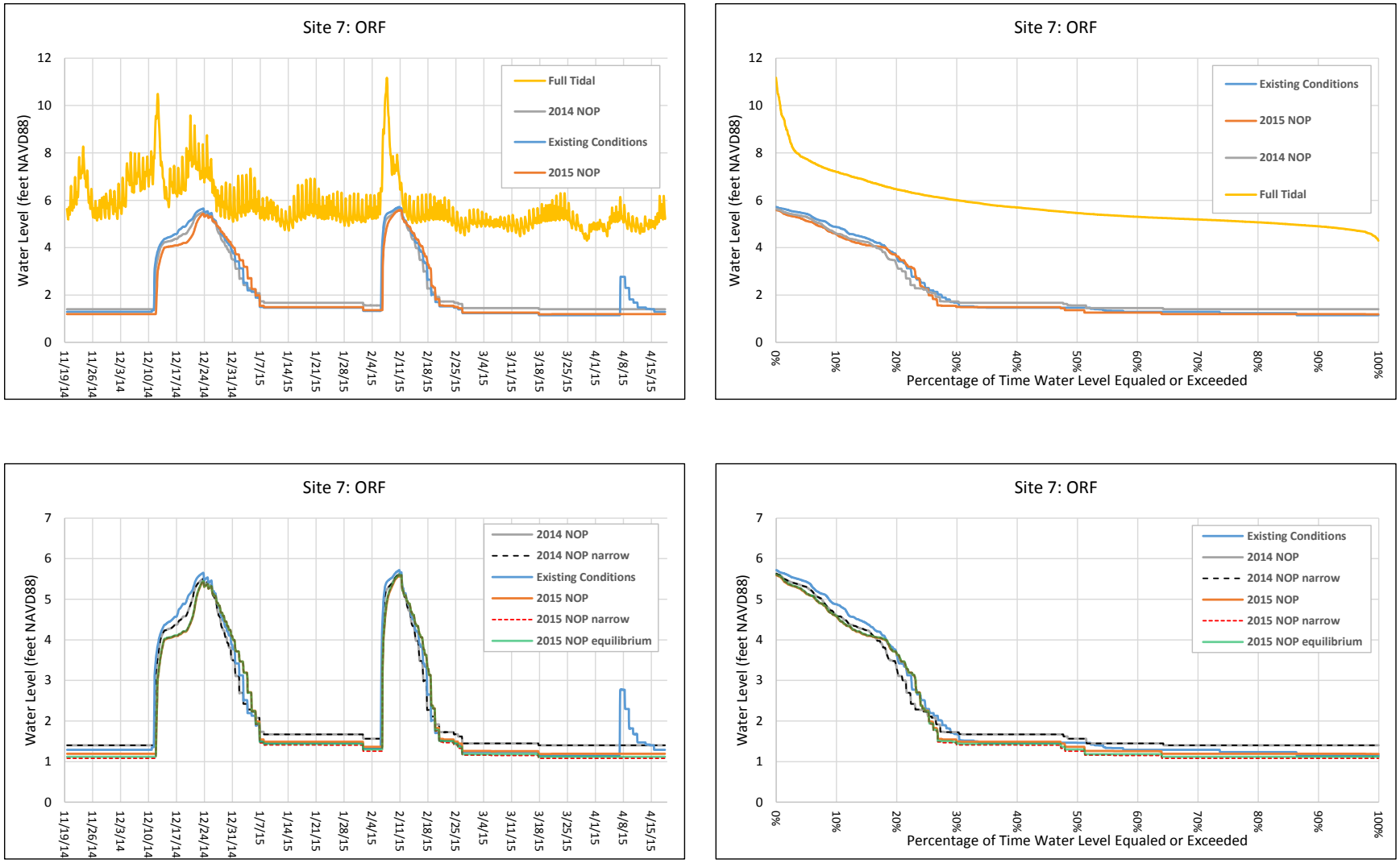


FIGURE 34g: Simulated water levels for the 2014/15 winter storm. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

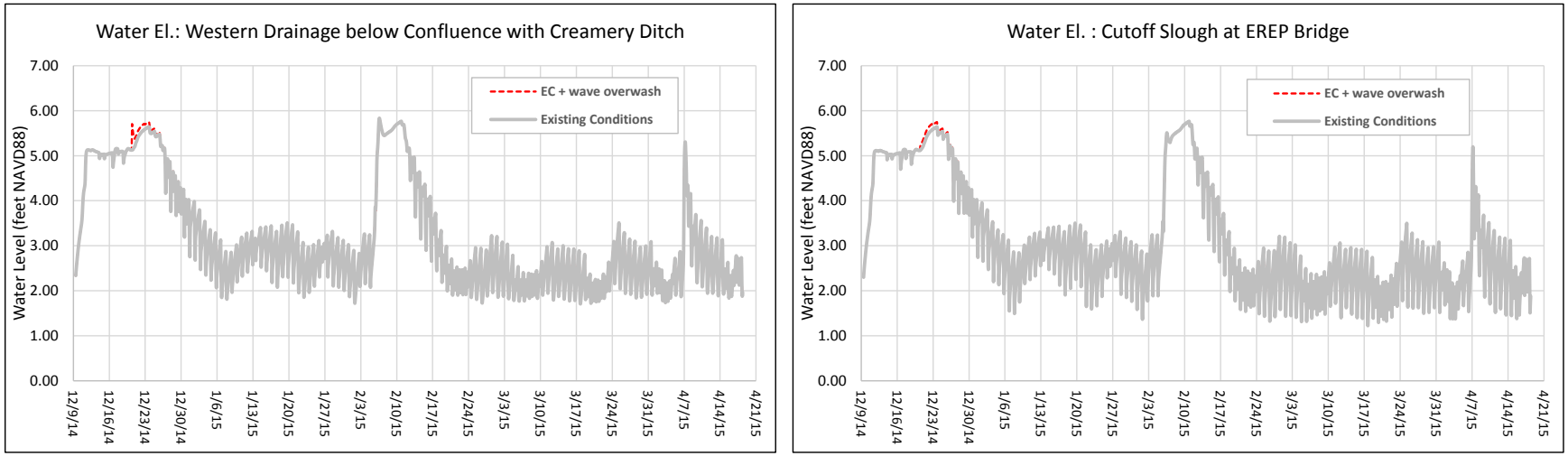


FIGURE 35a: Simulated water levels of Existing Conditions wave overwash event on 12/20/14

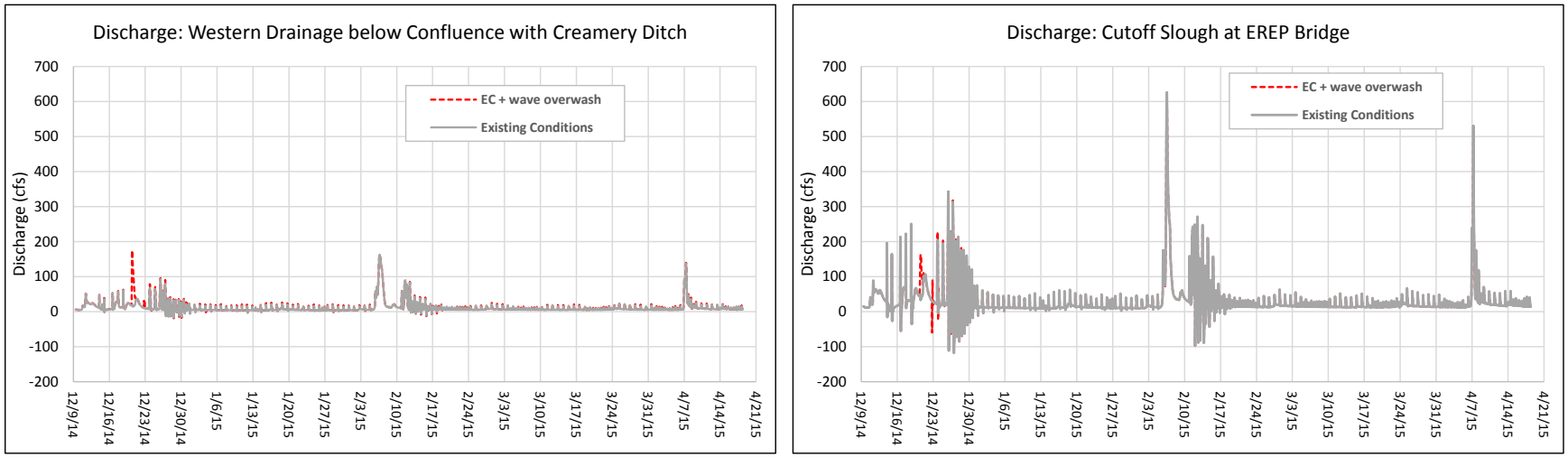


FIGURE 35b: Simulated flow rates of Existing Conditions wave overwash event on 12/20/14

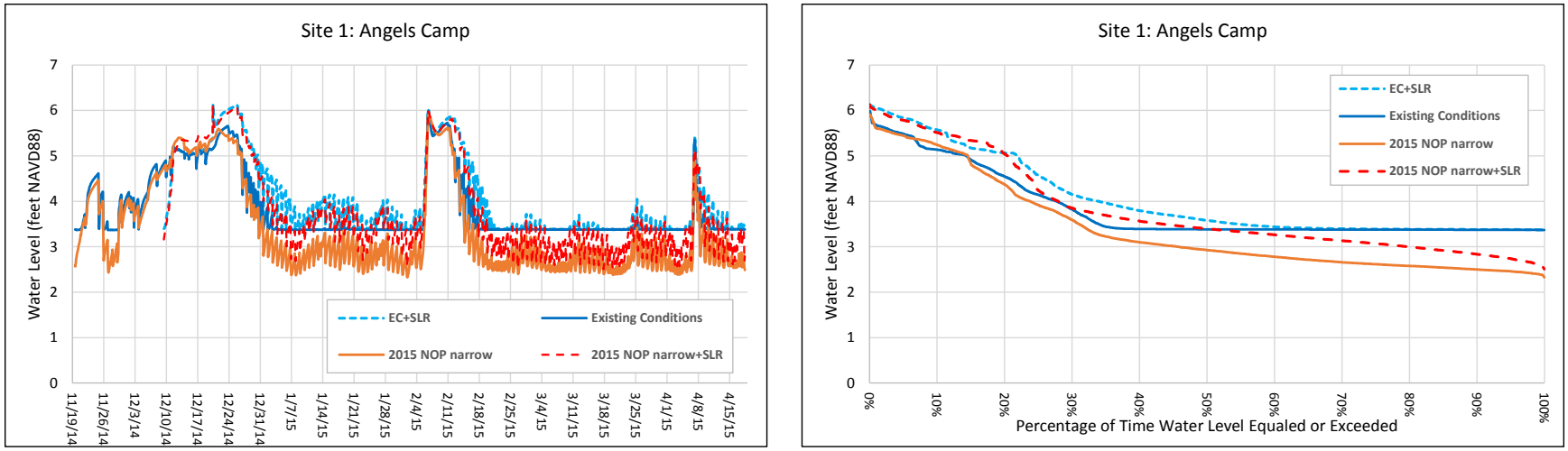


FIGURE 36a: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

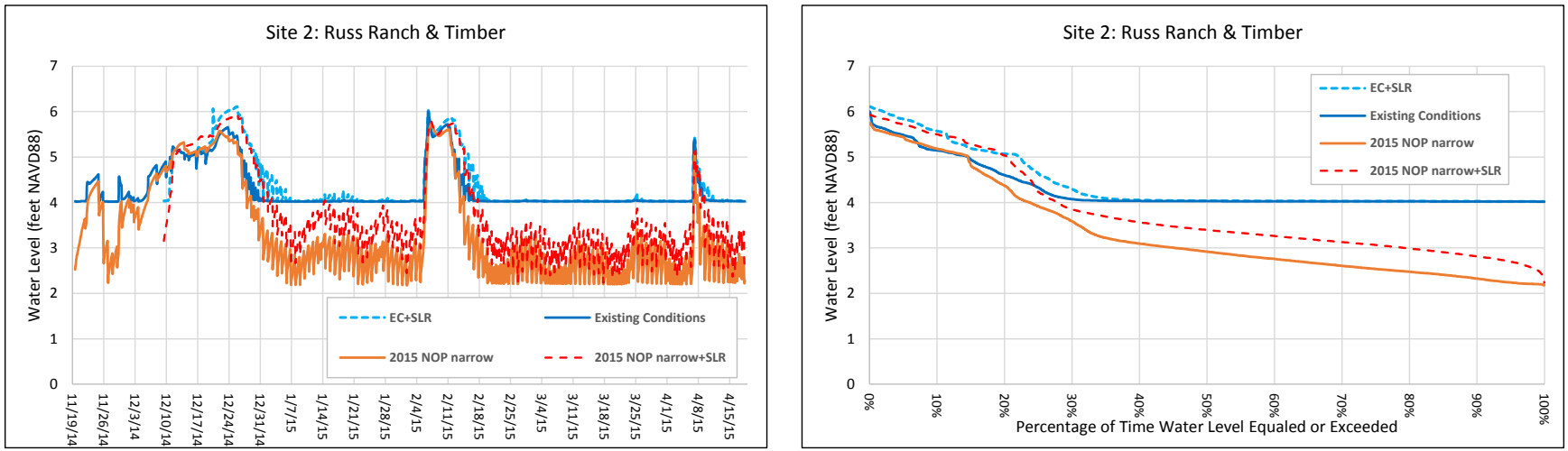


FIGURE 36b: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

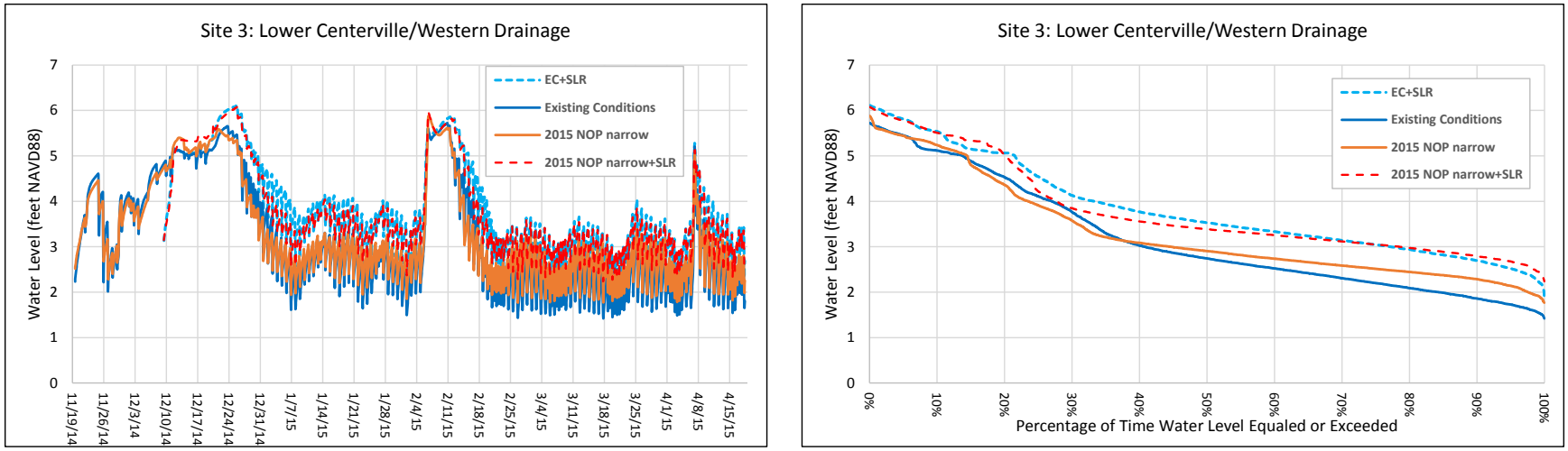


FIGURE 36c: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

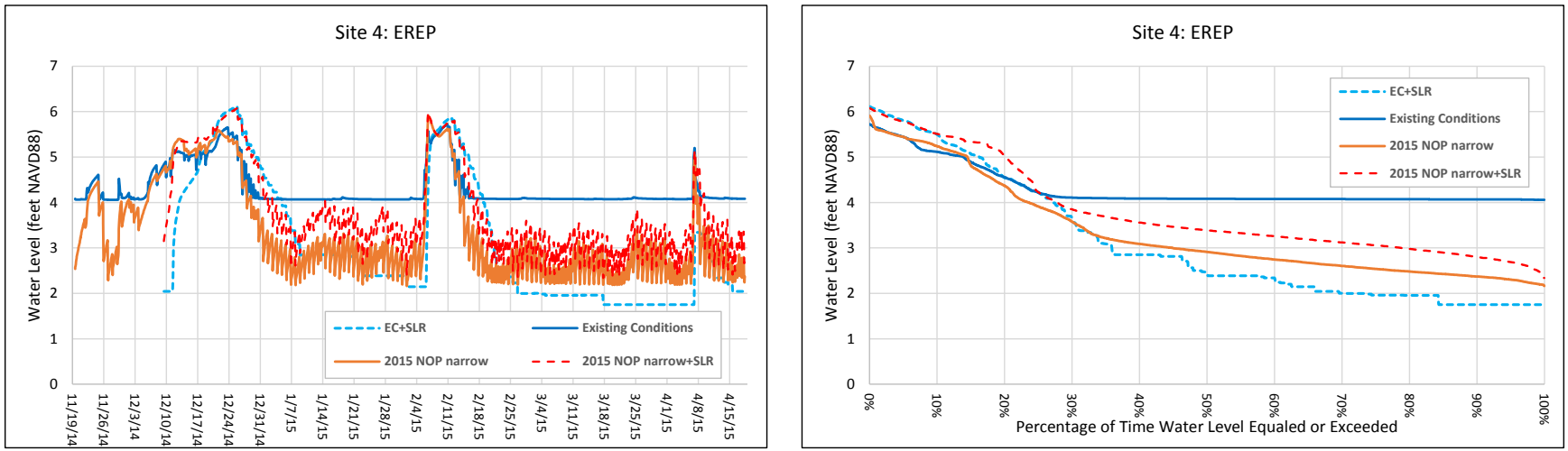


FIGURE 36d: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

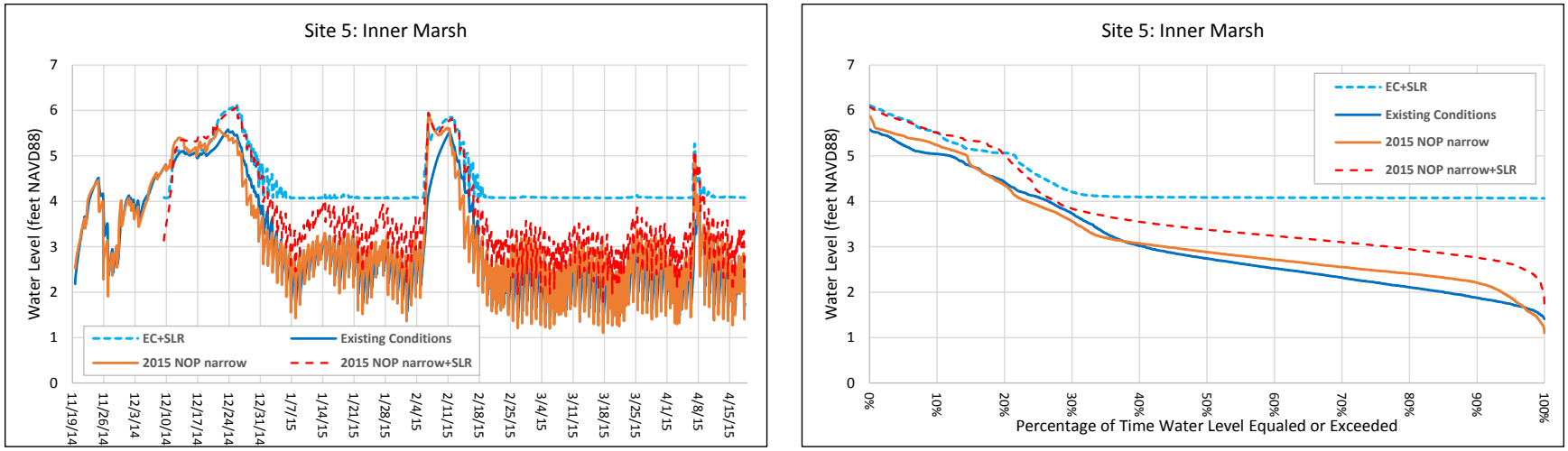


FIGURE 36e: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

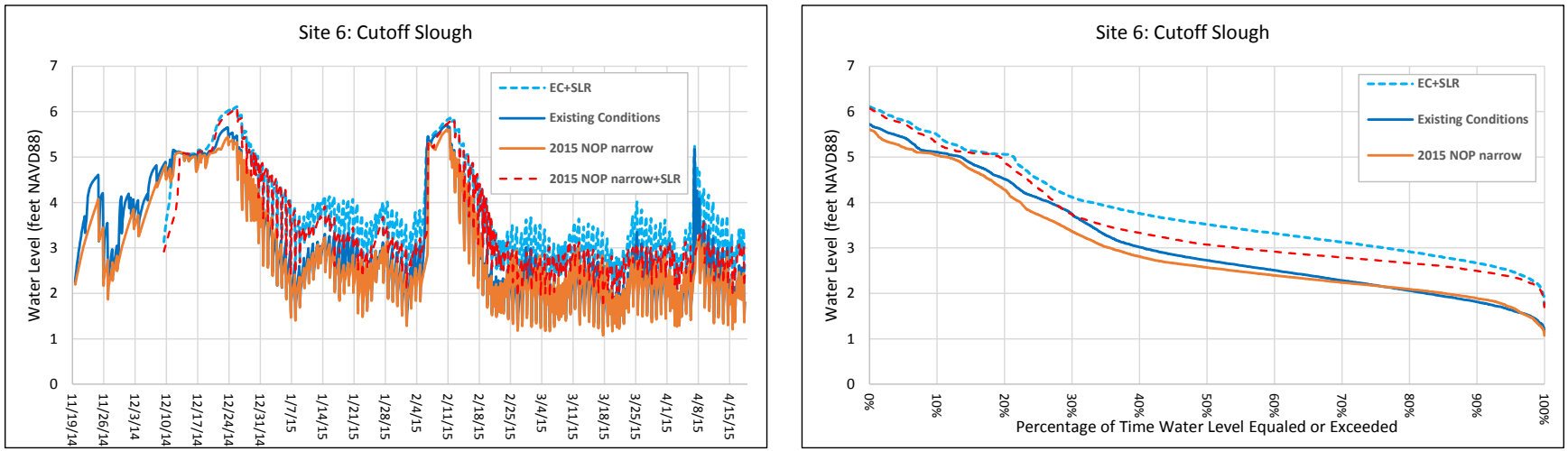


FIGURE 36f: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

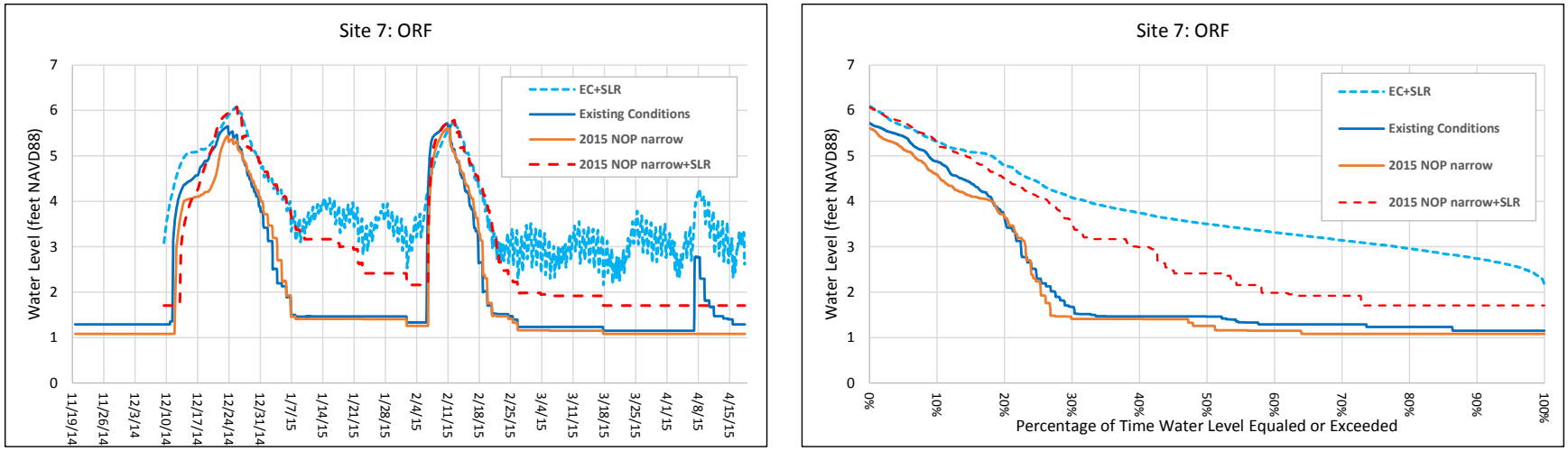


FIGURE 36g: Simulated water levels for the 2014/15 winter storm with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

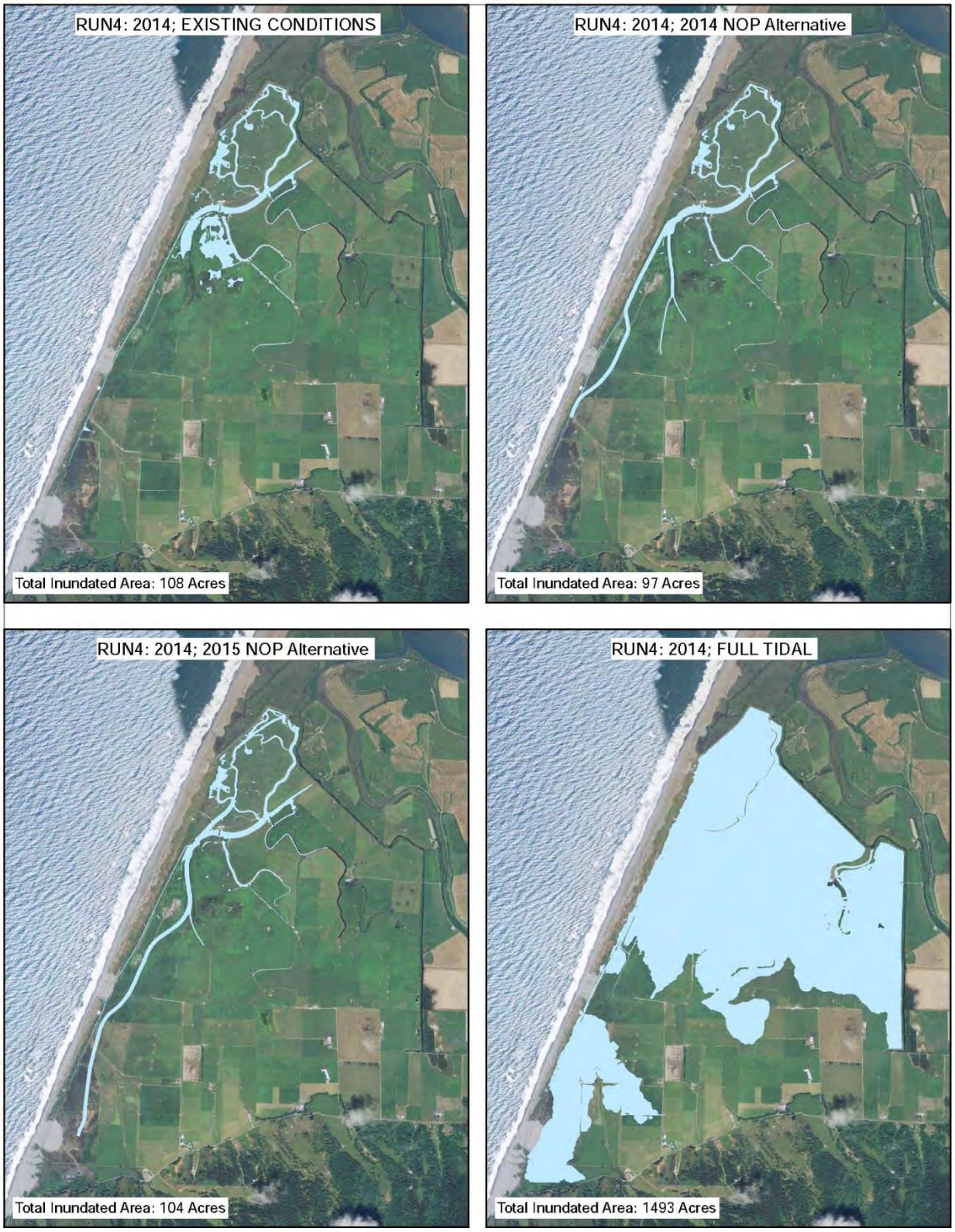


FIGURE 37a: Maximum inundation areas for each project alternative during 2014 dry winter period.

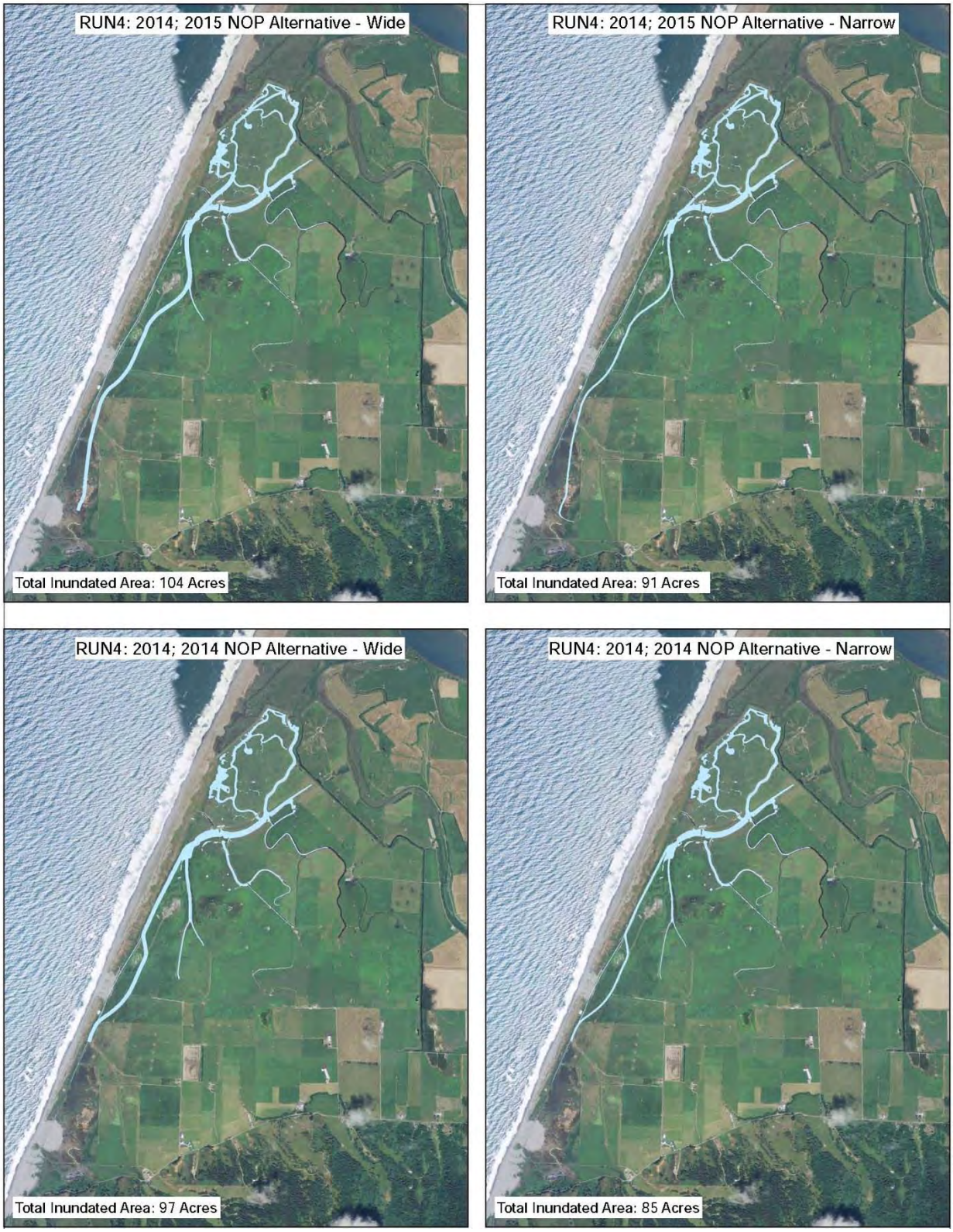


FIGURE 37b: Comparison of maximum inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2014 dry winter period.

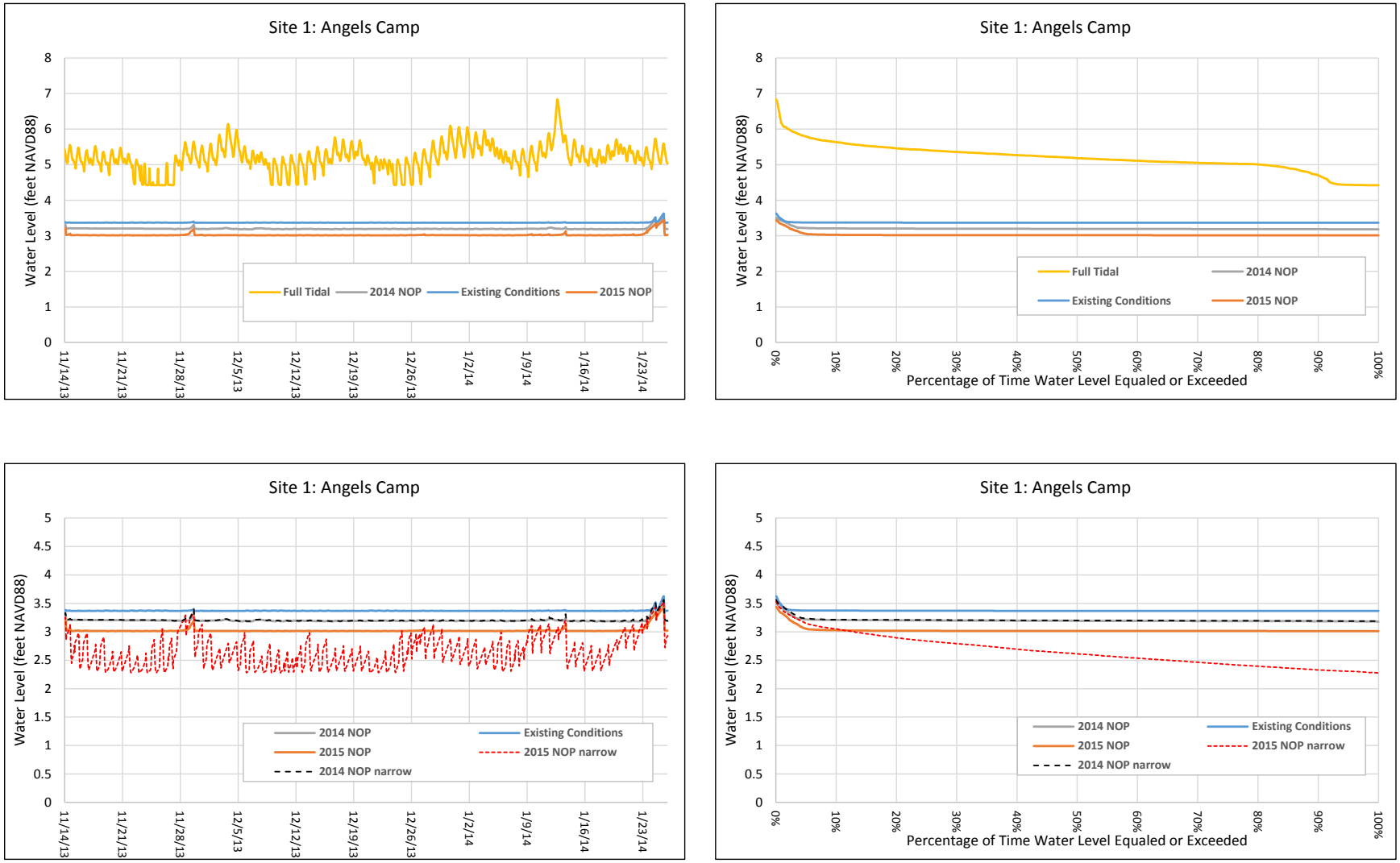


FIGURE 38a: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

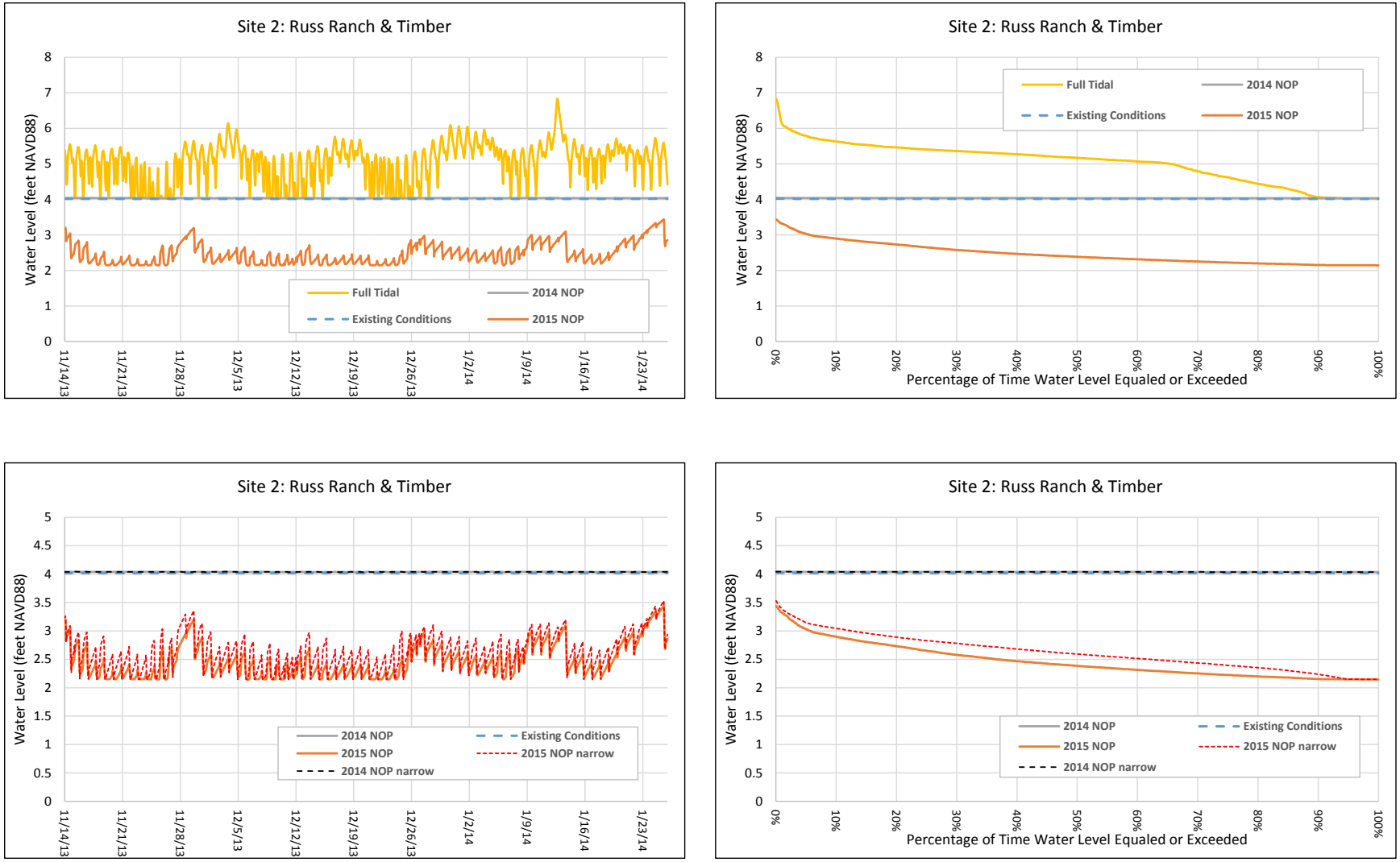


FIGURE 38b: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

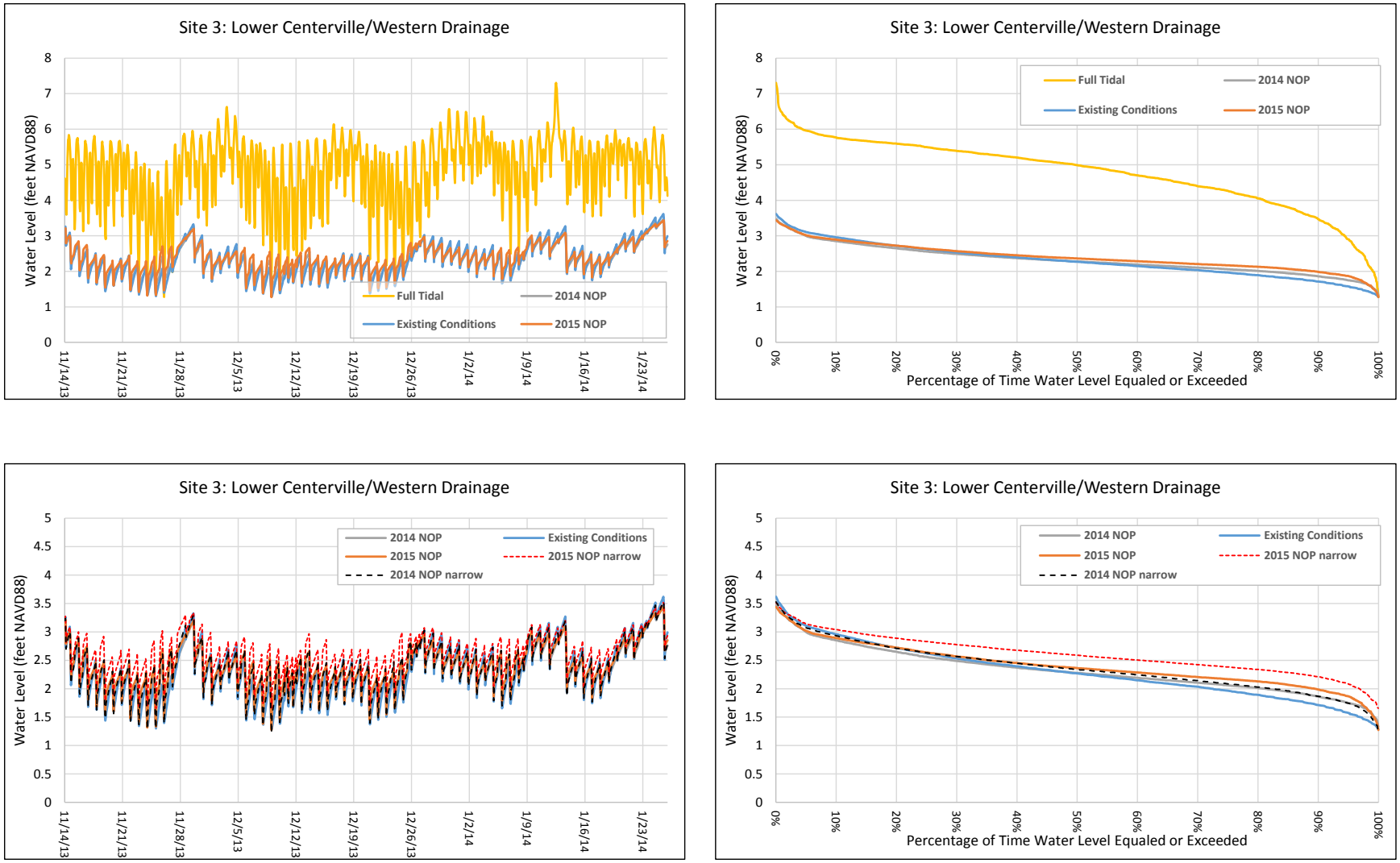


FIGURE 38c: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

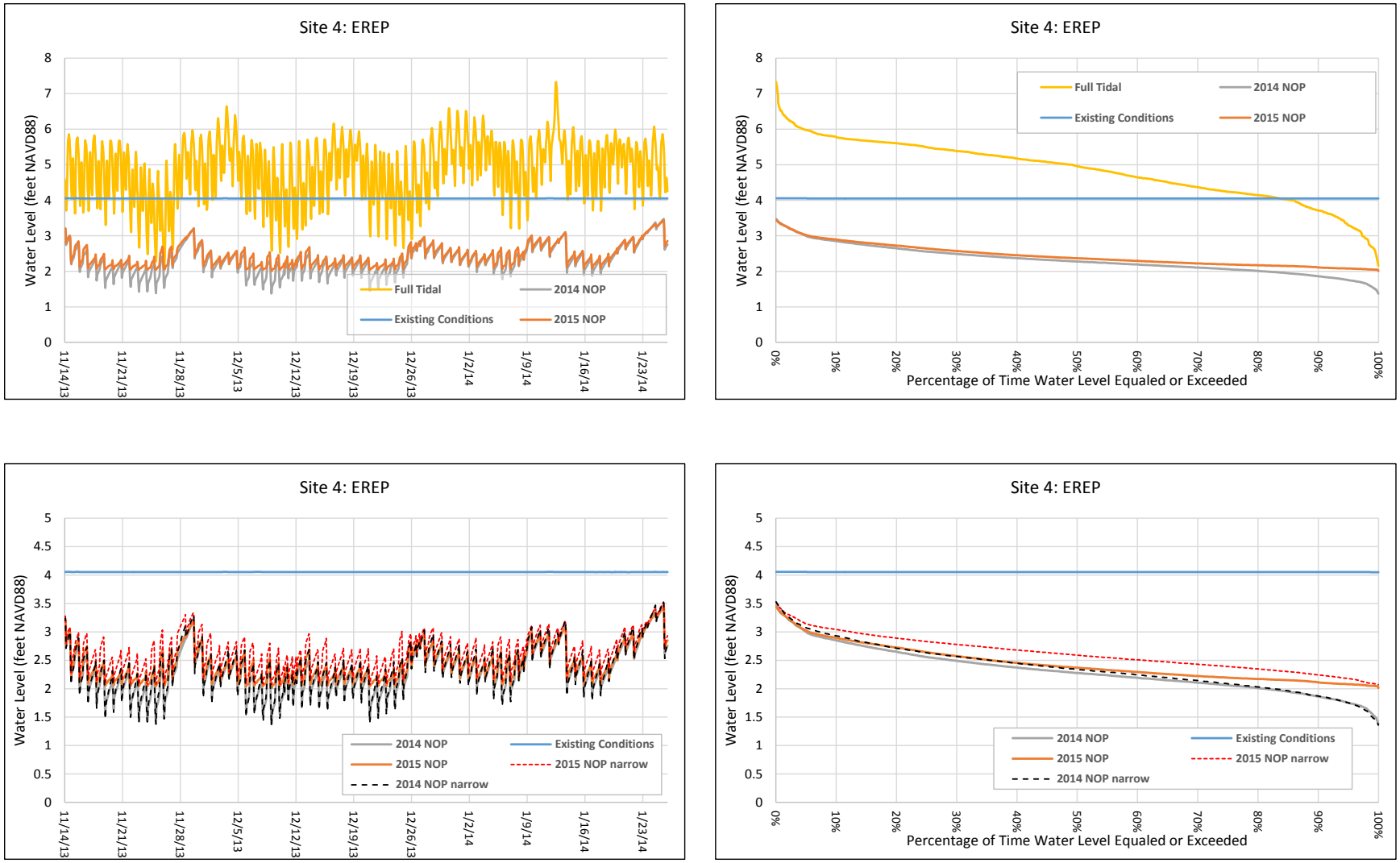


FIGURE 38d: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

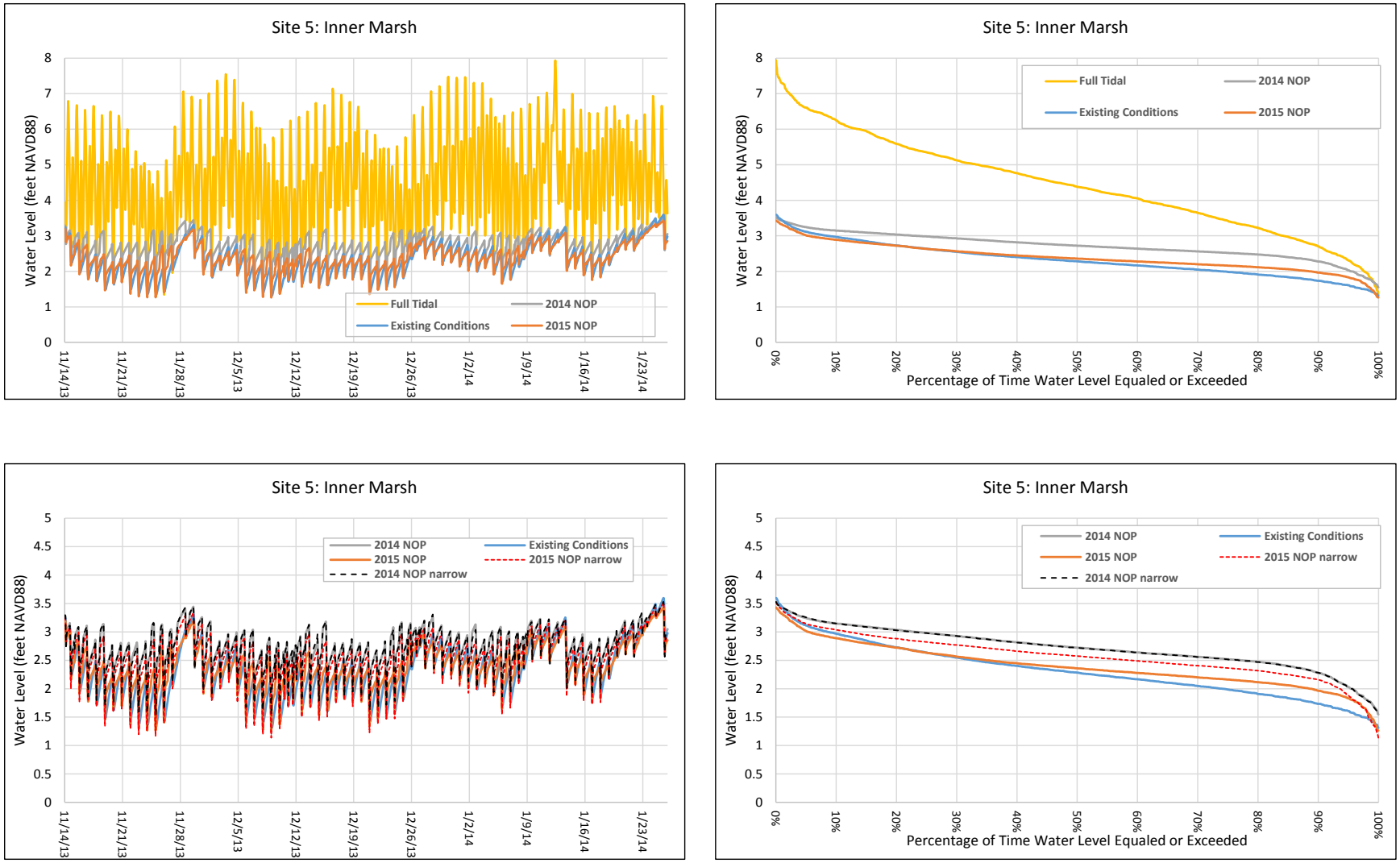


FIGURE 38e: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

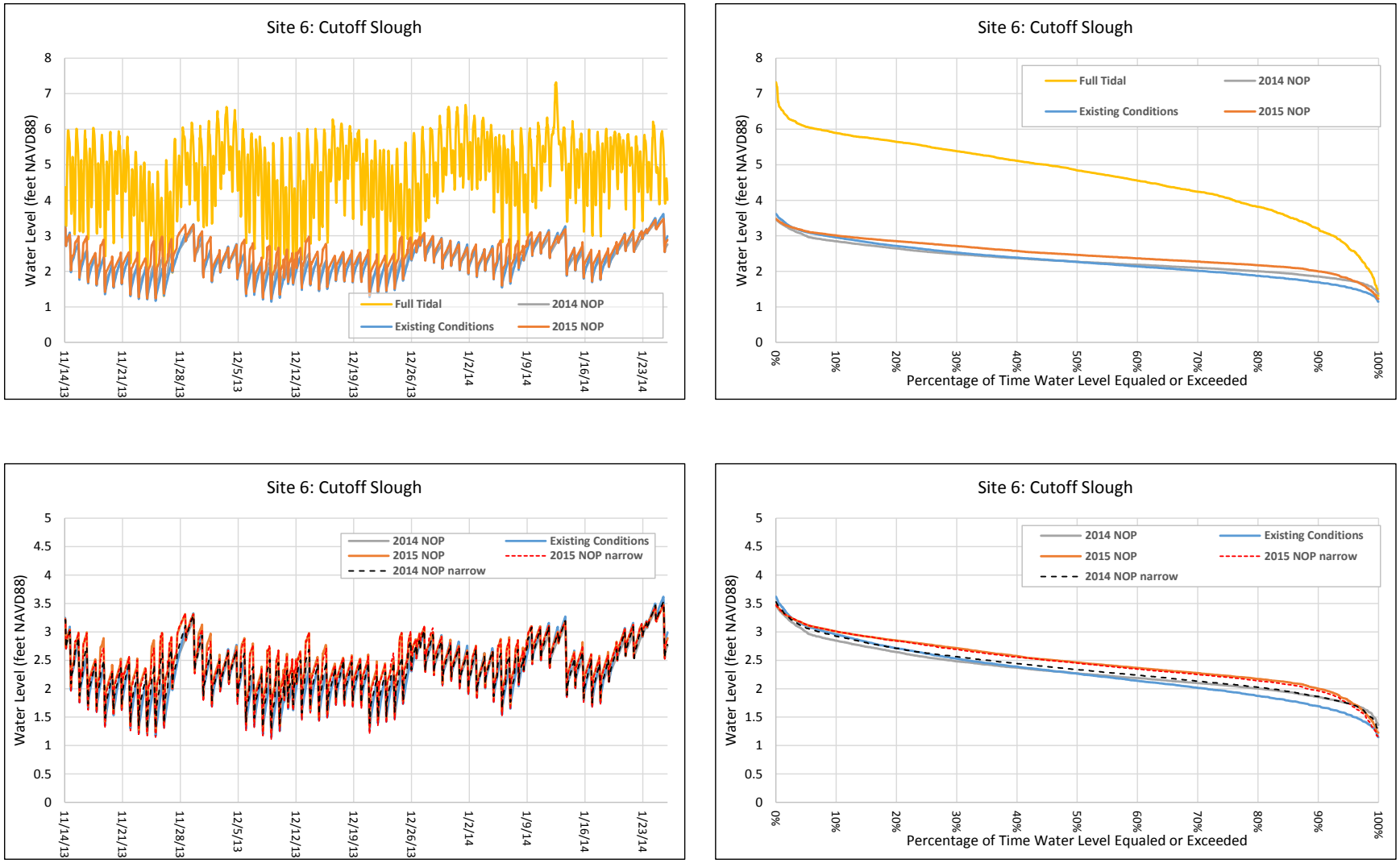


FIGURE 38f: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

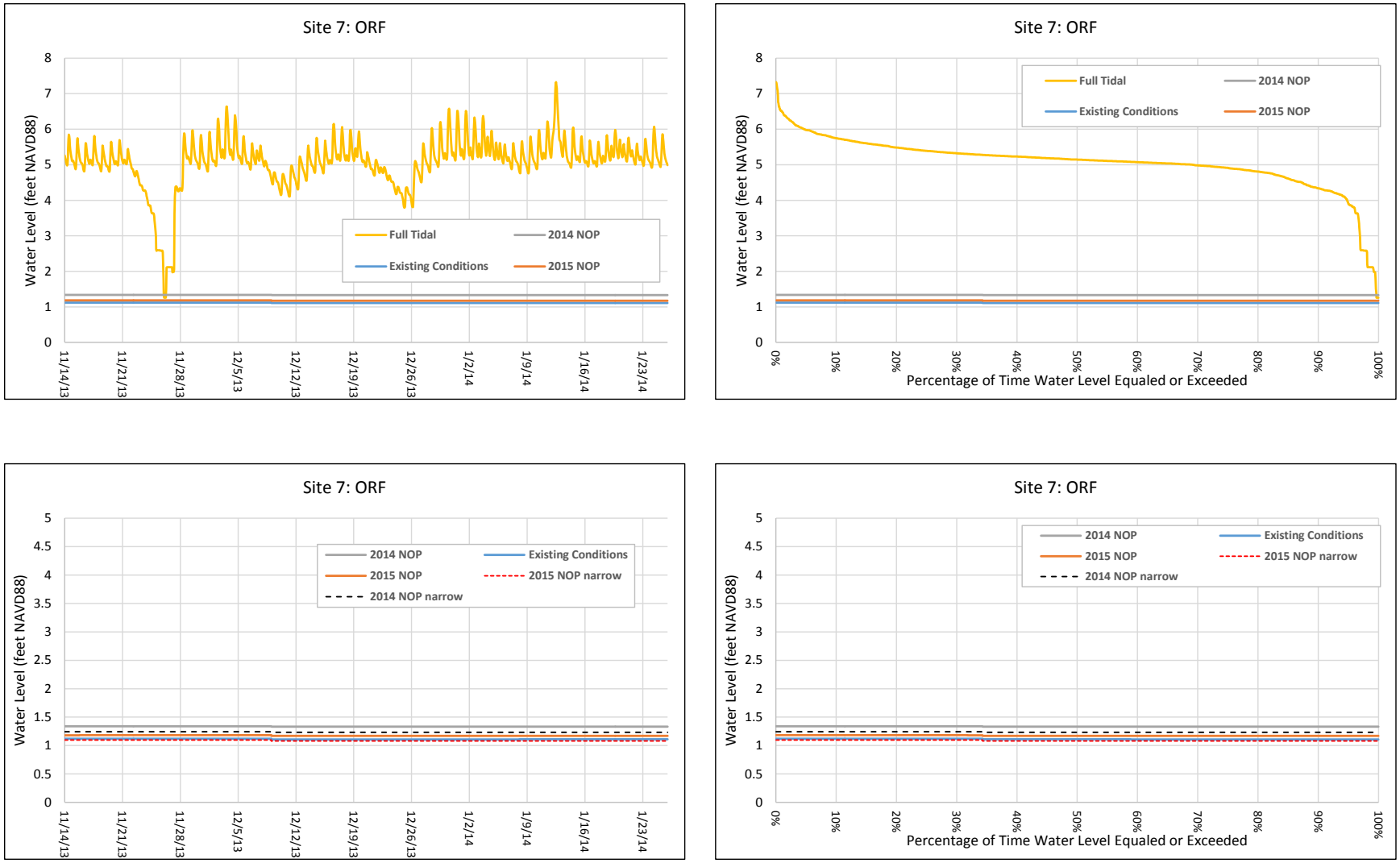


FIGURE 38g: Simulated water levels for the 2014 dry winter period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

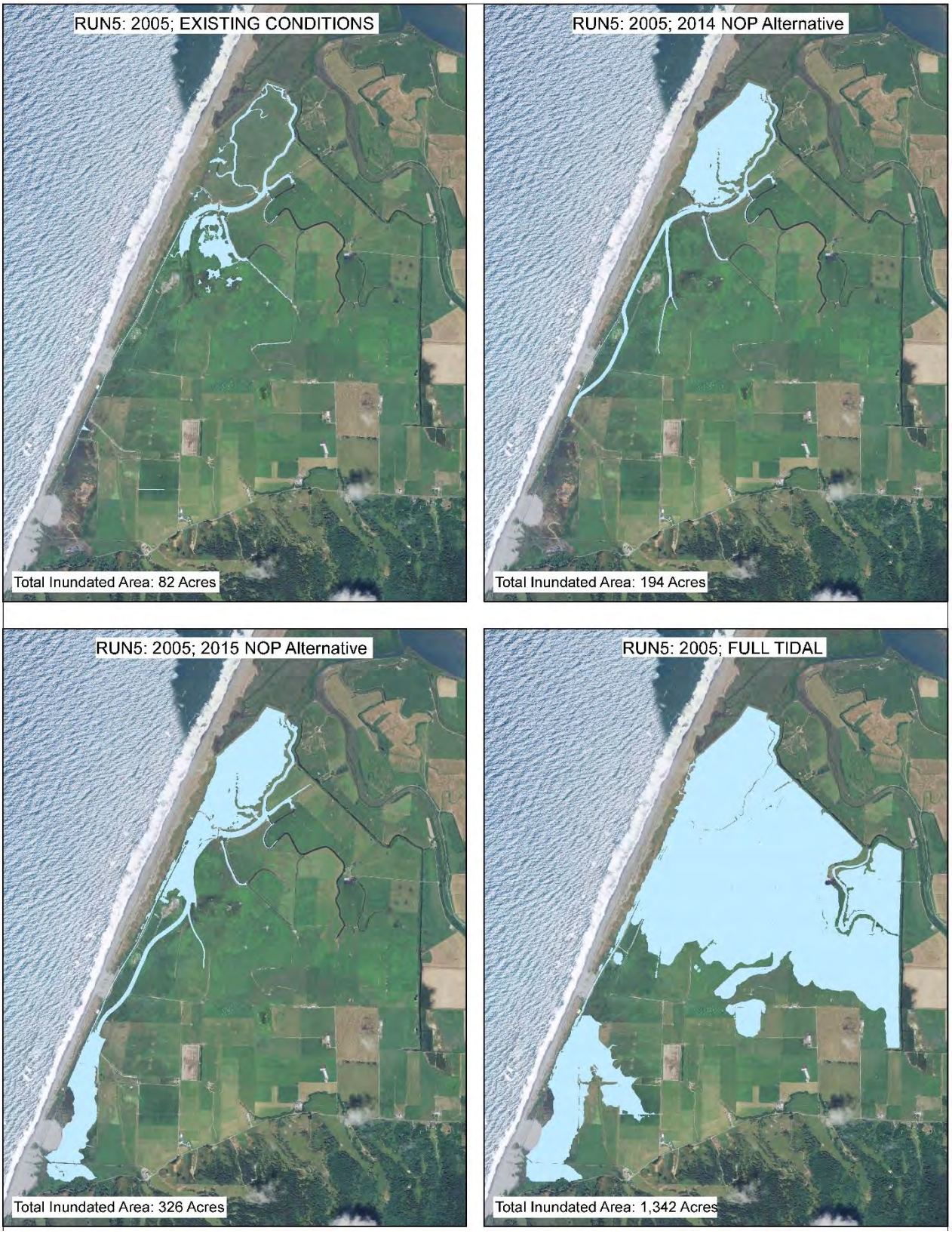


FIGURE 39a: Maximum inundation areas for each project alternative during 2005 summer period.

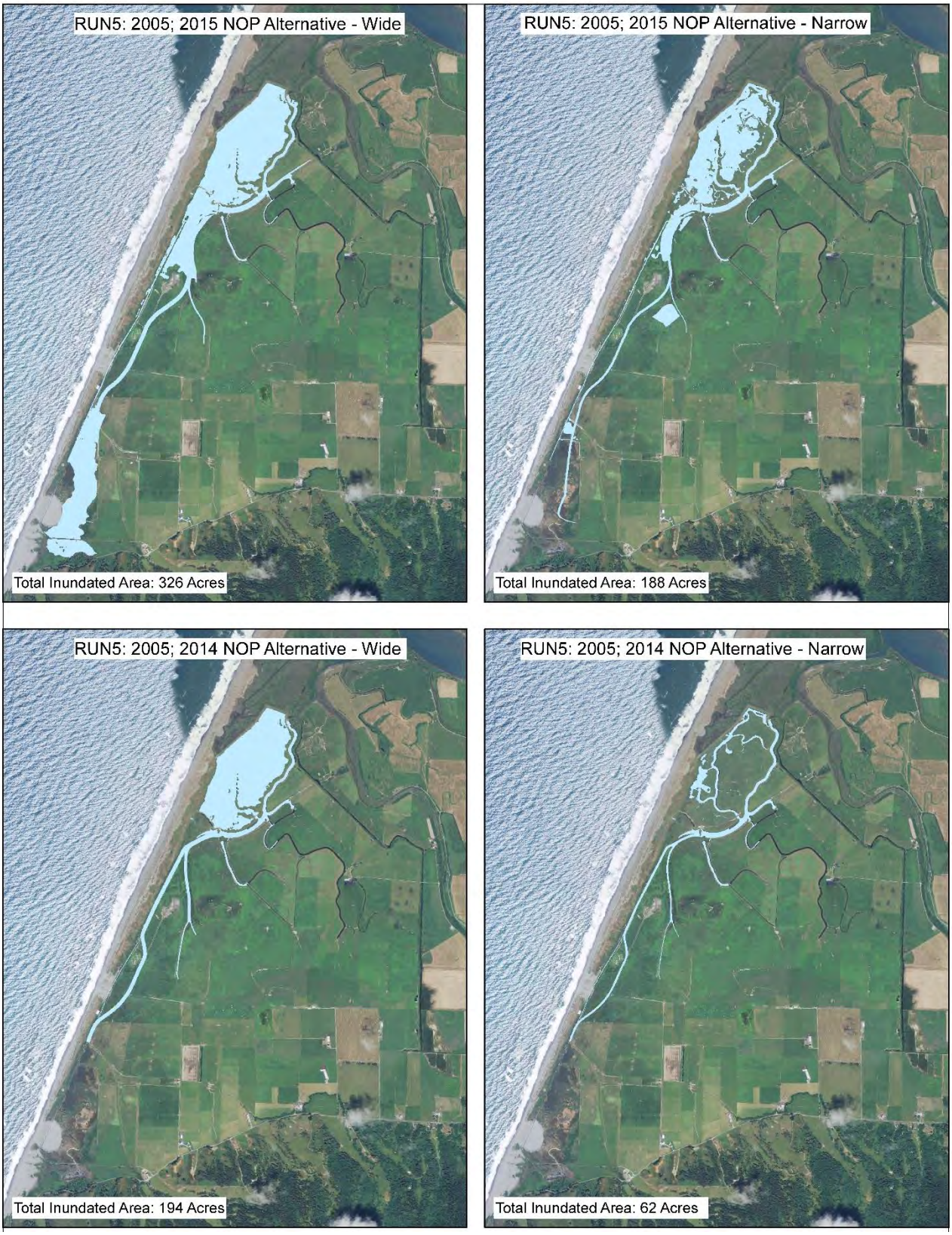


FIGURE 39b: Comparison of maximum inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2005 summer period.

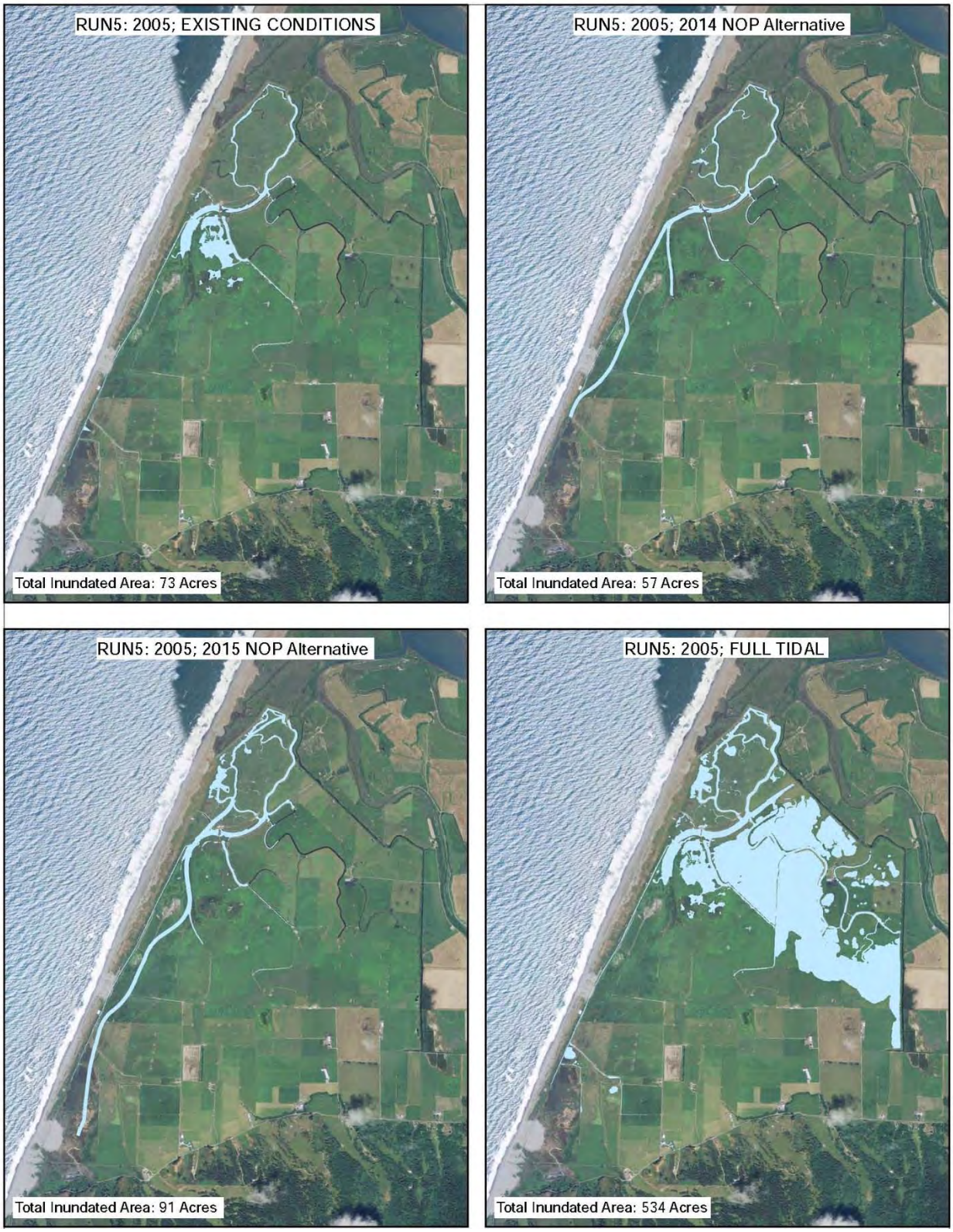


FIGURE 40a: Average inundation areas for each project alternative during 2005 summer period.

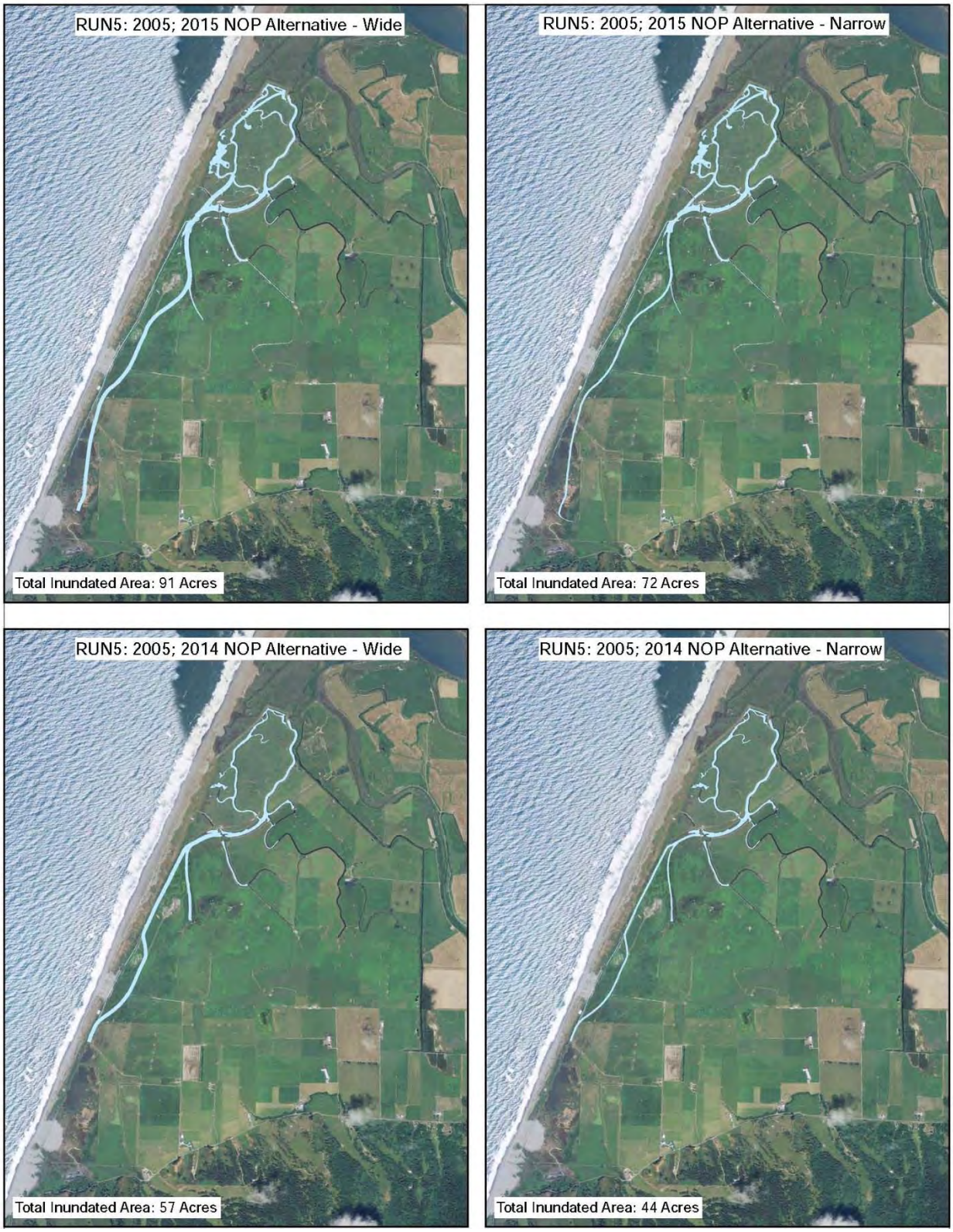


FIGURE 40b: Comparison of average inundation areas for 2014 and 2015 NOP alternatives for both 100% and 50% channel widths during 2005 summer period.

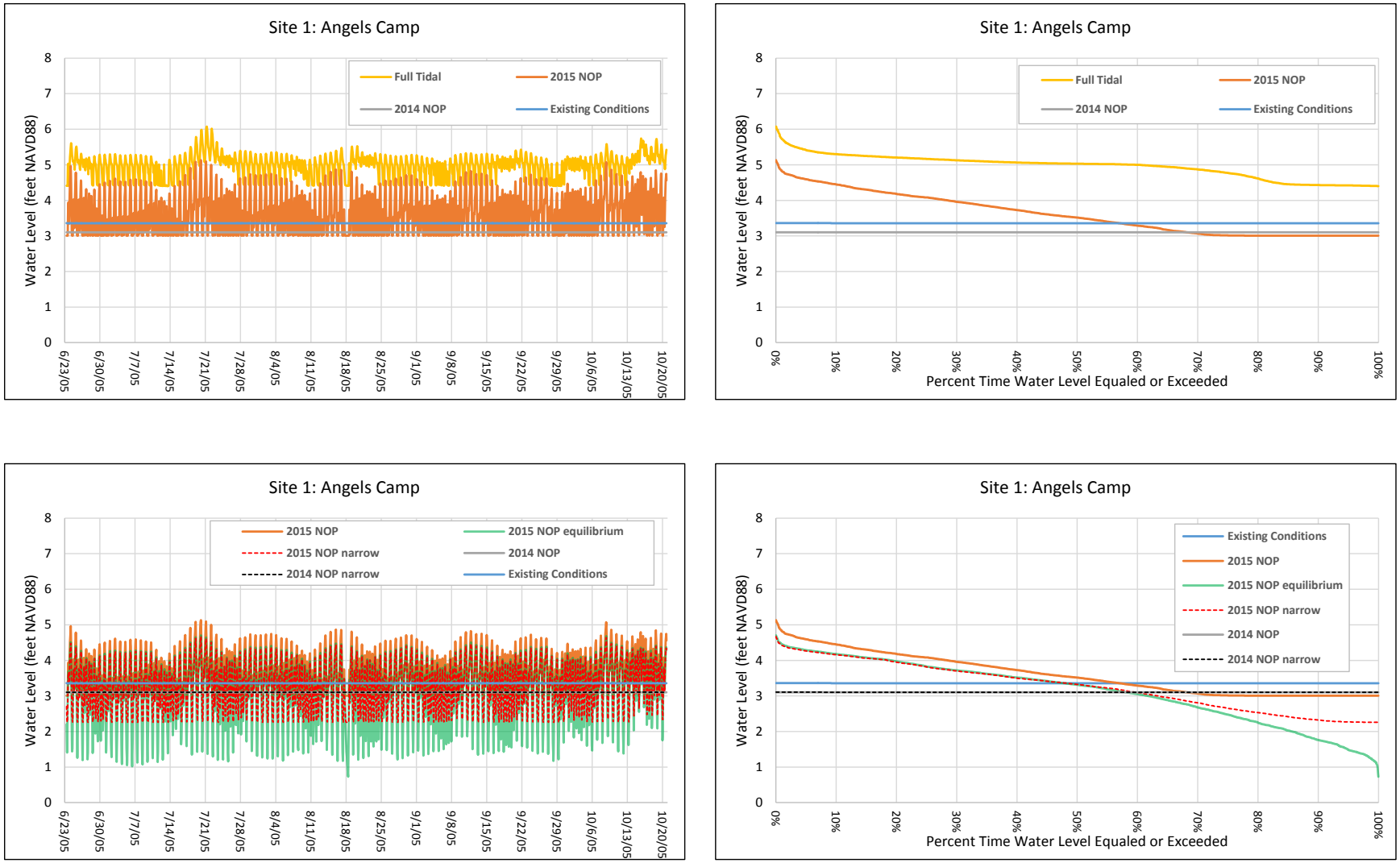


FIGURE 41a: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

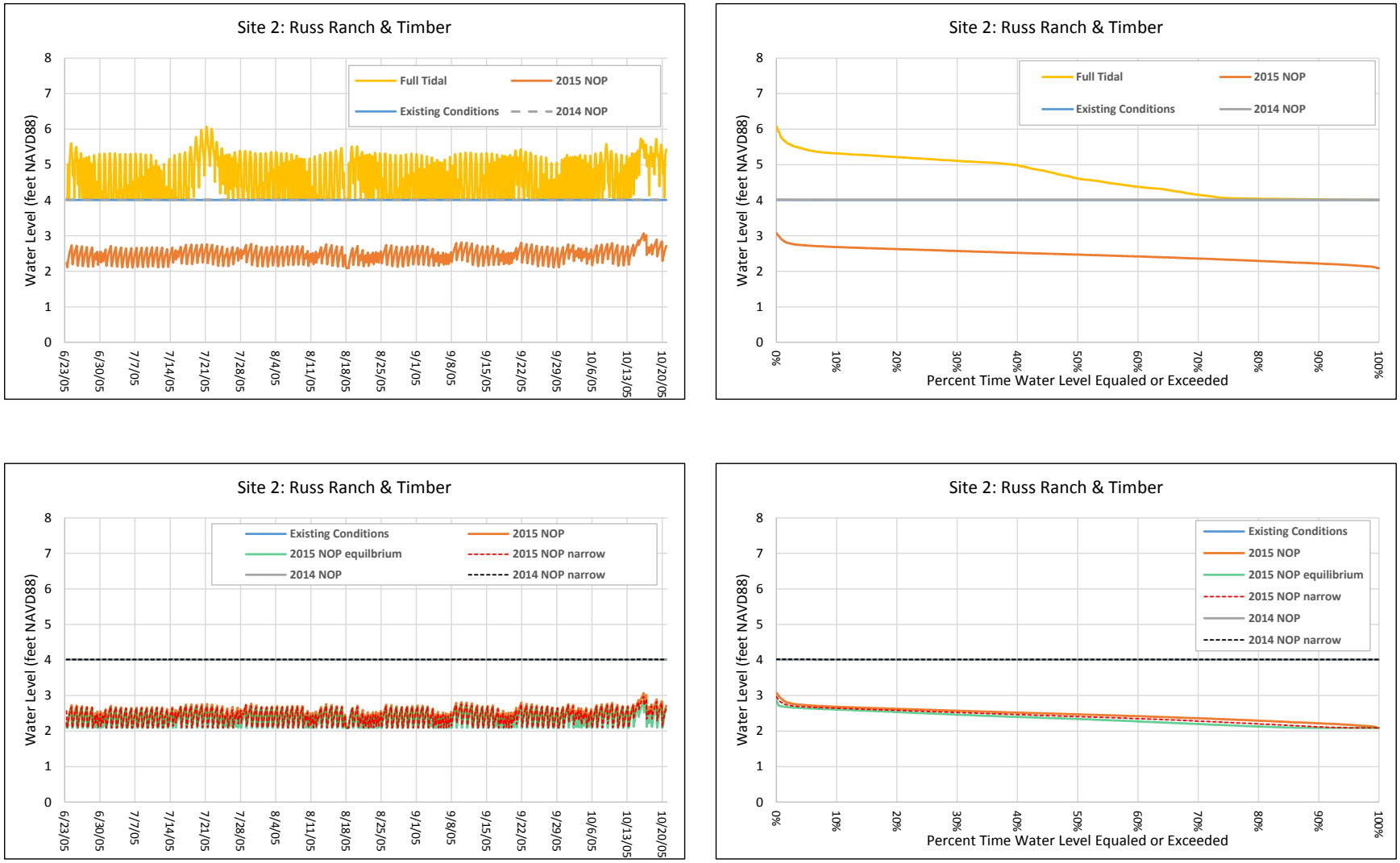


FIGURE 41b: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

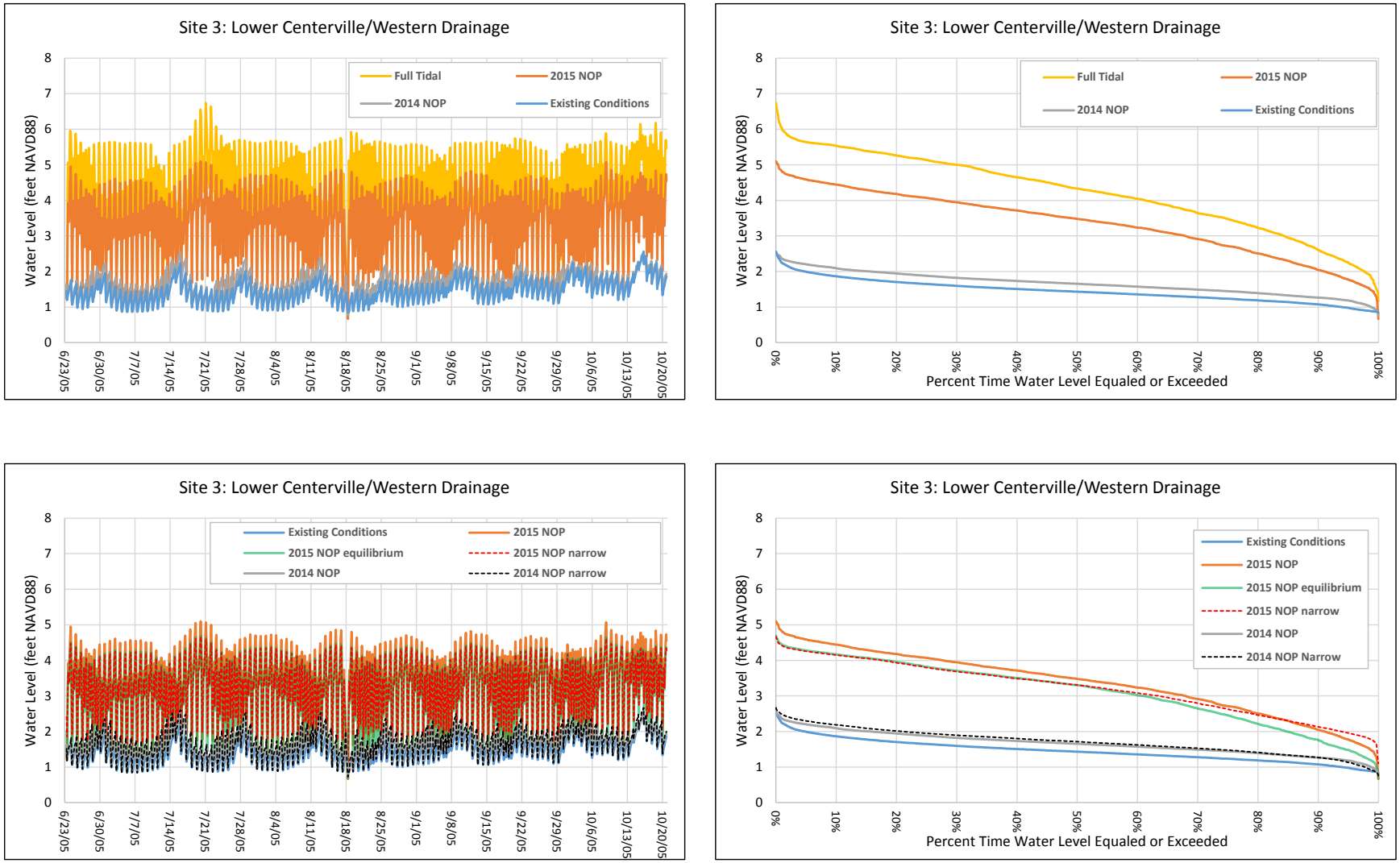


FIGURE 41c: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

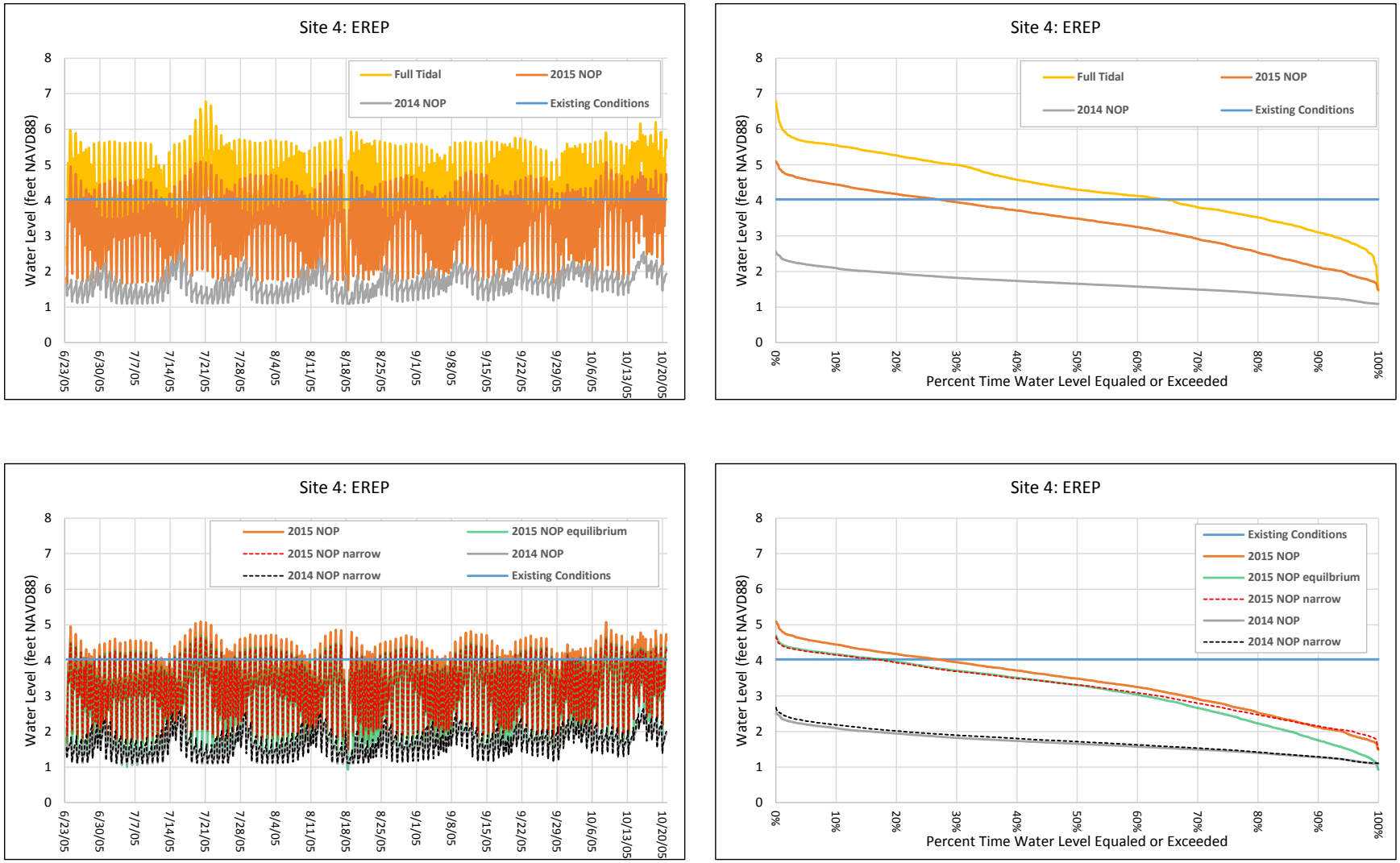


FIGURE 41d: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

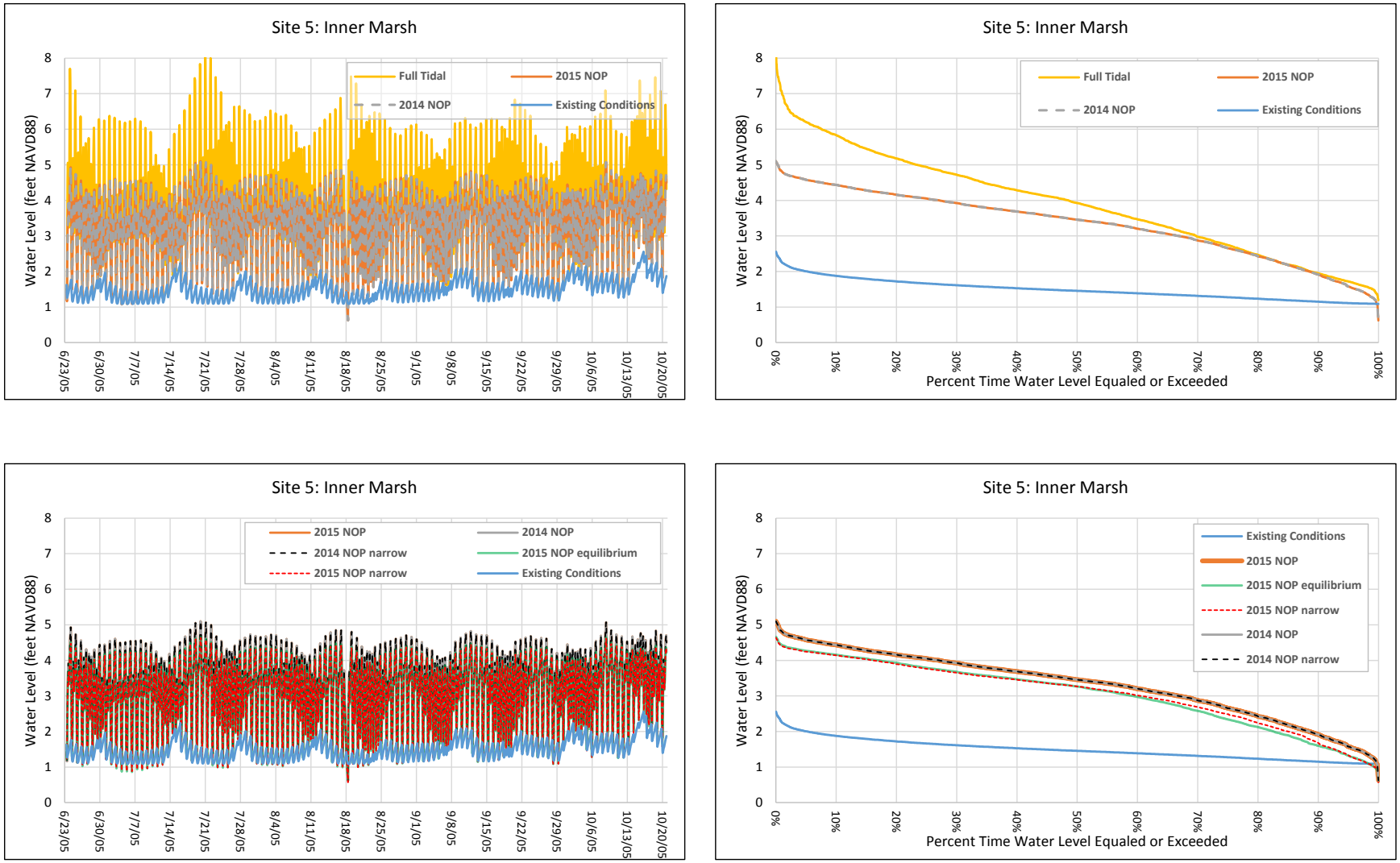


FIGURE 41e: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

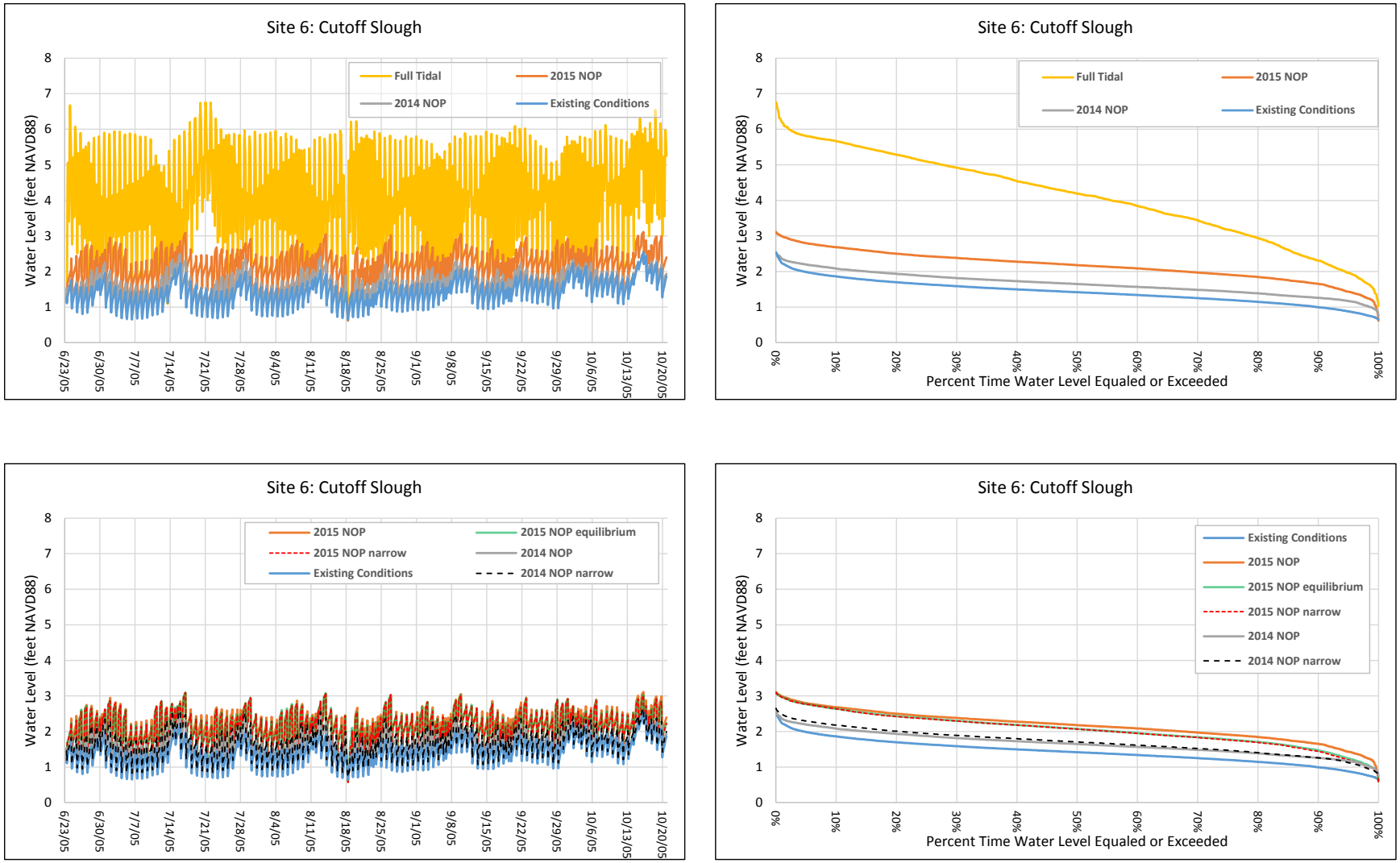


FIGURE 41f: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

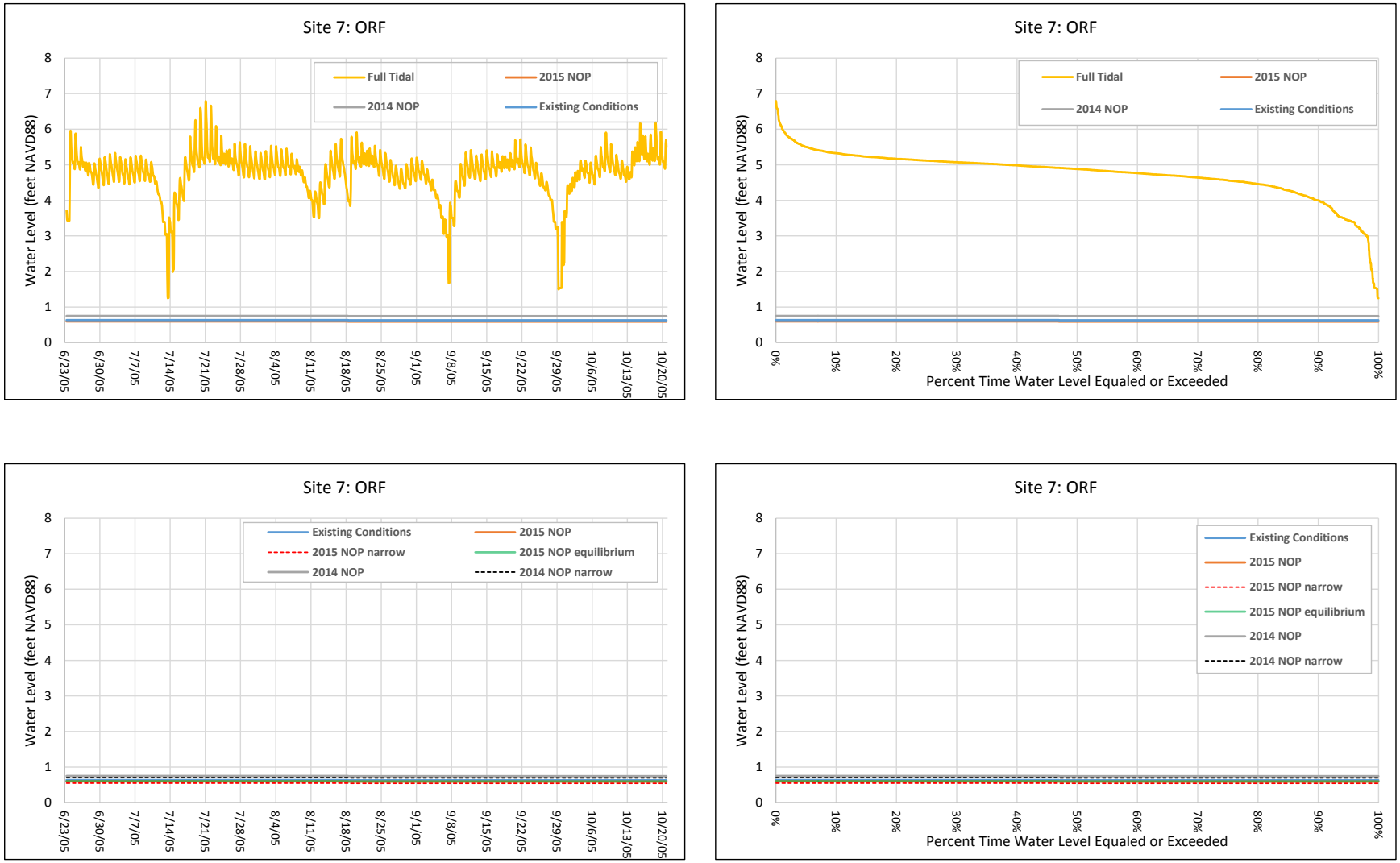


FIGURE 41g: Simulated water levels for the 2005 summer period. See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

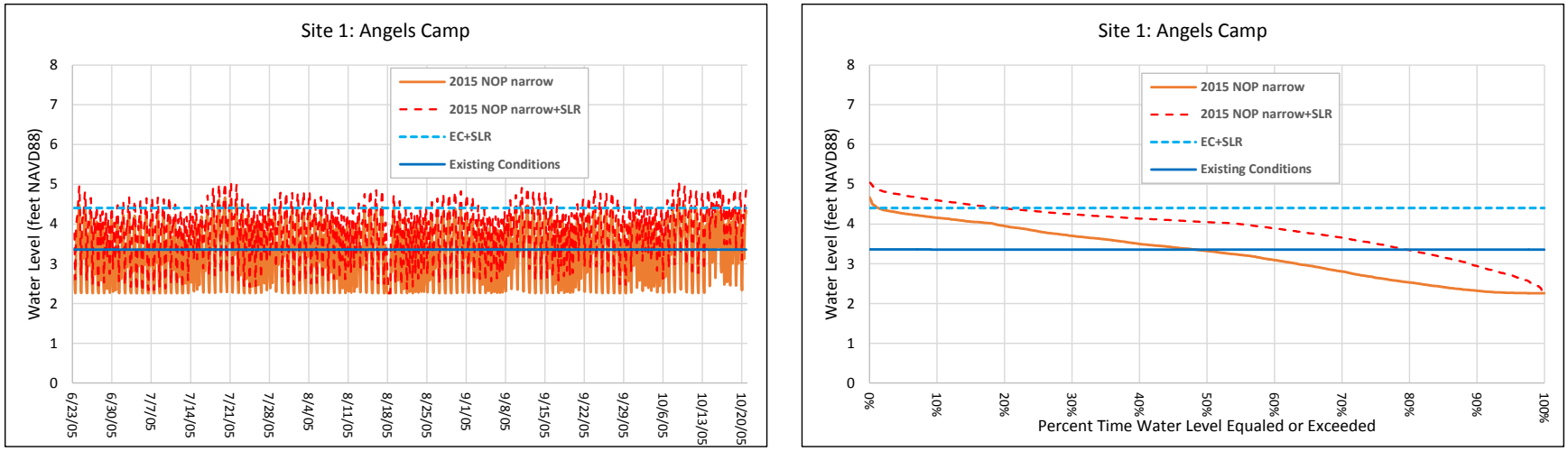


FIGURE 42a: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

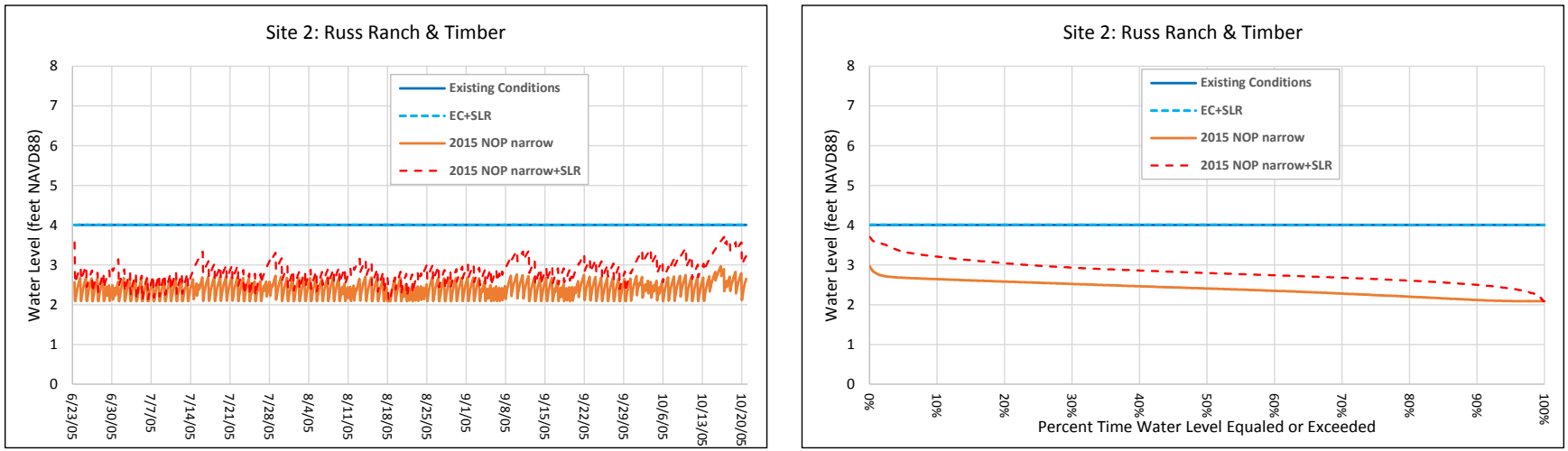


FIGURE 42b: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

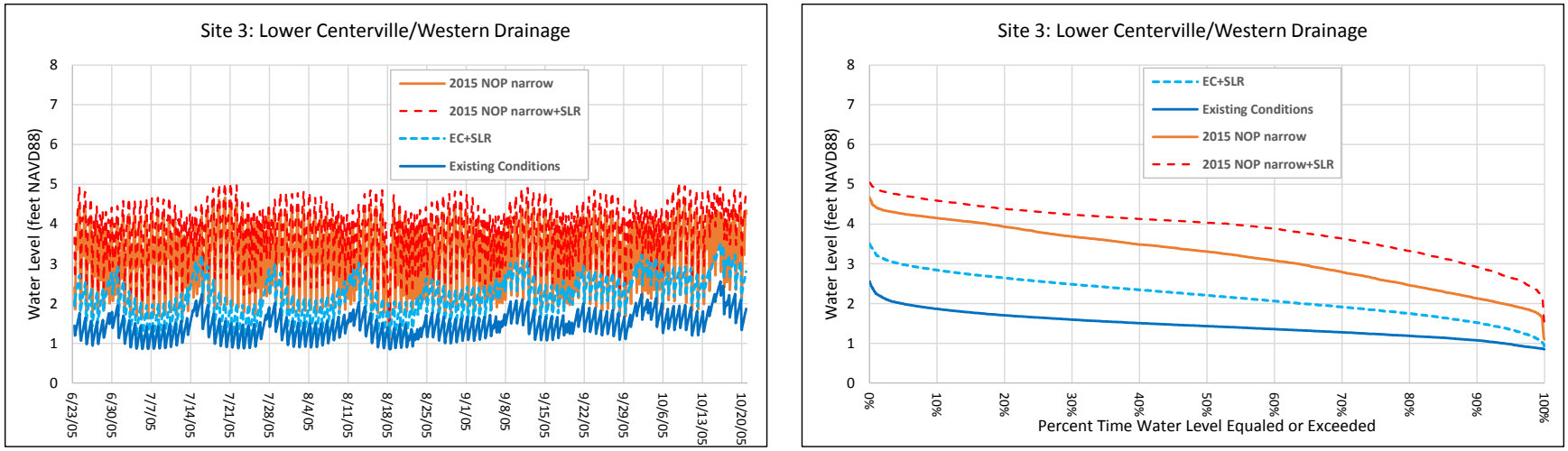


FIGURE 42c: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

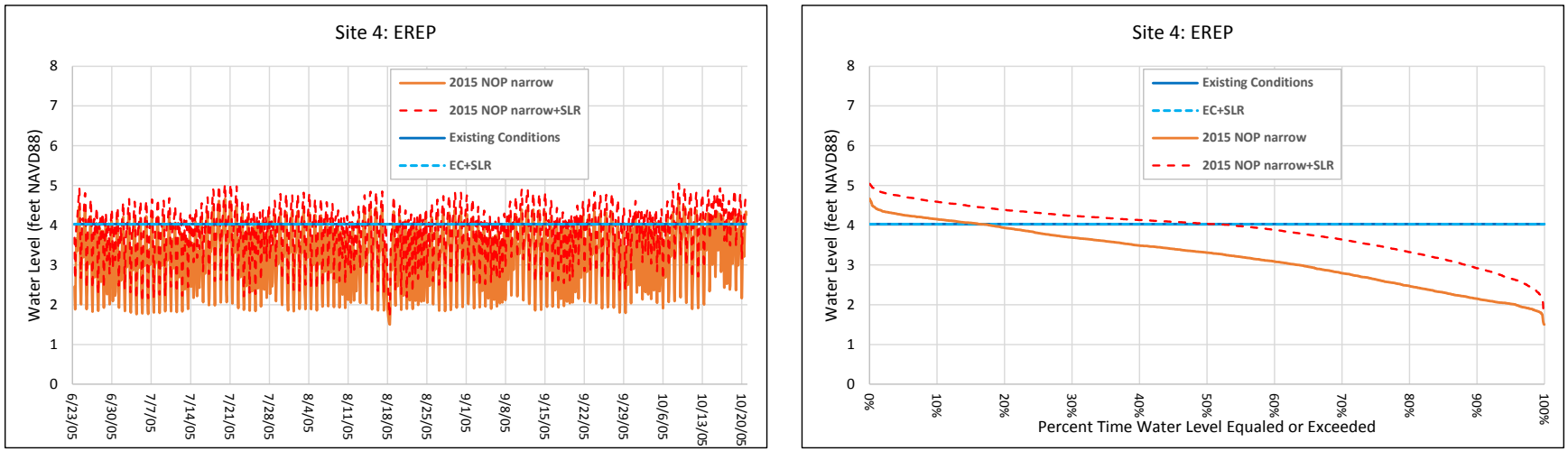
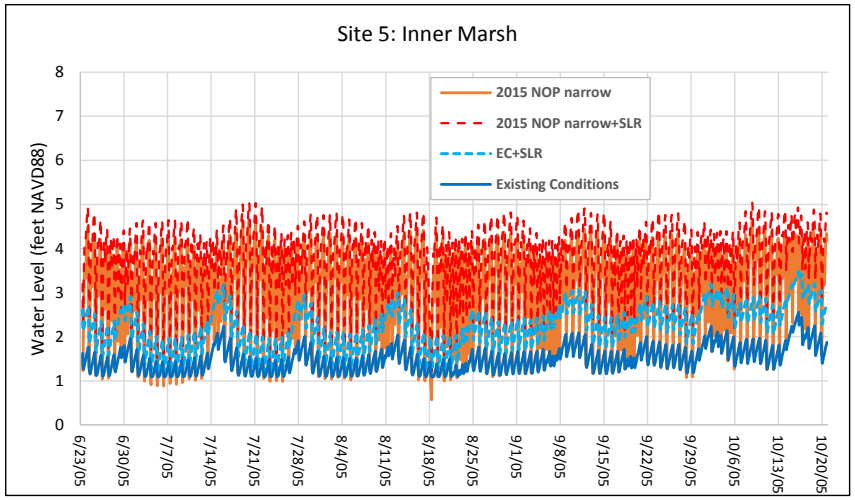


FIGURE 42d: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.



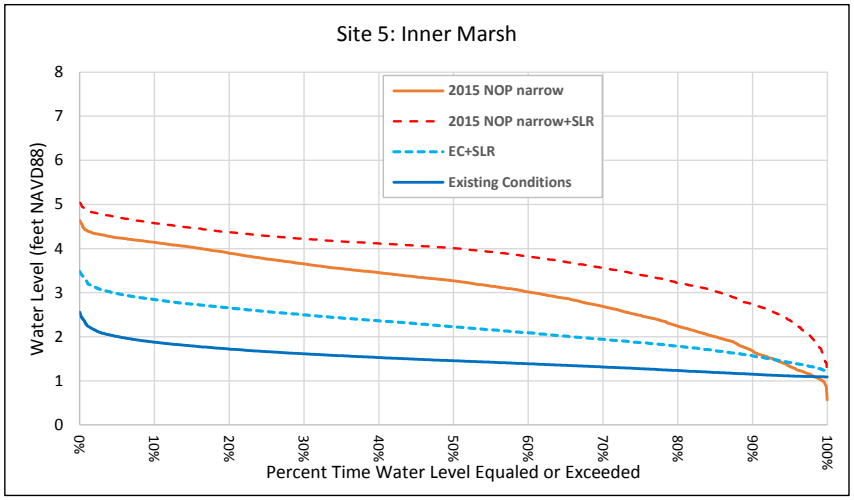
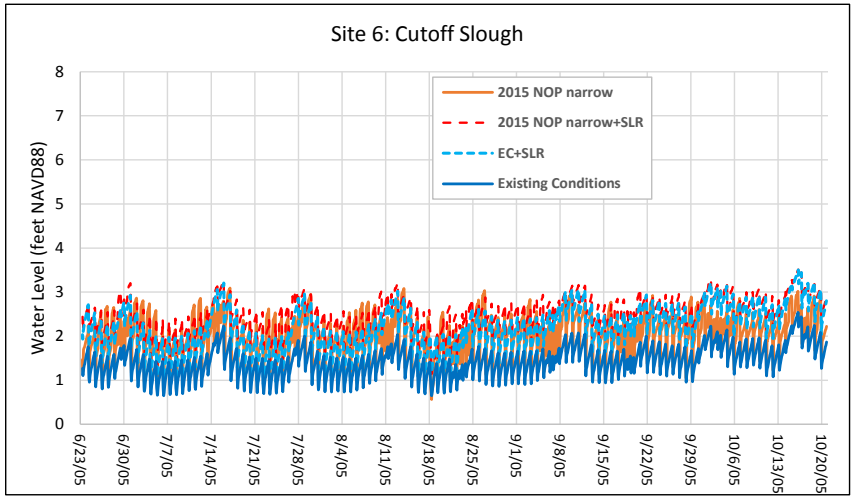


FIGURE 42e: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.



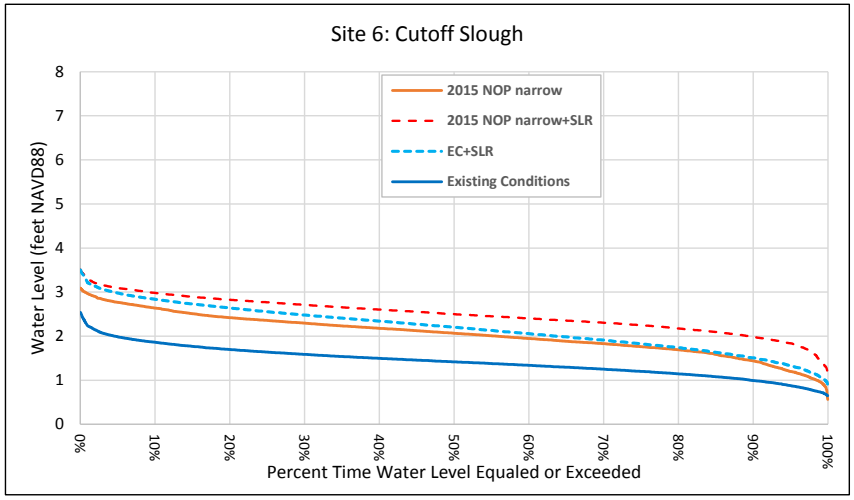
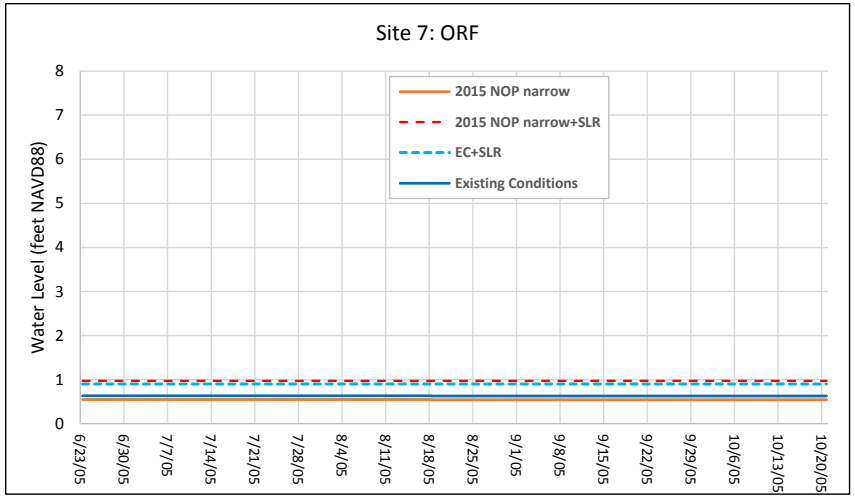


FIGURE 42f: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.



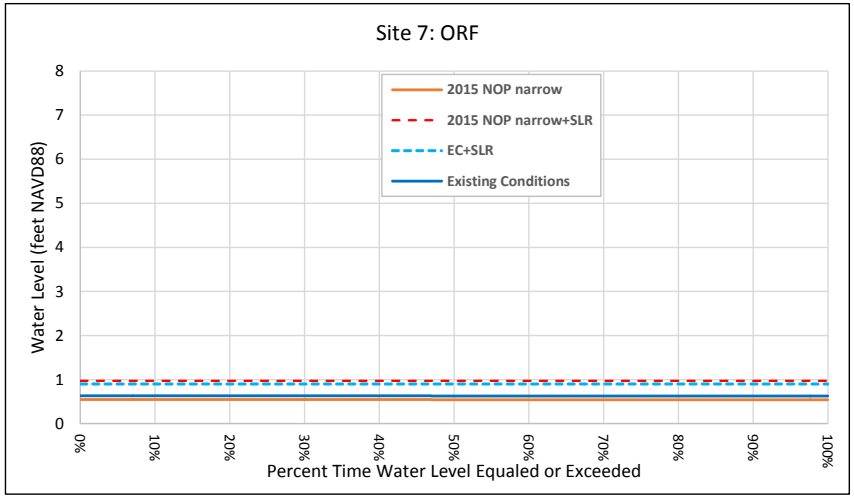


FIGURE 42g: Simulated water levels for the 2005 summer period with 1-foot of sea level rise (SLR). See Figure 28 for site locations. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

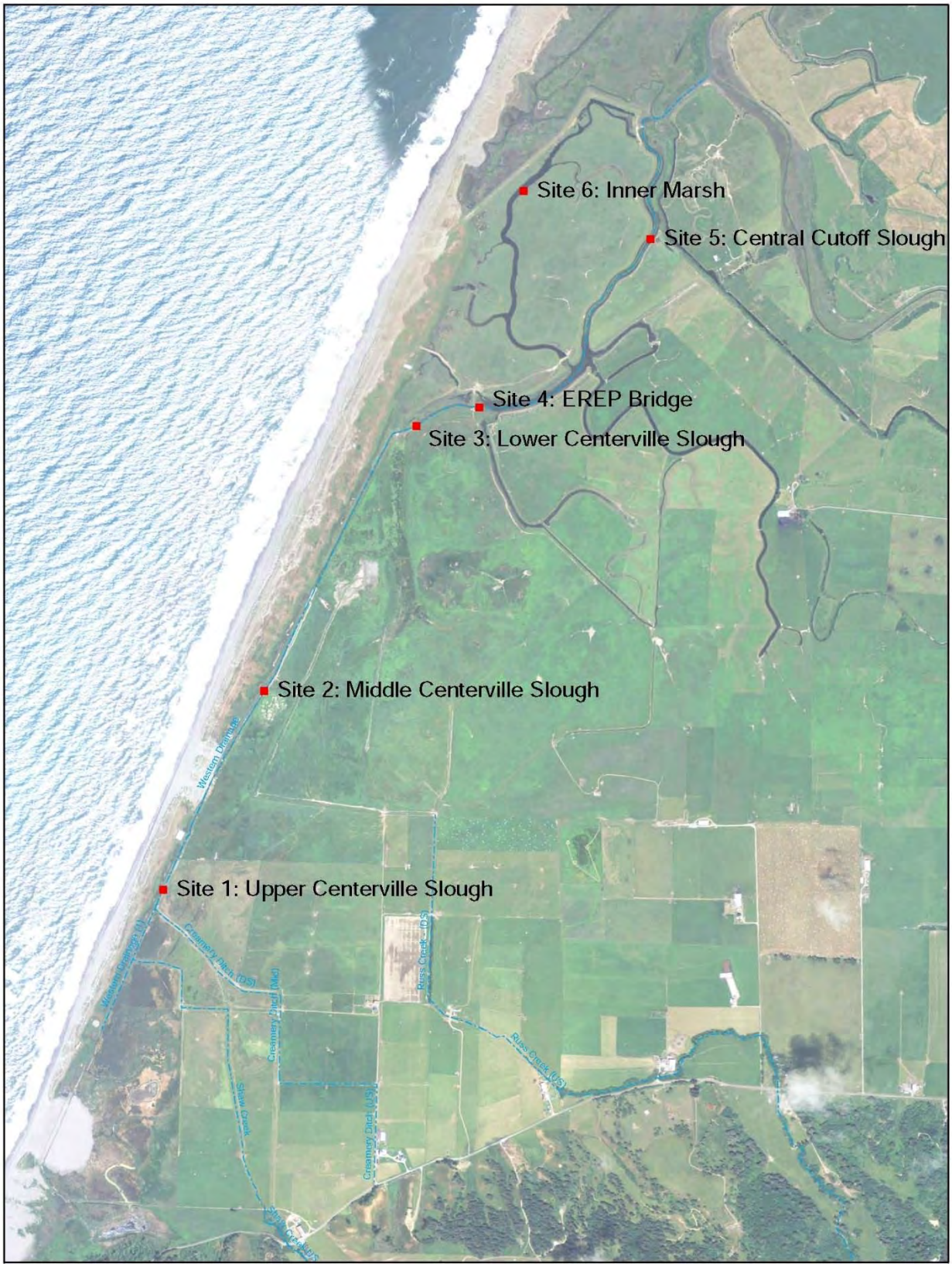


FIGURE 43: Locations of simulated velocity and salinity results.

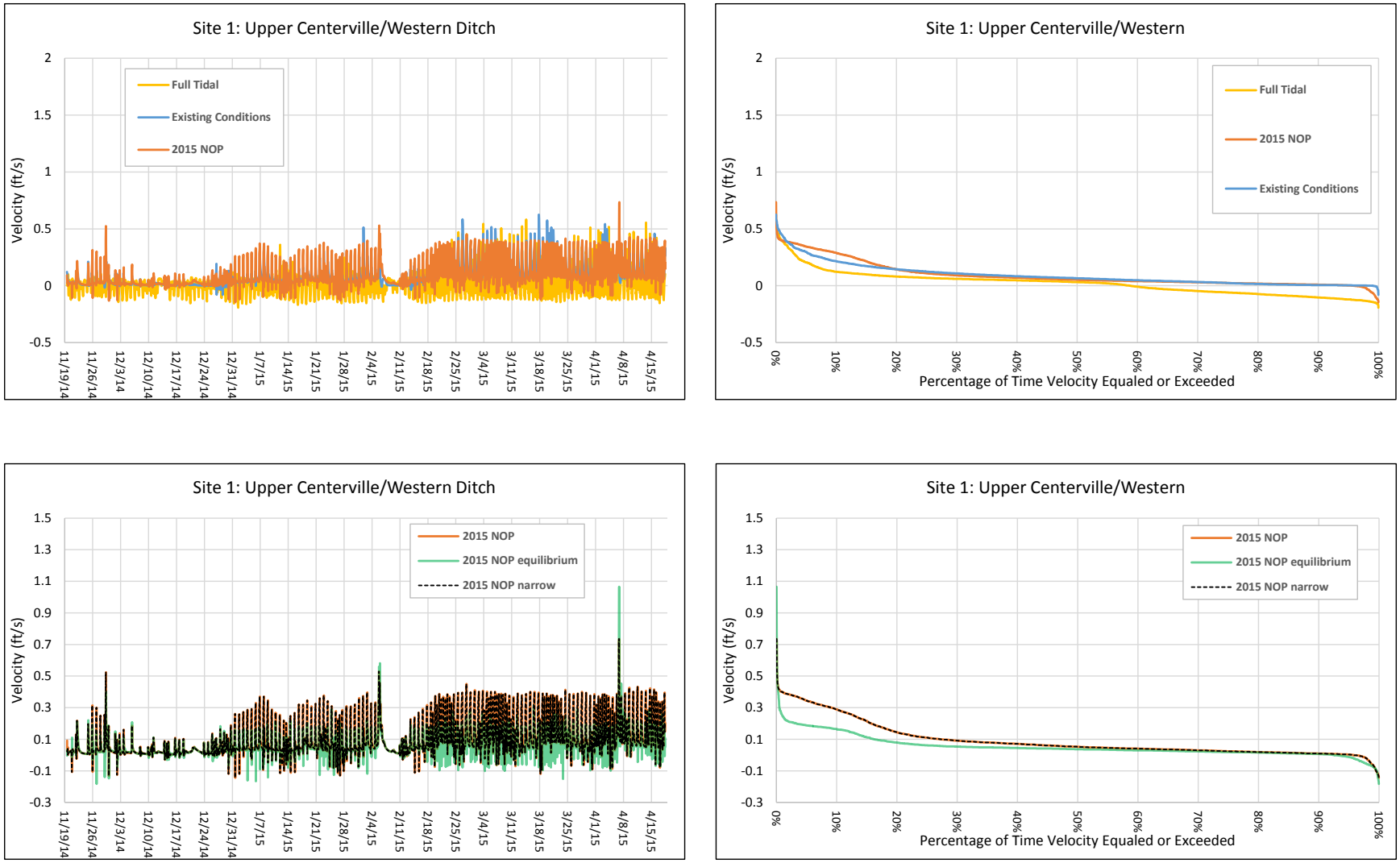


FIGURE 44a: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

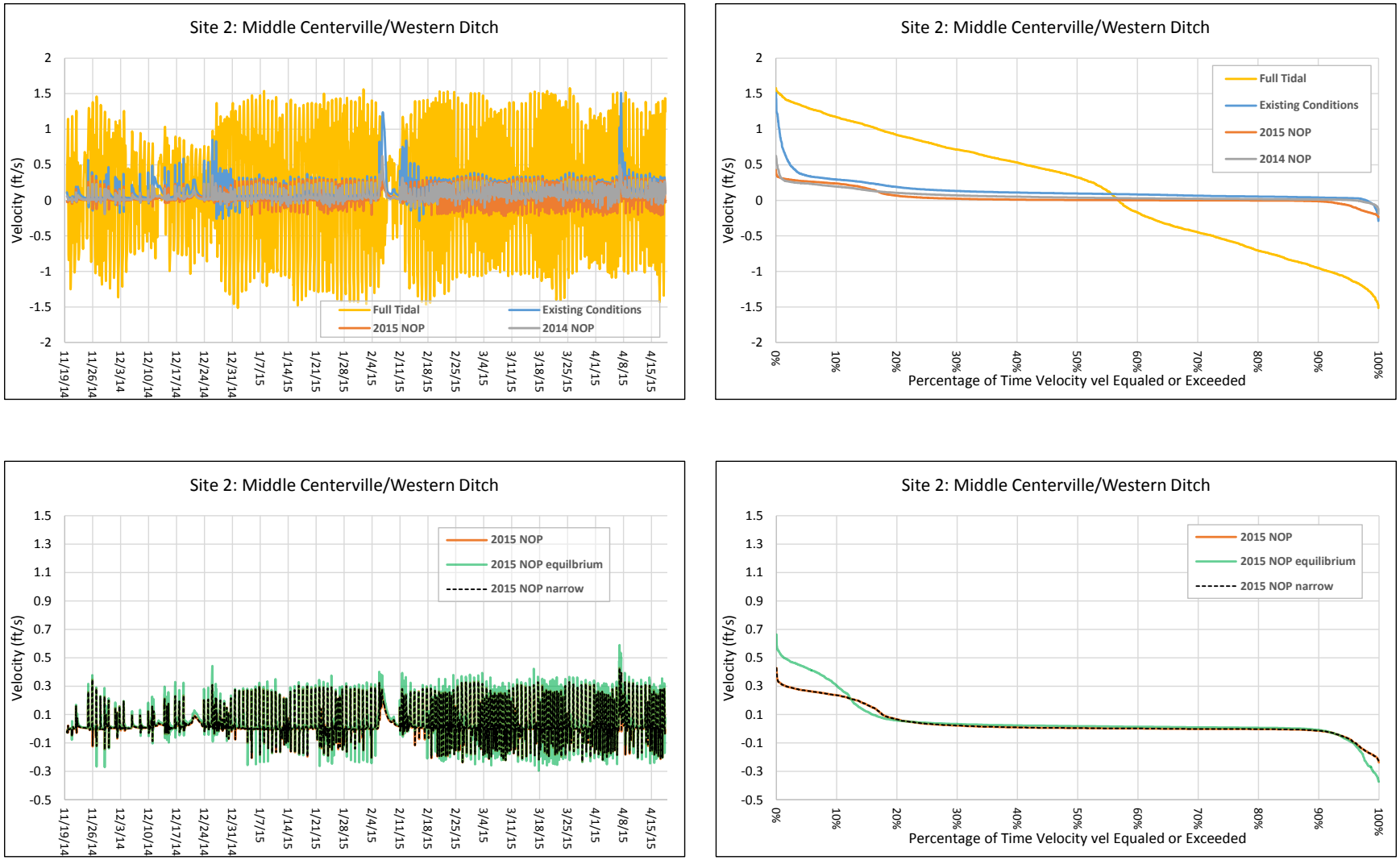


FIGURE 44b: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

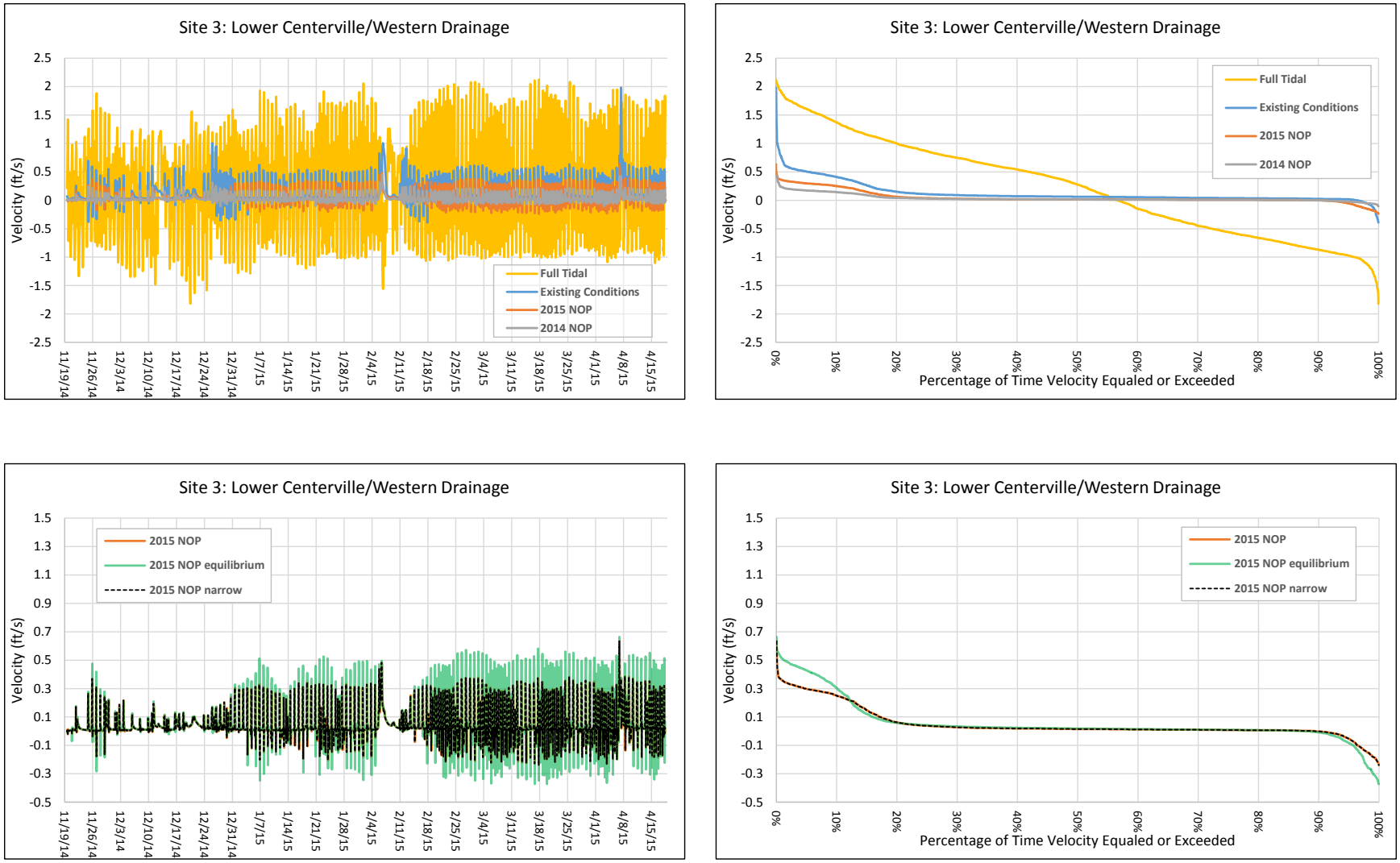


FIGURE 44c: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

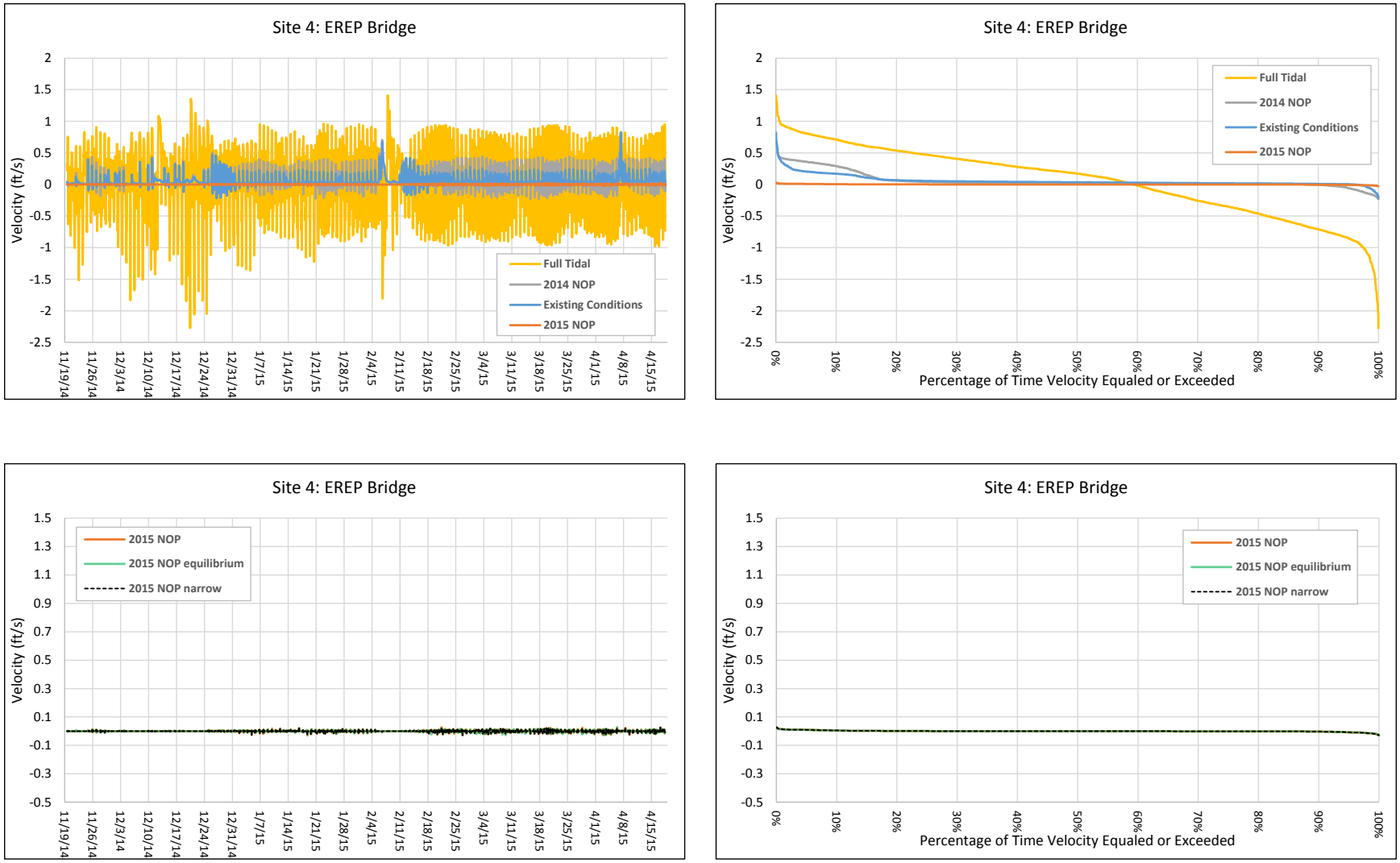


FIGURE 44d: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

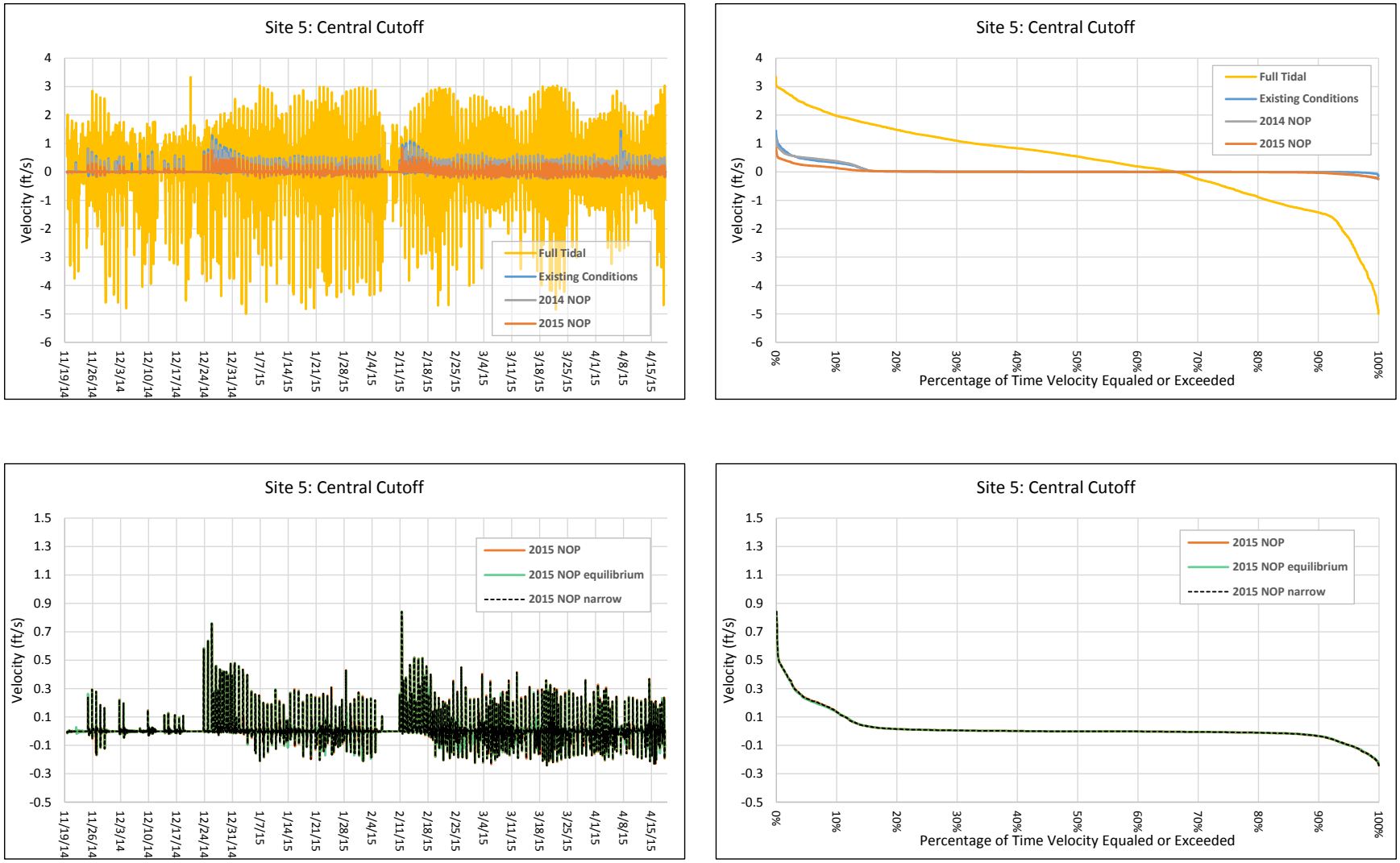


FIGURE 44e: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

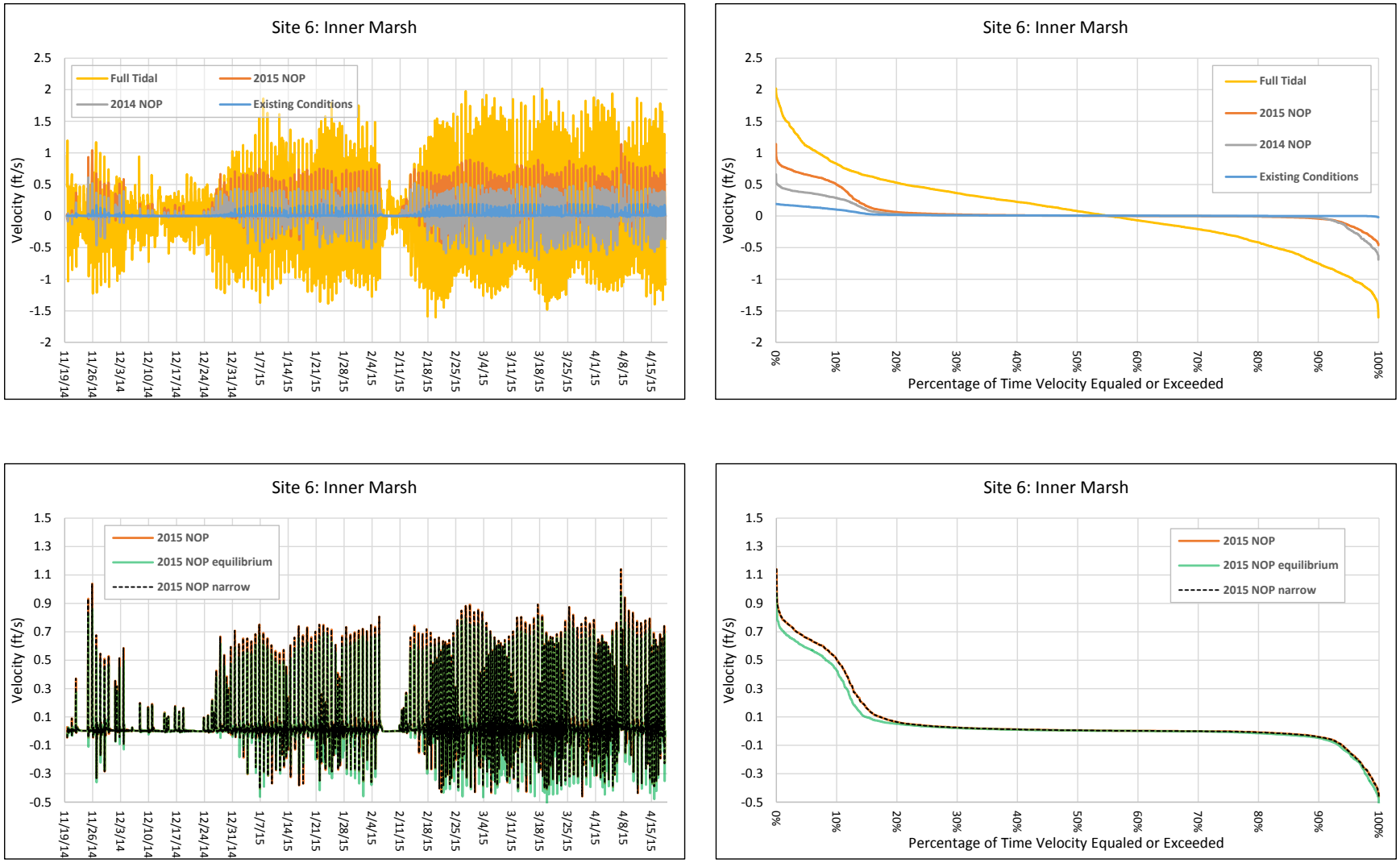


FIGURE 44f: Simulated velocities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

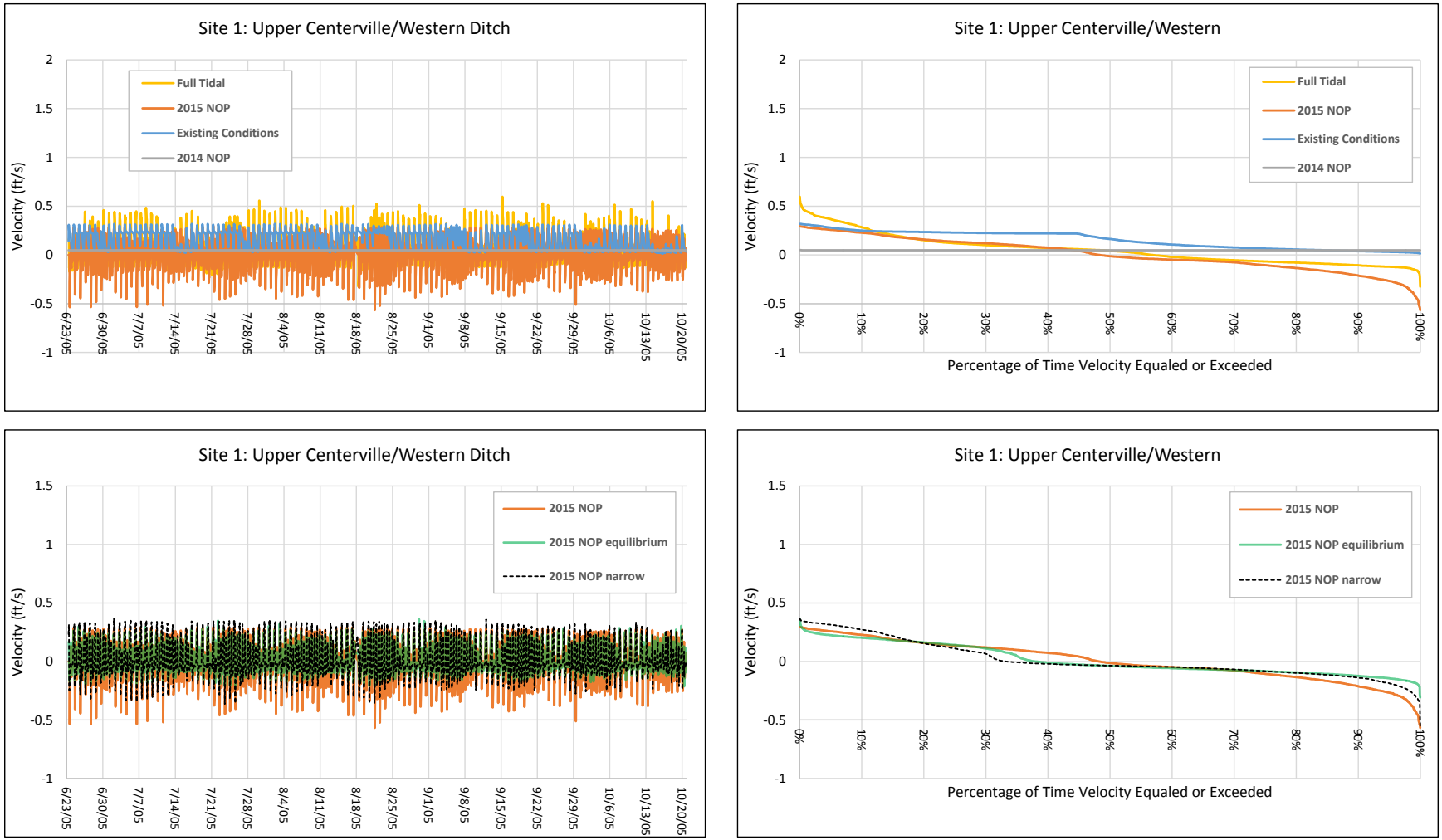


FIGURE 45a: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

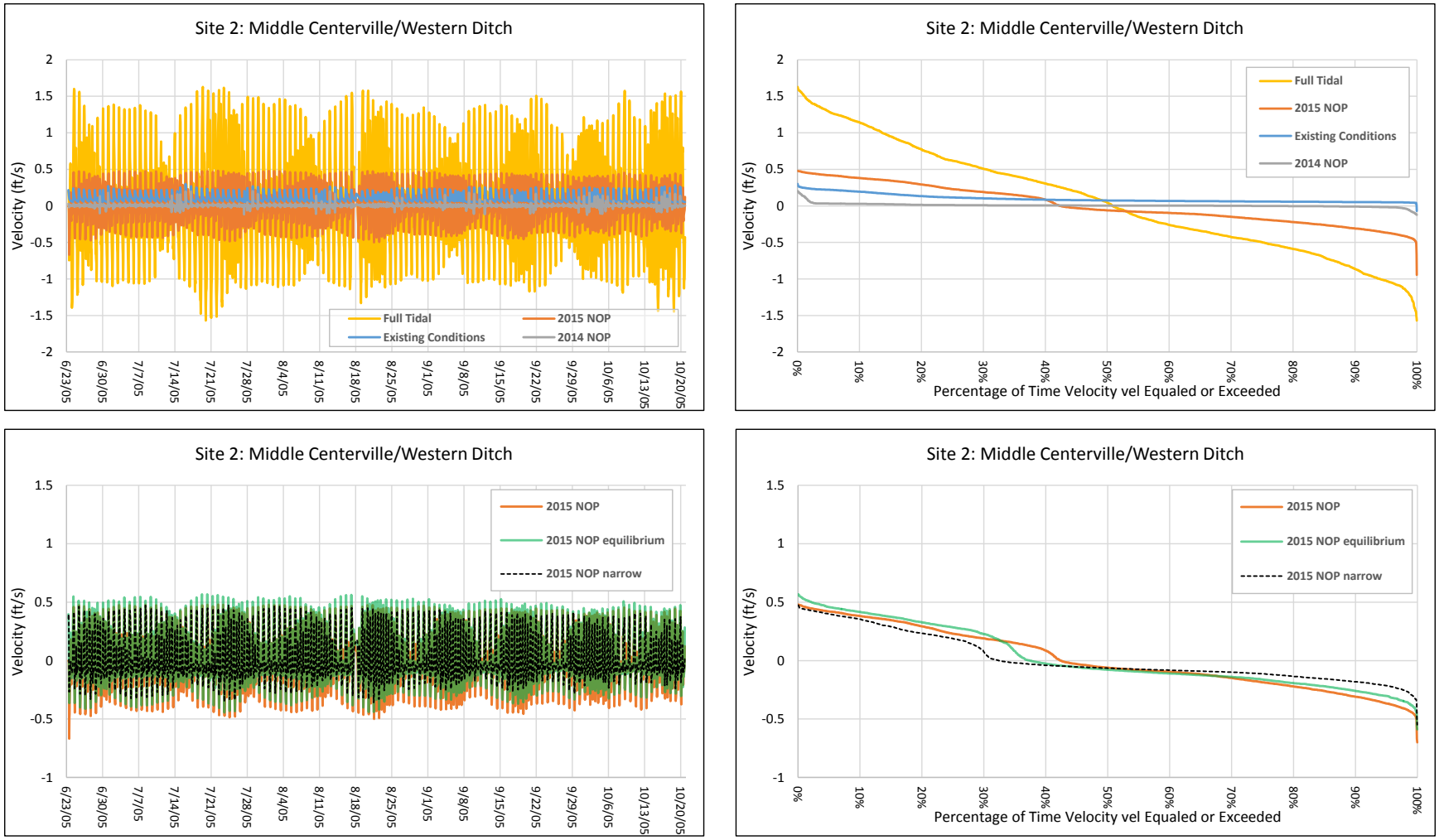


FIGURE 45b: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

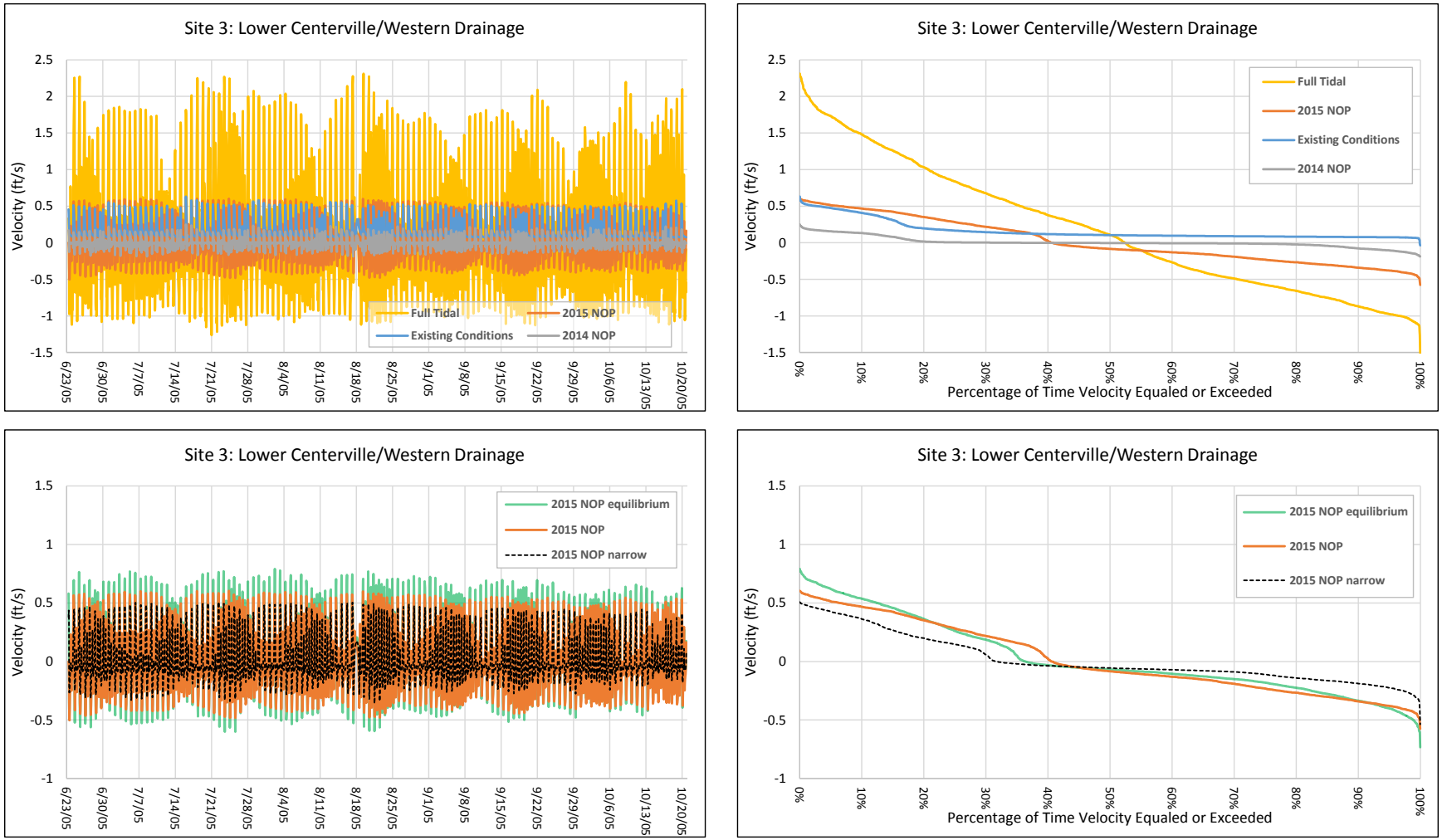


FIGURE 45c: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

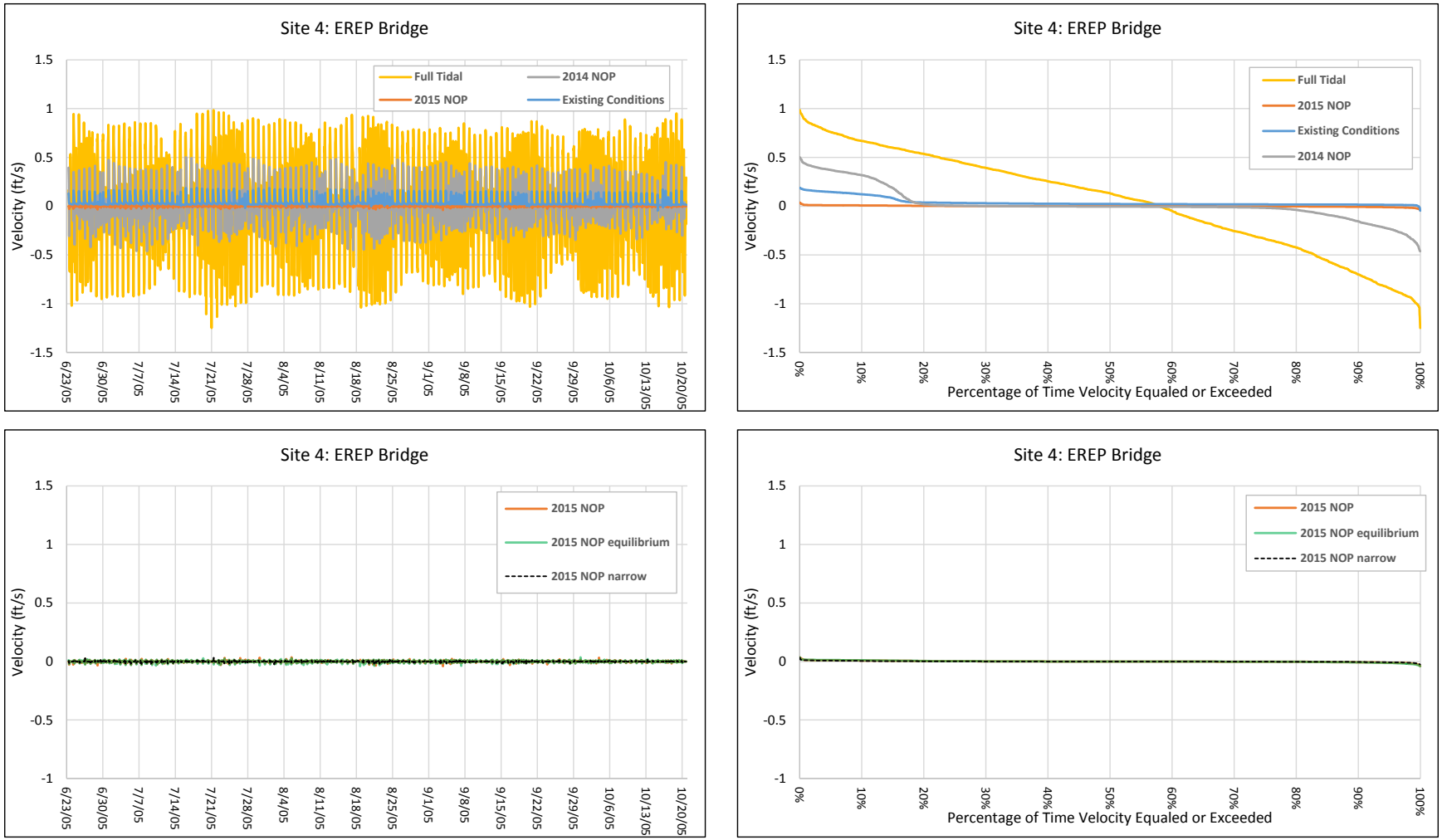


FIGURE 45d: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

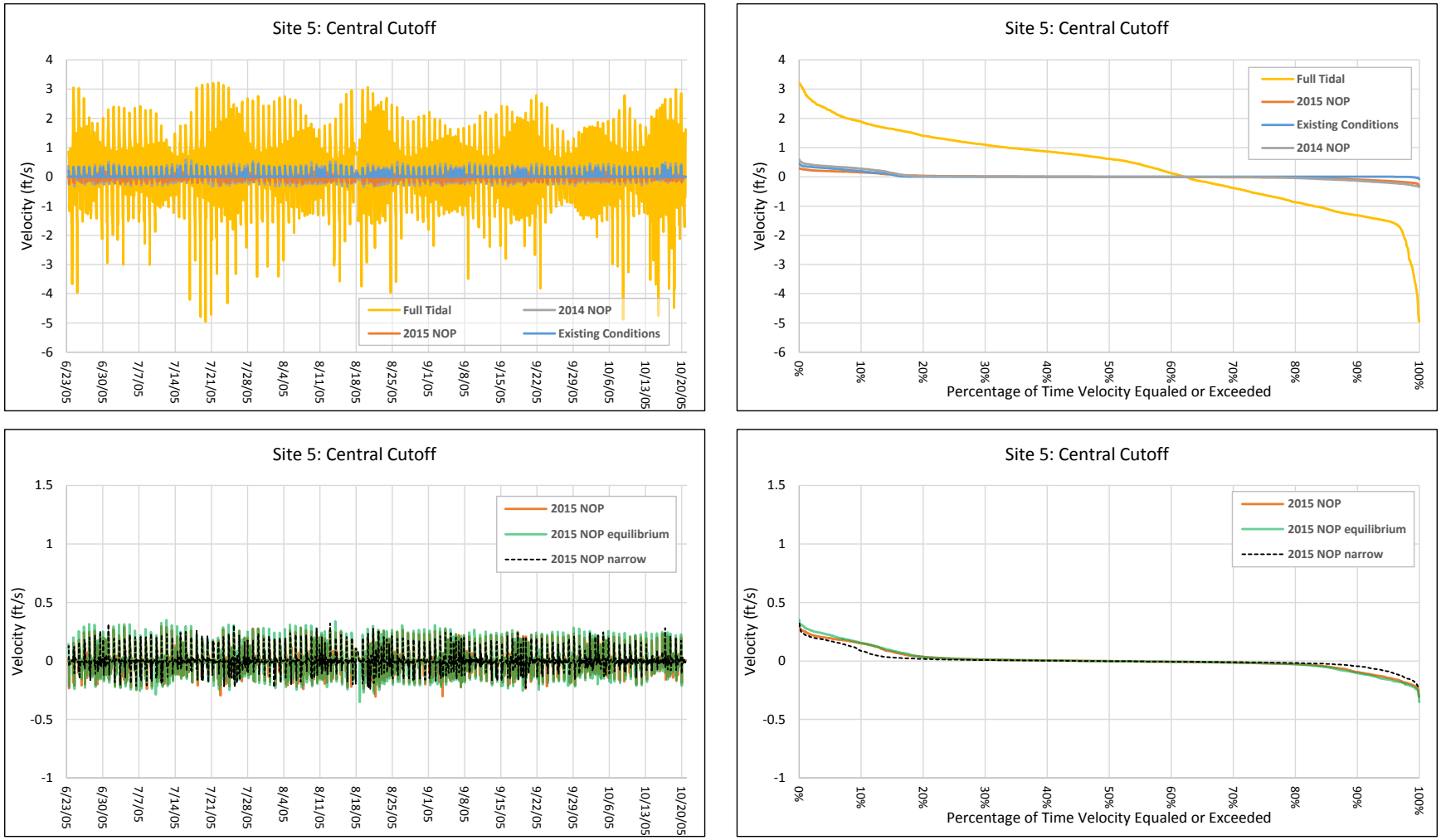


FIGURE 45e: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

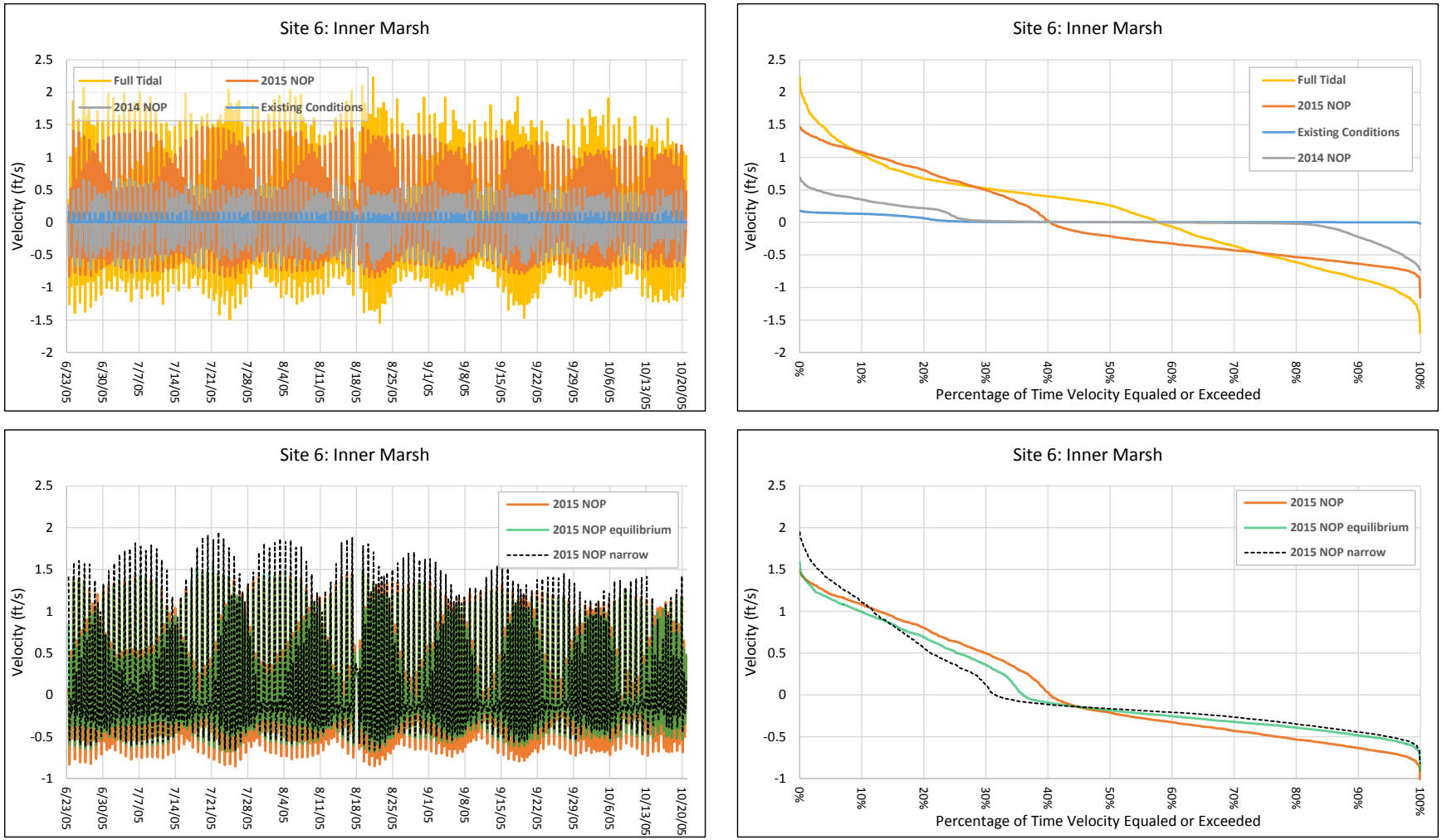


FIGURE 45f: Simulated velocities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated velocity time-series graphs for each alternative. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

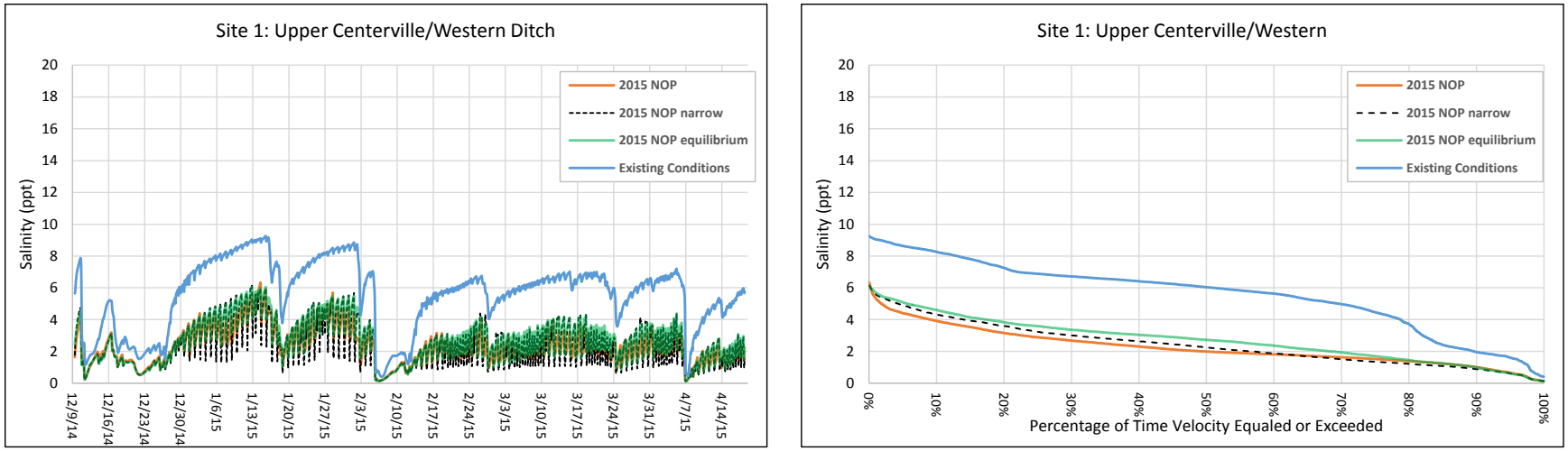


FIGURE 46a: Simulated salinities for the 2014/15 winter period. See Figure 24 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.

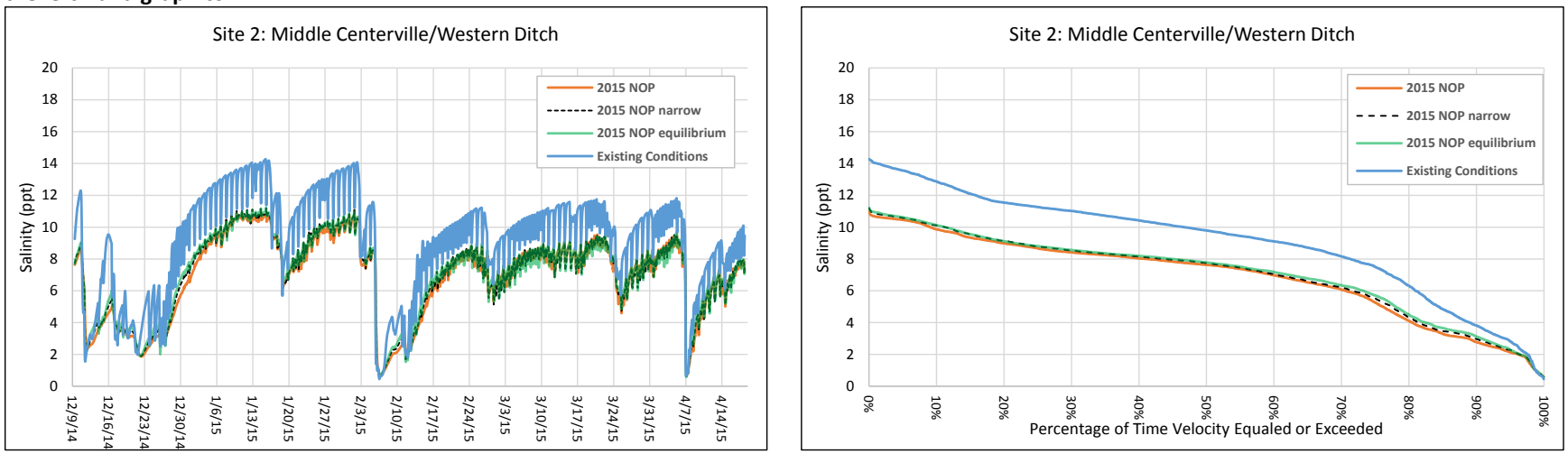
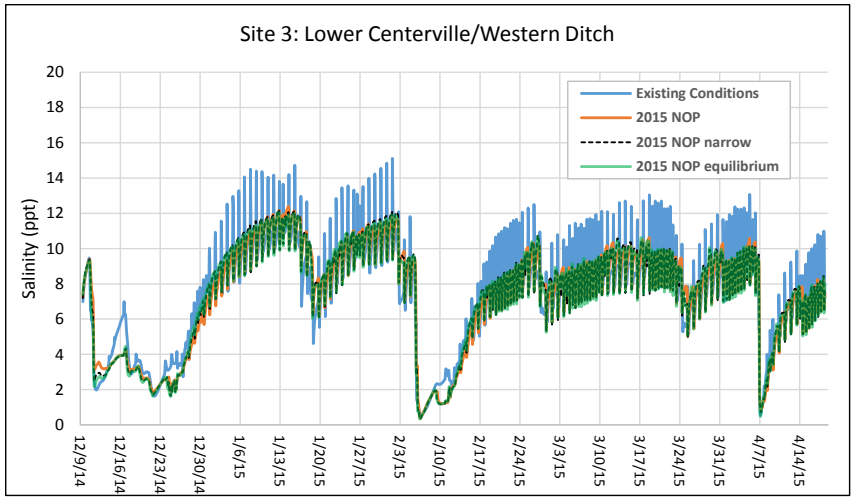


FIGURE 46b: Simulated salinities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



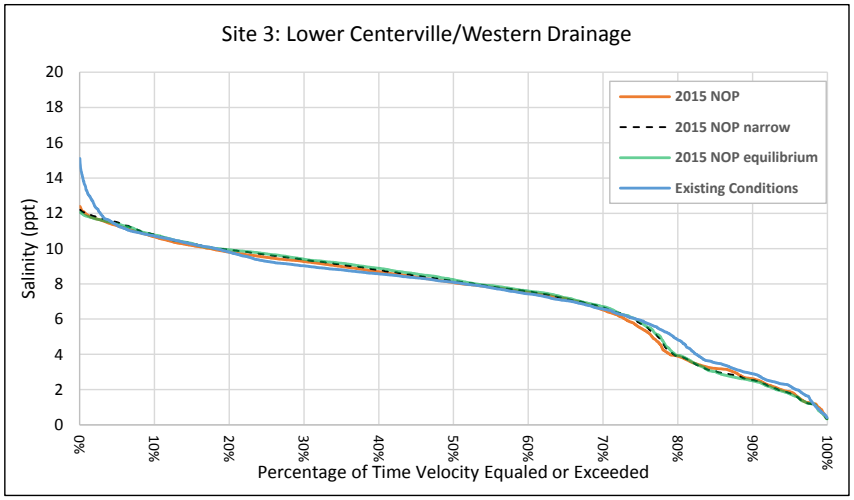
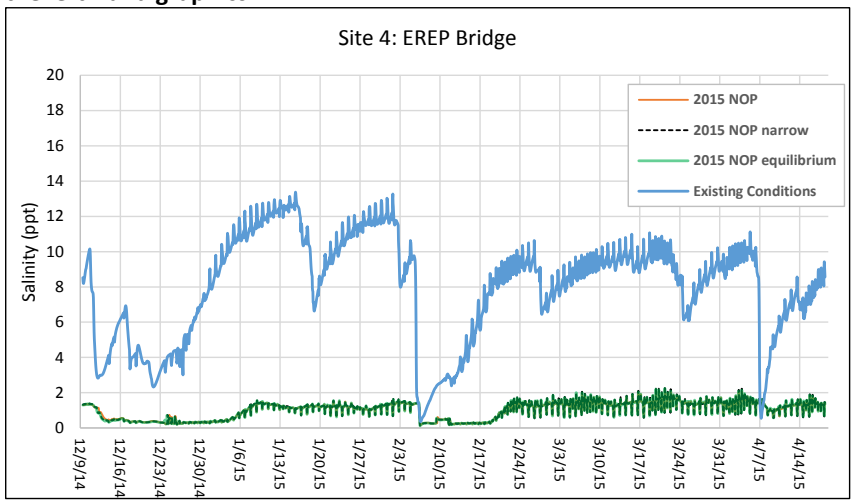


FIGURE 46c: Simulated salinities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



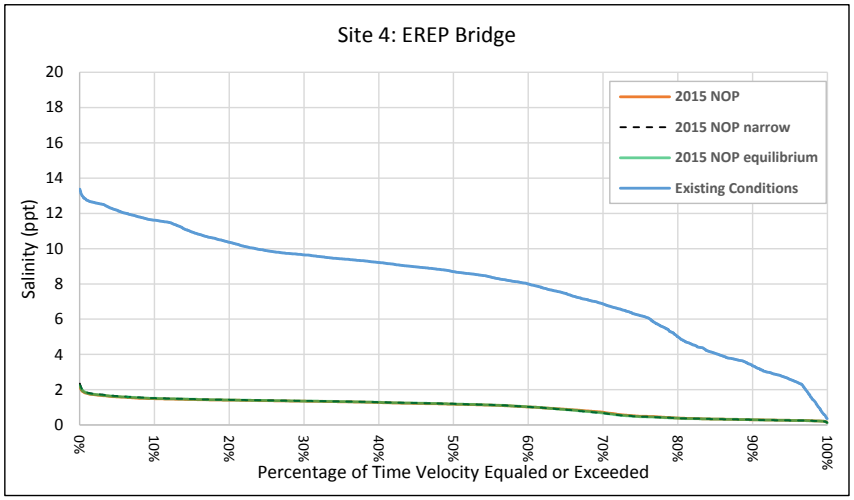


FIGURE 46d: Simulated salinities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.

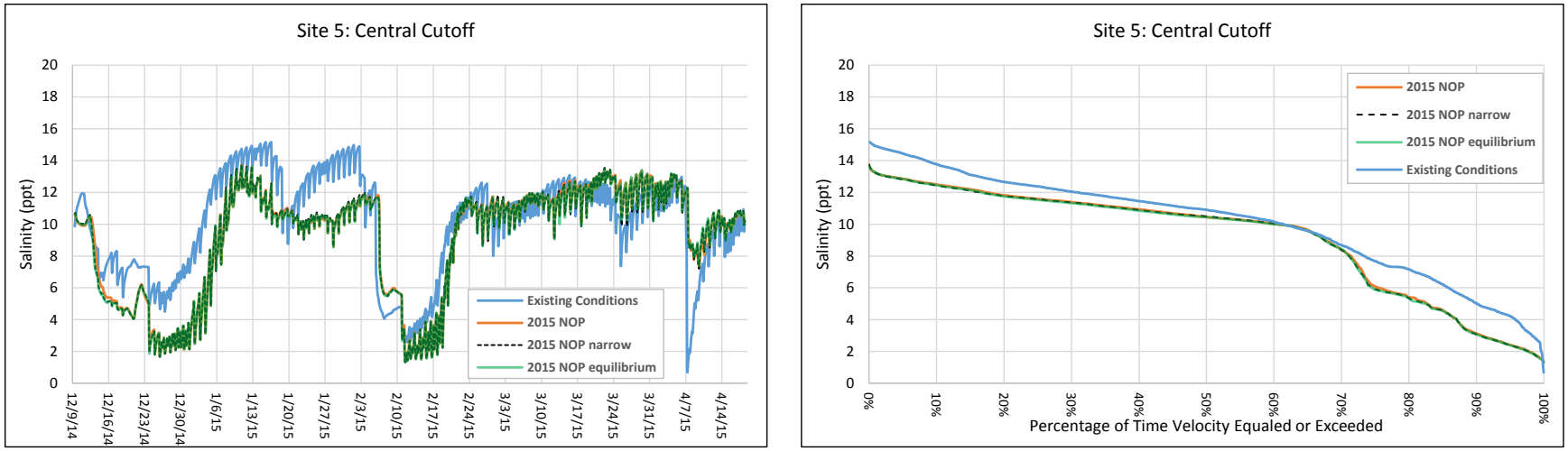


FIGURE 46e: Simulated salinities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.

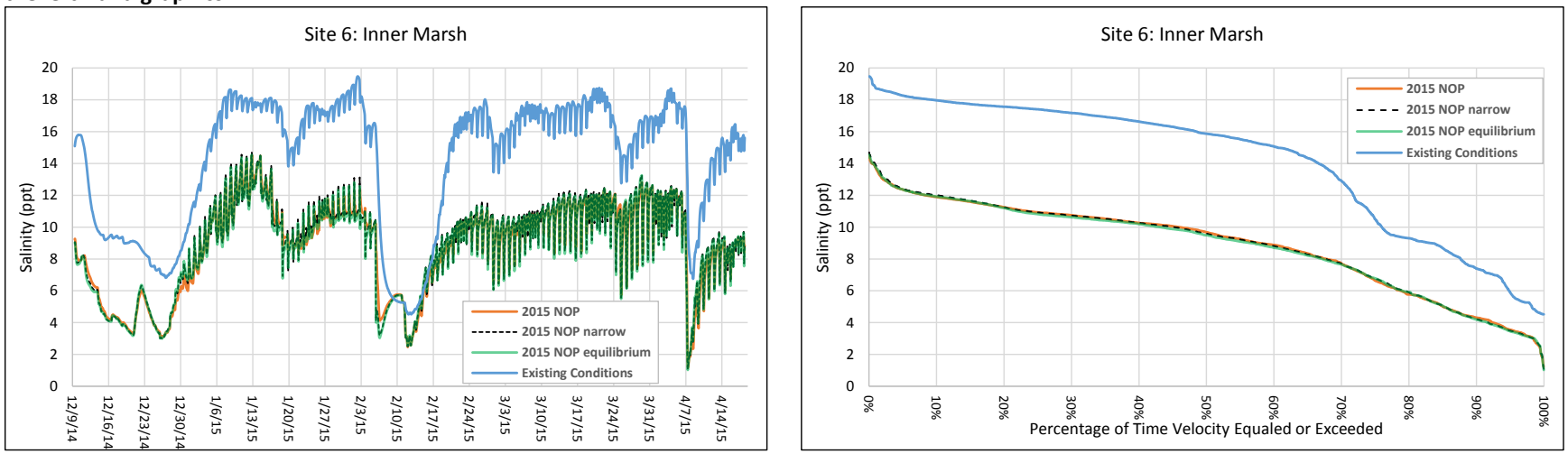


FIGURE 46f: Simulated salinities for the 2014/15 winter period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.

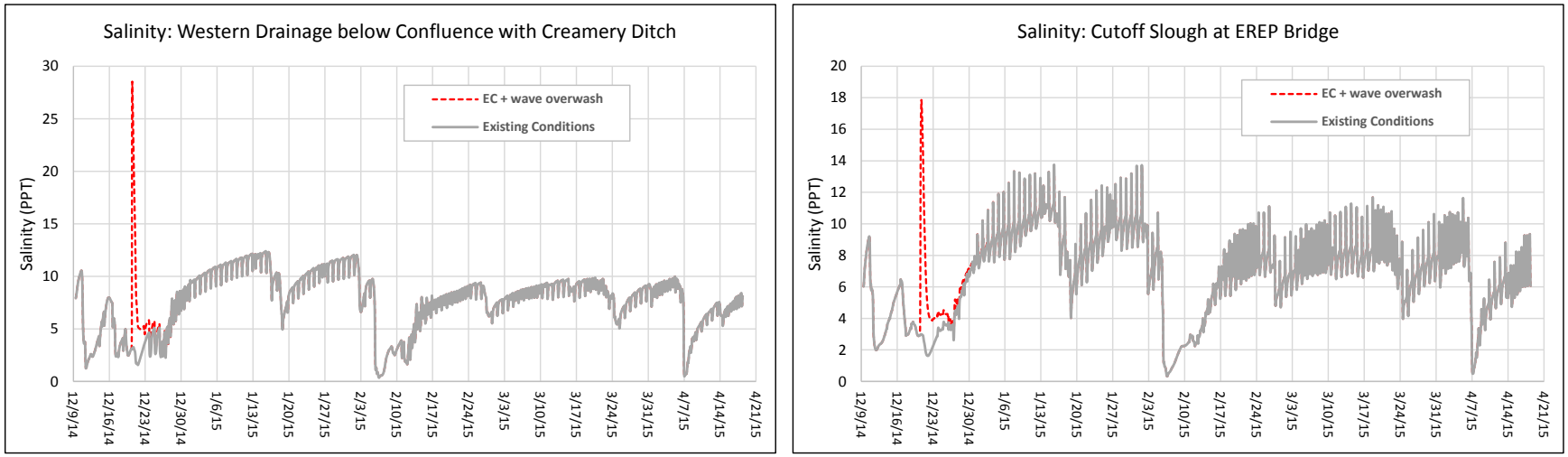
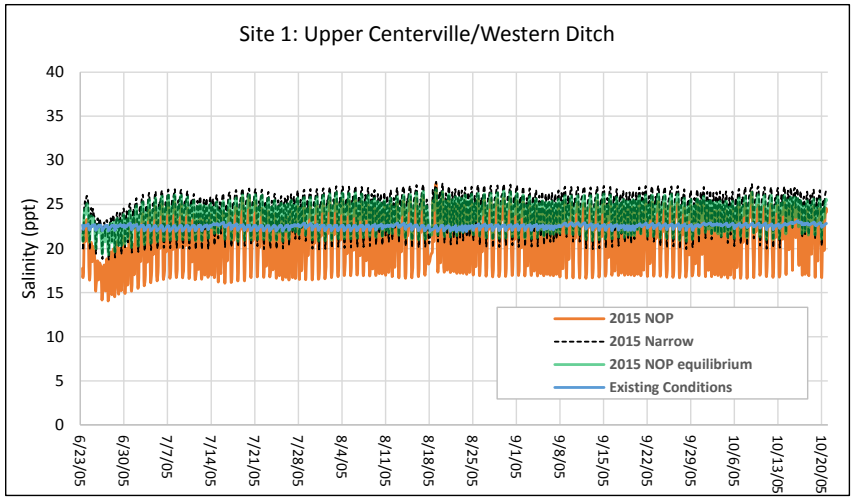


FIGURE 47: Simulated salinities of Existing Conditions wave overwash event on 12/20/14.



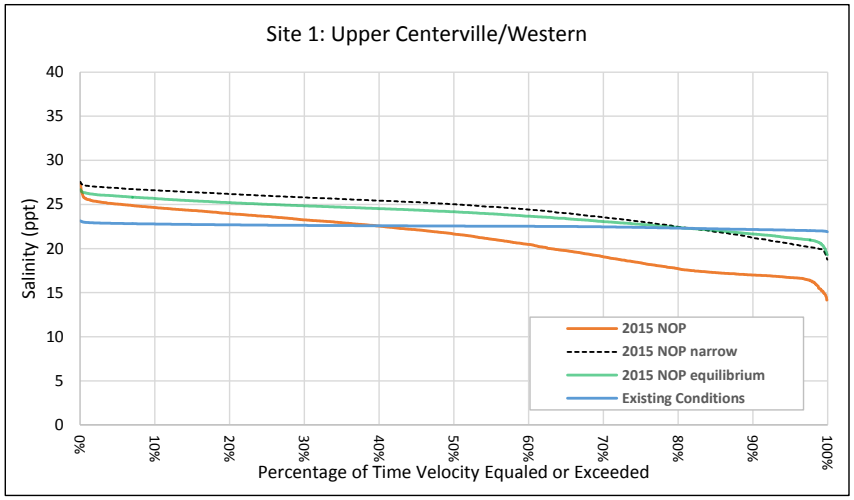
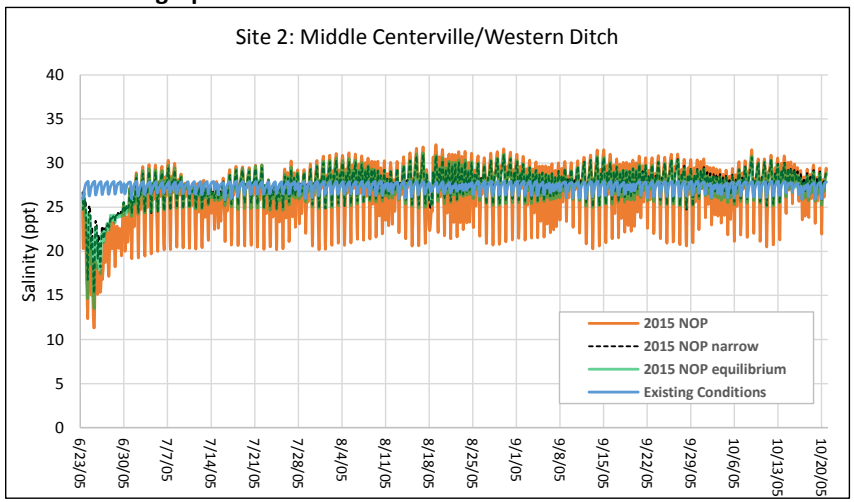


FIGURE 48a: Simulated salinities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



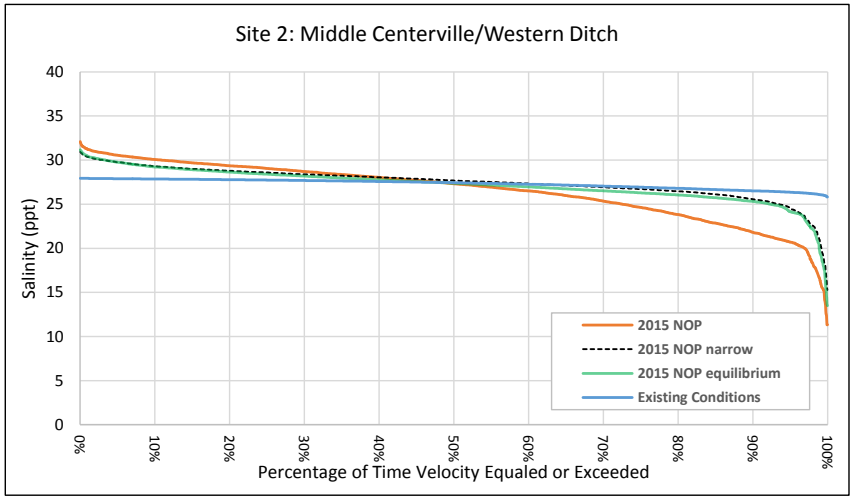
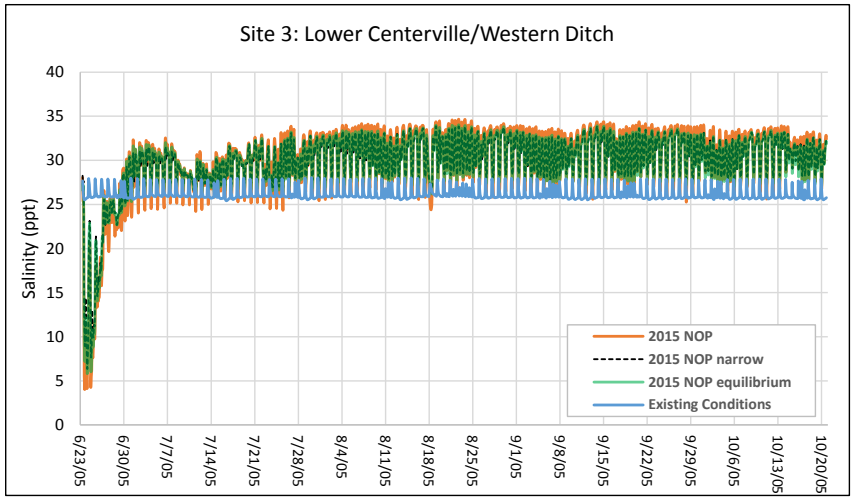


FIGURE 48b: Simulated salinities for the 2005 summer period. See Figure 24 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



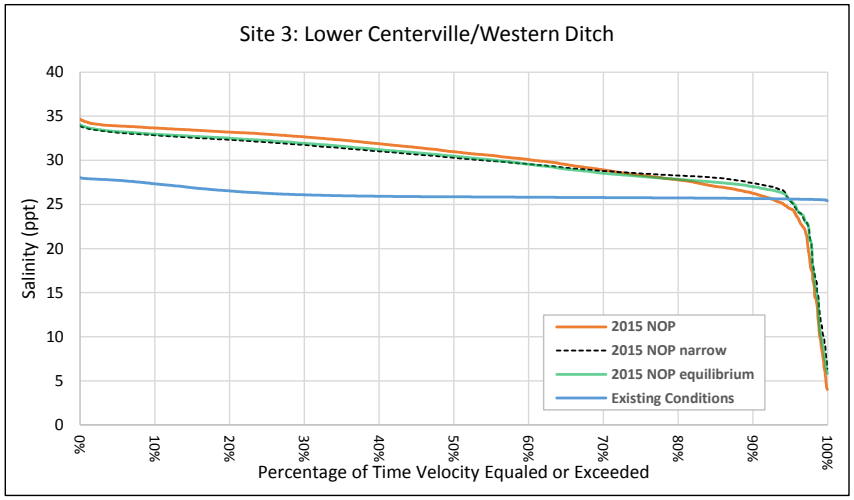
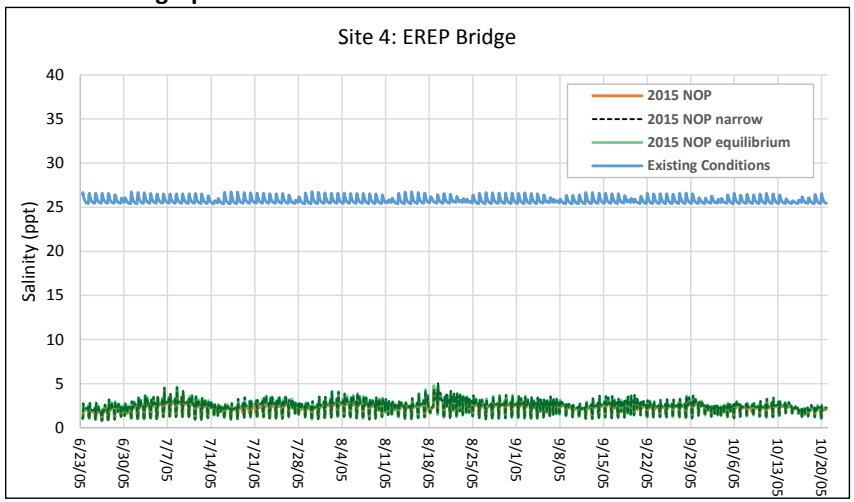


FIGURE 48c: Simulated salinities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



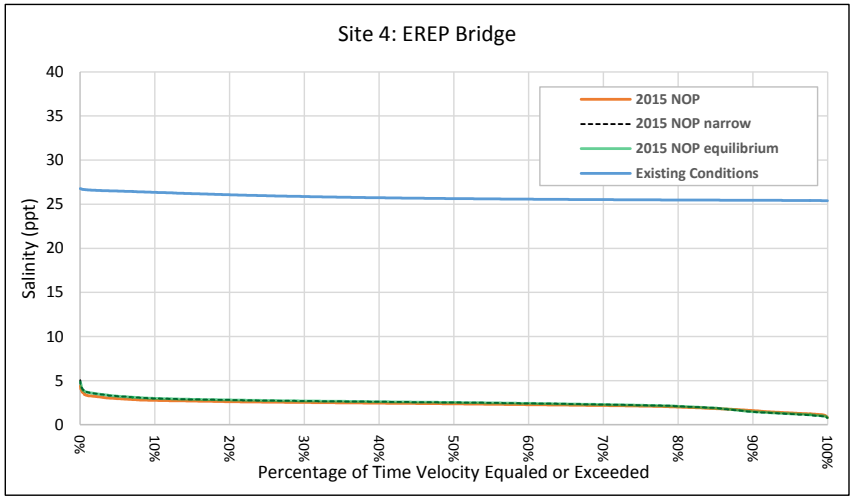
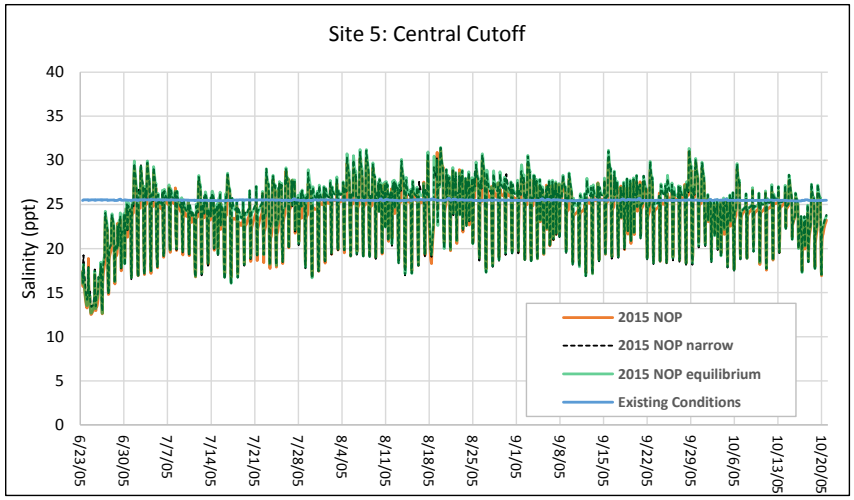


FIGURE 48d: Simulated salinities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



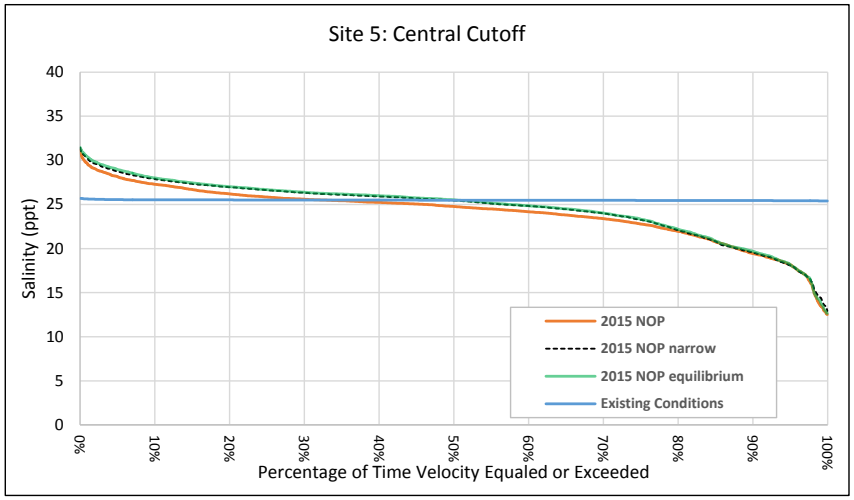
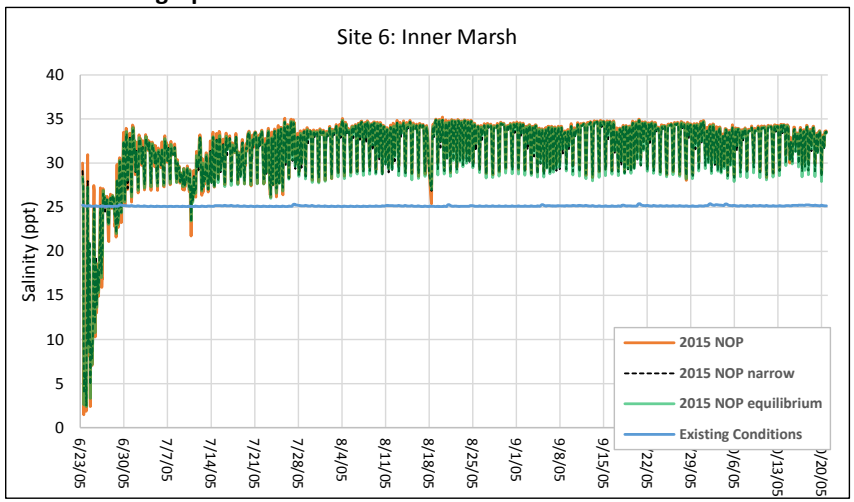


FIGURE 48e: Simulated salinities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.



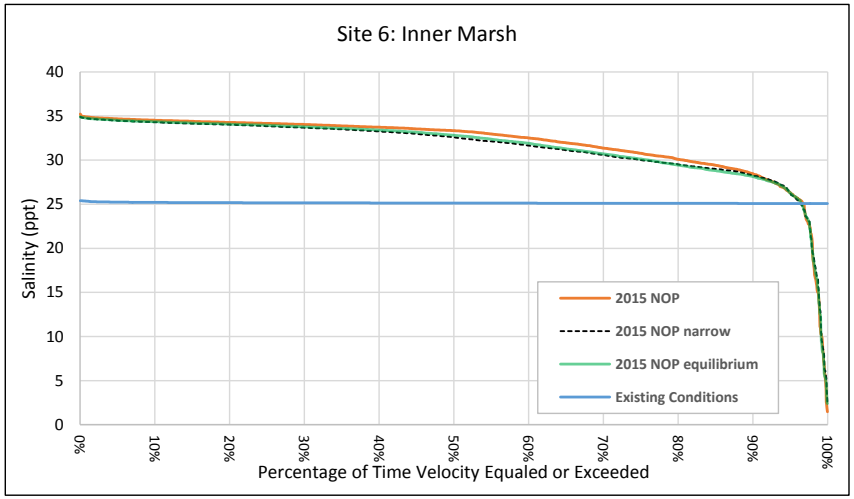


FIGURE 48f: Simulated salinities for the 2005 summer period. See Figure 43 for site locations. Graphs on the left are simulated salinity time-series graphs for the 2015 NOP alternatives and existing conditions. Graphs on the right are salinity exceedance probability curves for each of the periods simulated in the left-hand graphics.

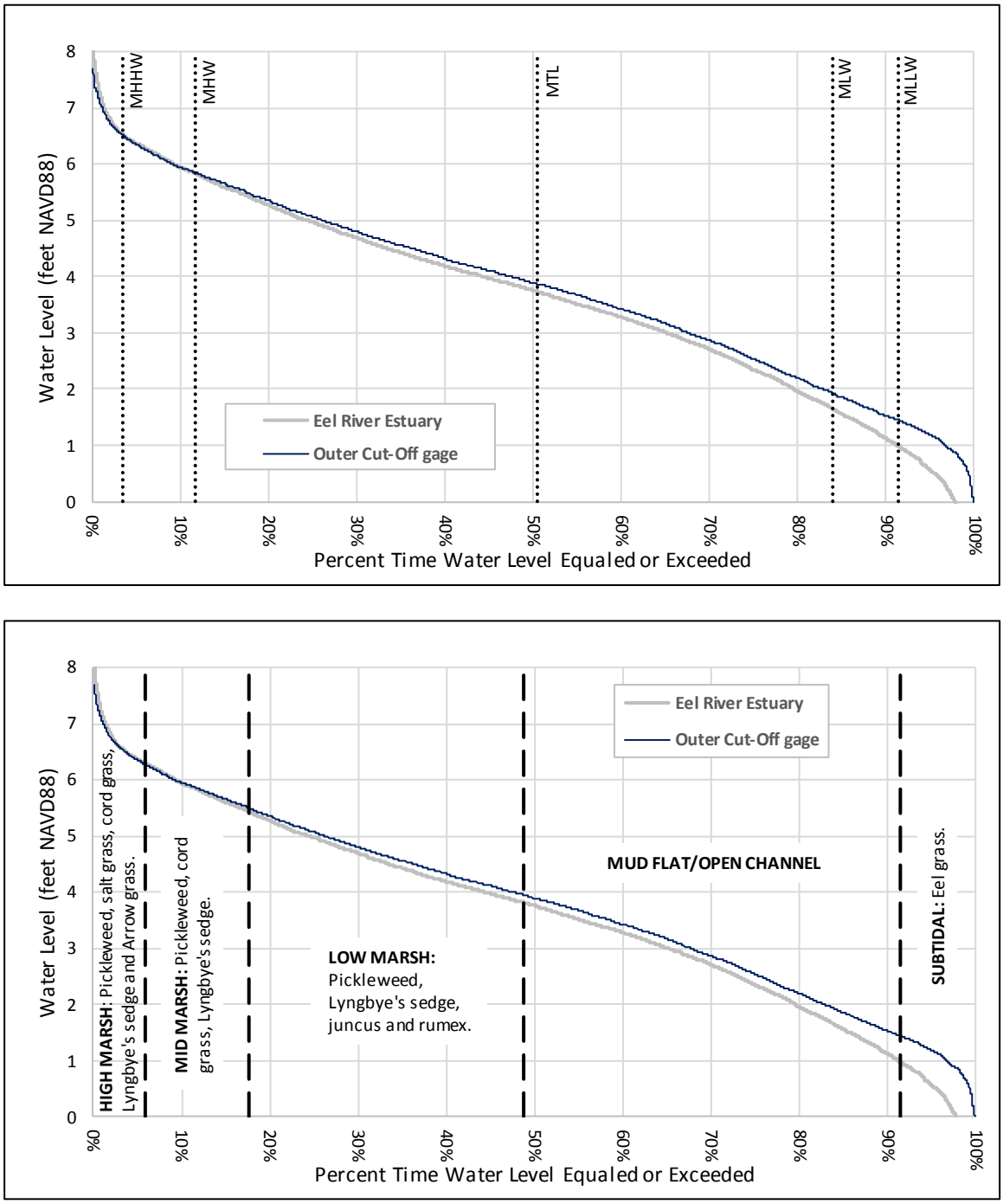
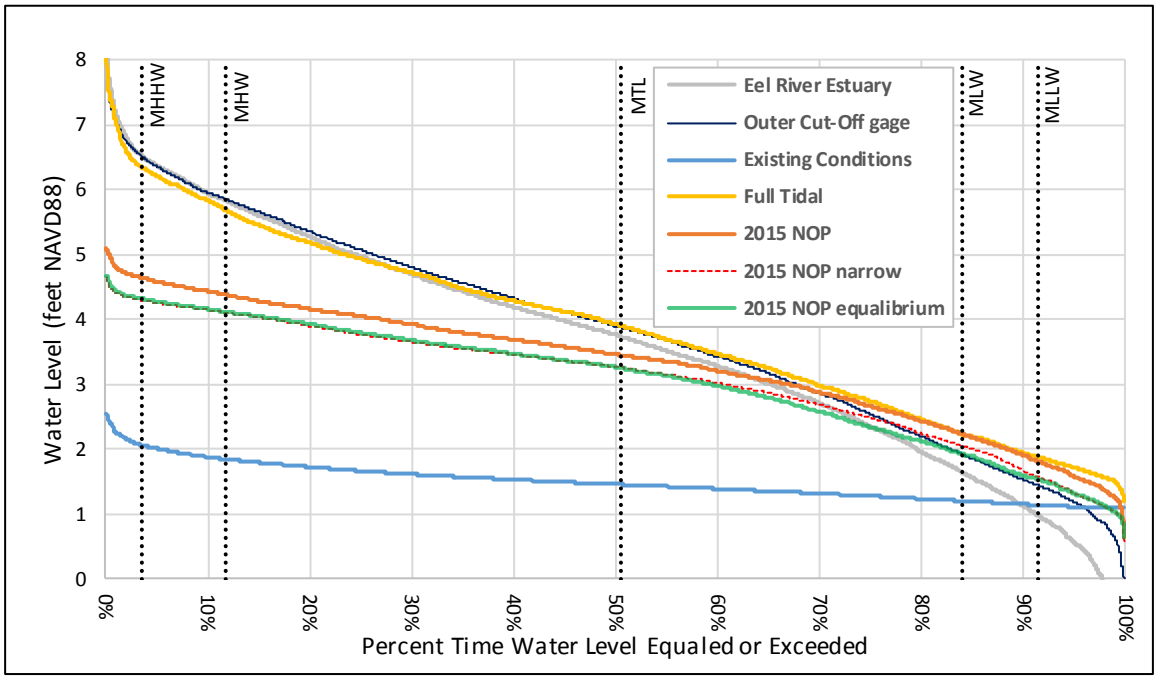


FIGURE 49: Duration and level of summer tidal exchange in Eel River Estuary and outer Cut-Off Slough tide gate in relation to tidal datums (upper graph), vegetation communities and marsh types (lower graph). Summer simulation period 6/23/05 to 10/20/05.



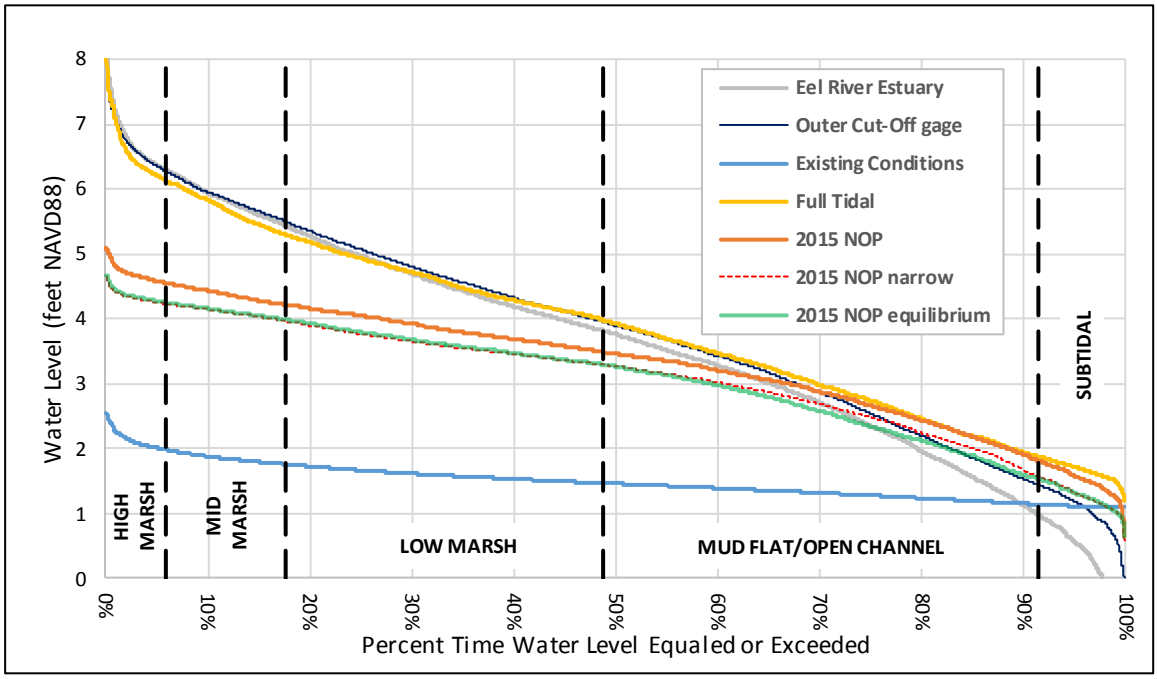


FIGURE 50: Comparison of simulated summer water level inundation duration curves for Project alternatives with tidal datums and marsh habitat zones. Summer simulation period 6/23/05 to 10/20/05.

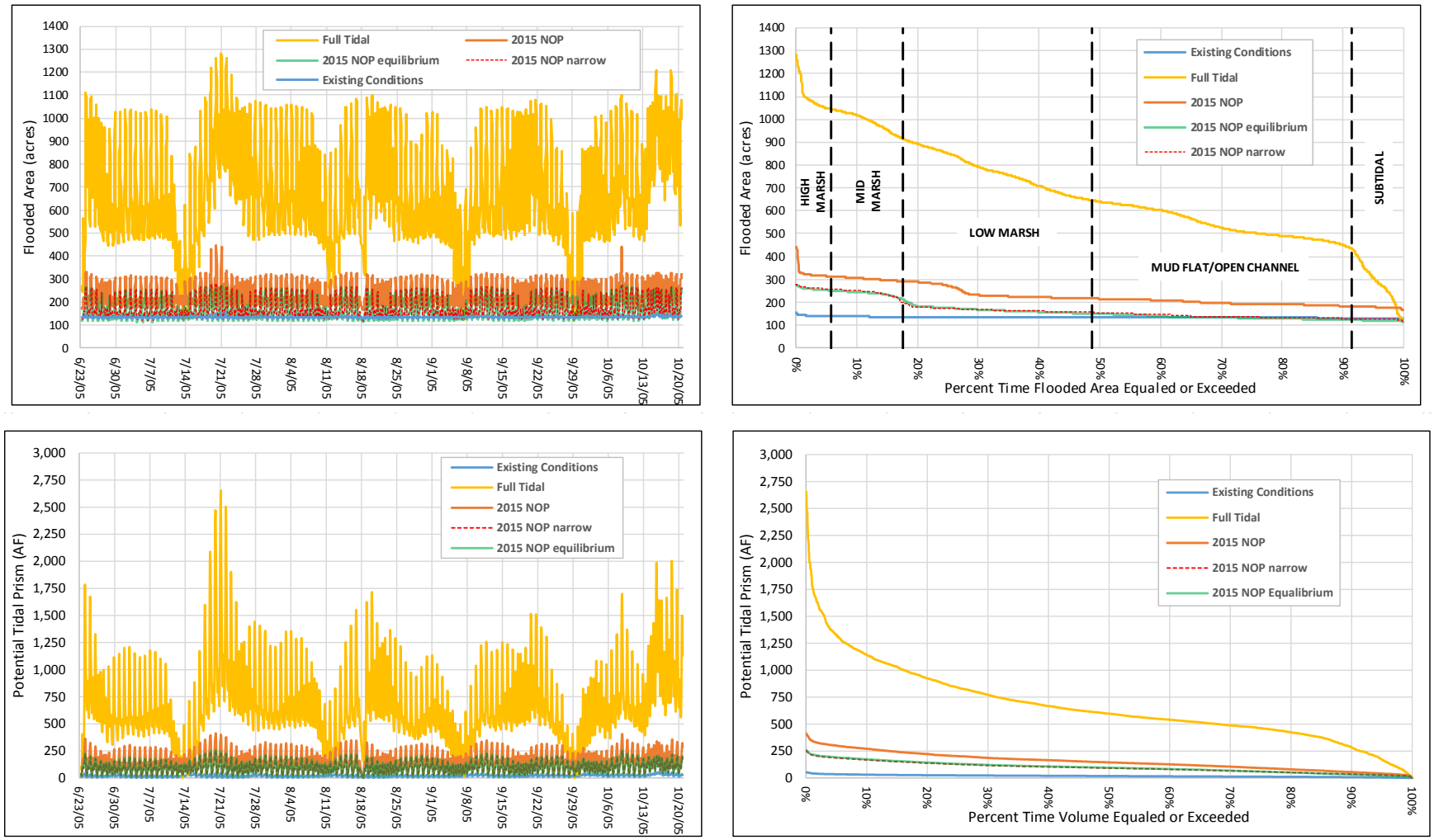


FIGURE 51: Simulated total project flooded areas (in acres) and volumes (as potential tidal prism in acre-ft [AF]) for the 2005 summer period. Graphs on the left are simulated hydrographs for each alternative. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

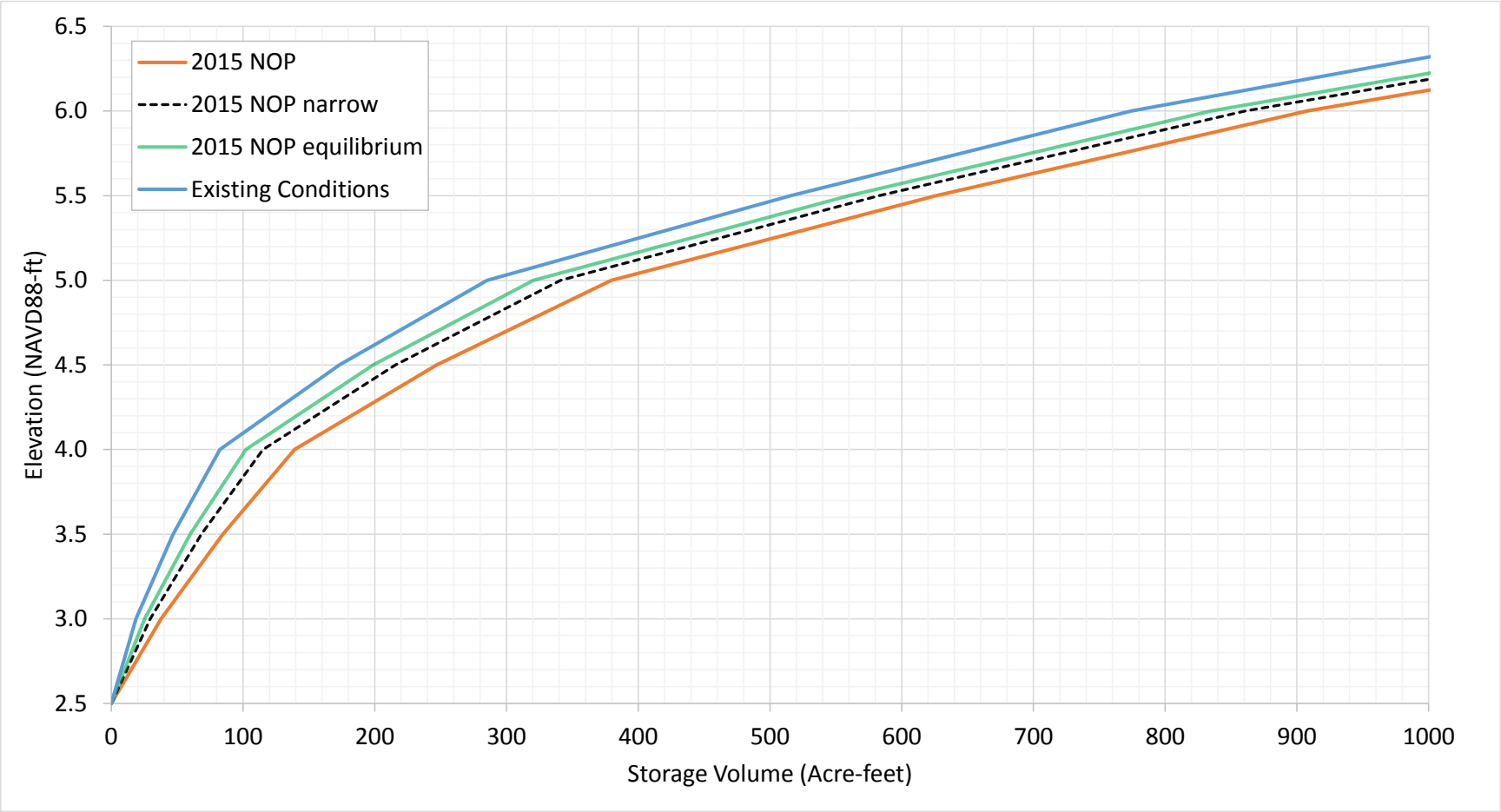


FIGURE 52: Flood storage-volume above datum elevation of 2.5-feet NAVD88 for selected project alternatives.

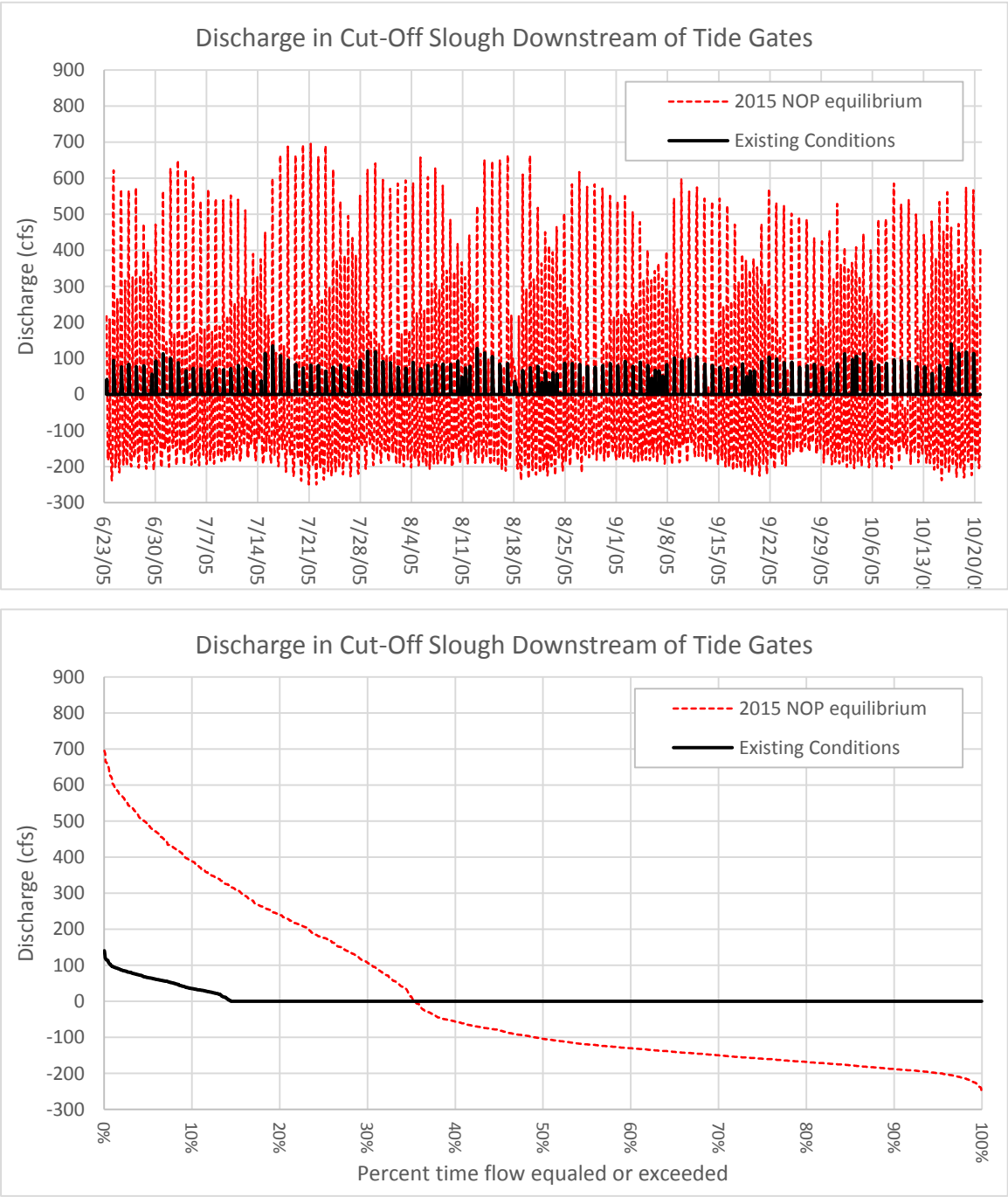


FIGURE 53: Simulated cumulative discharge through existing and project tide gates during 2005 summer period. Upper graph contains simulated discharge hydrographs, lower graph contains water level exceedance probability curves for data presented in upper graph.

FIGURE 54: Locations of simulated water level and velocity results on lower Cut-Off Slough and Salt River.

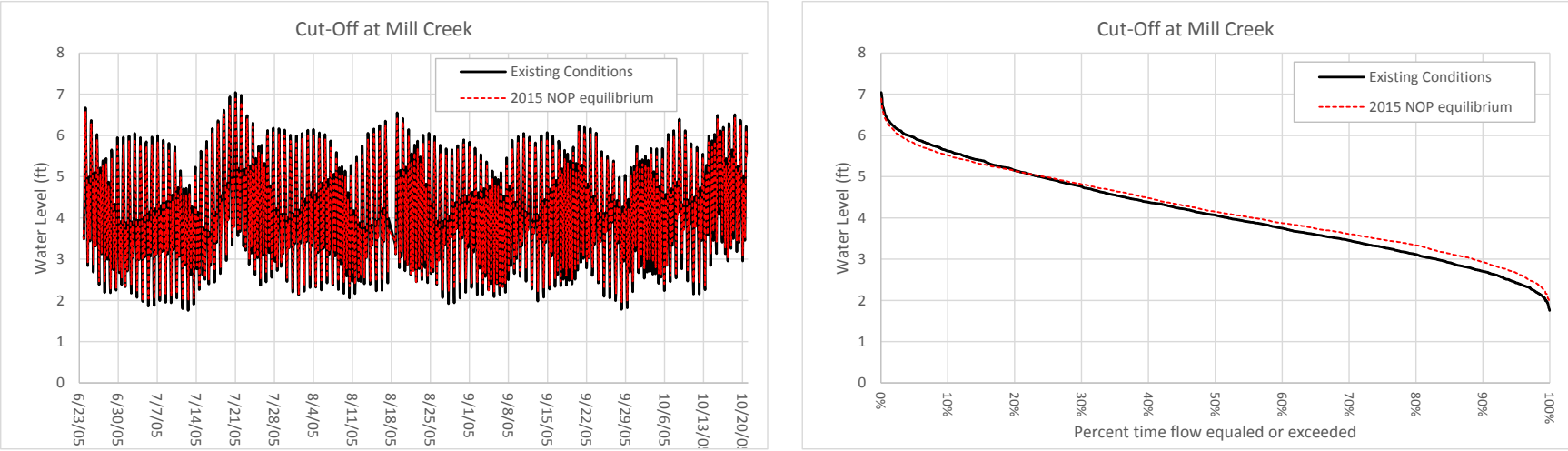


FIGURE 55a: Simulated pre- and post-project water levels in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated hydrographs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

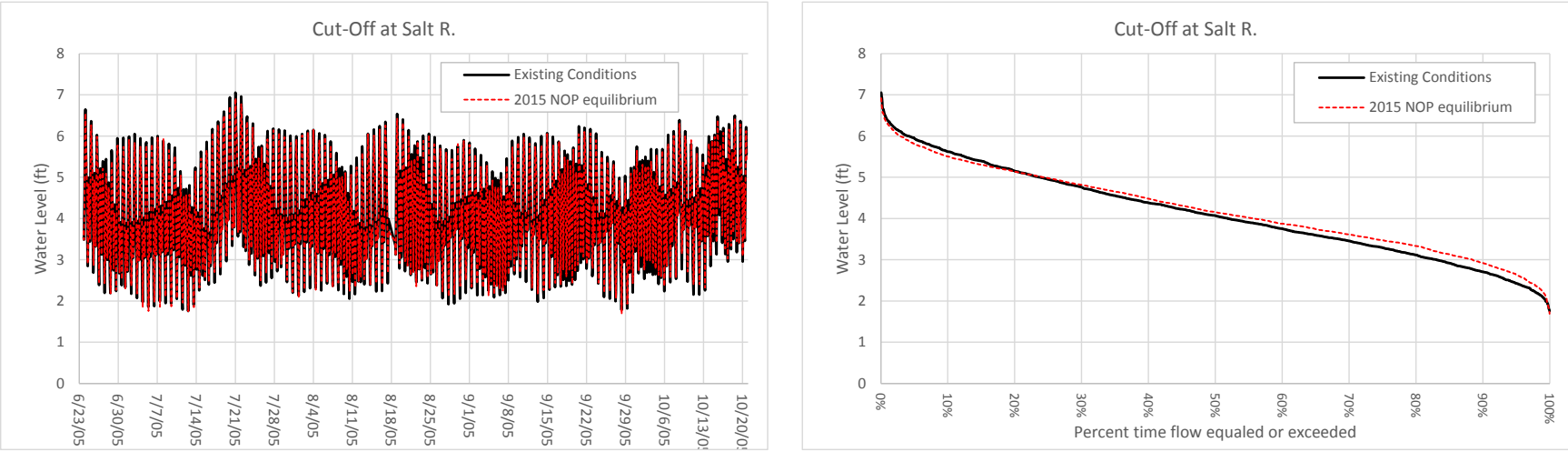


FIGURE 55b: Simulated pre- and post-project water levels in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated hydrographs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

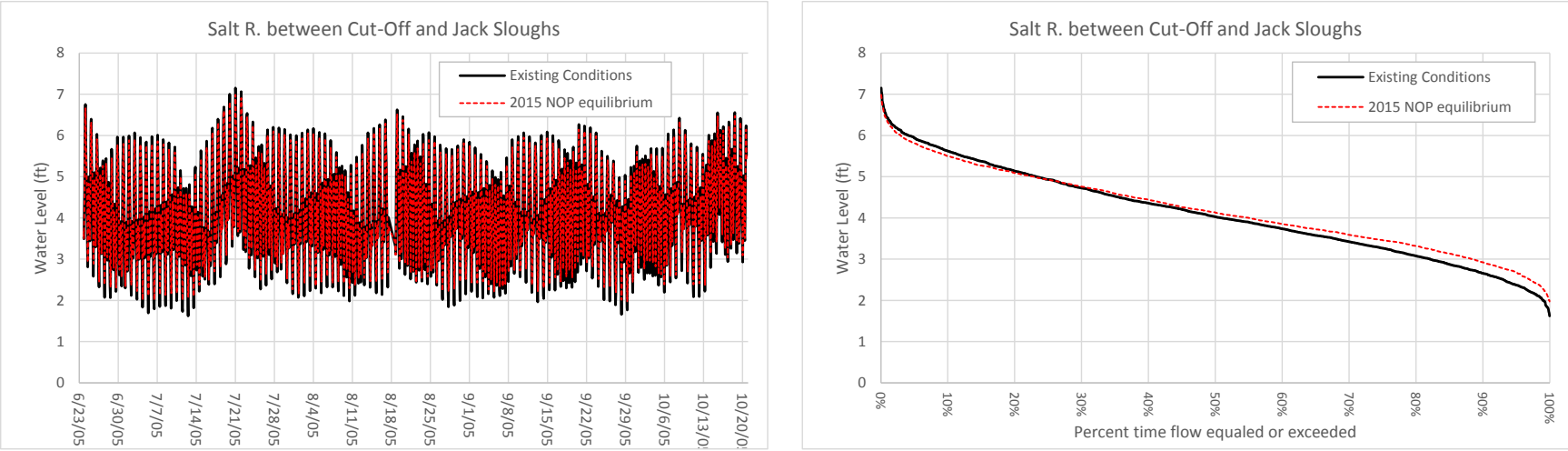


FIGURE 55c: Simulated pre- and post-project water levels in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated hydrographs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

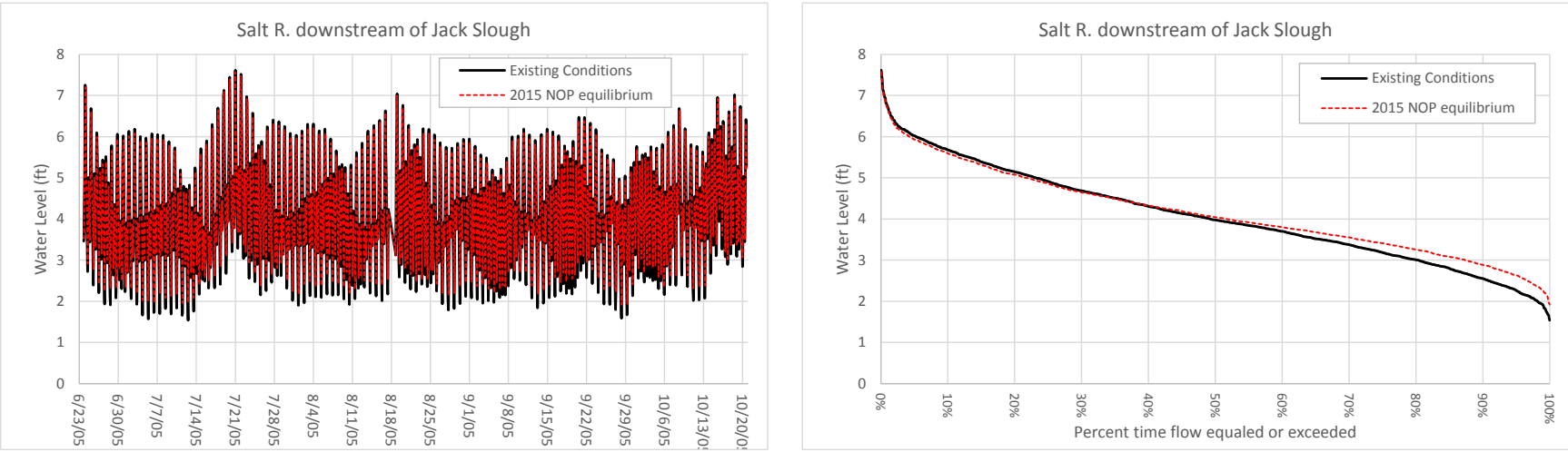


FIGURE 55d: Simulated pre- and post-project water levels in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated hydrographs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are water level exceedance probability curves for each of the periods simulated in the left-hand graphics.

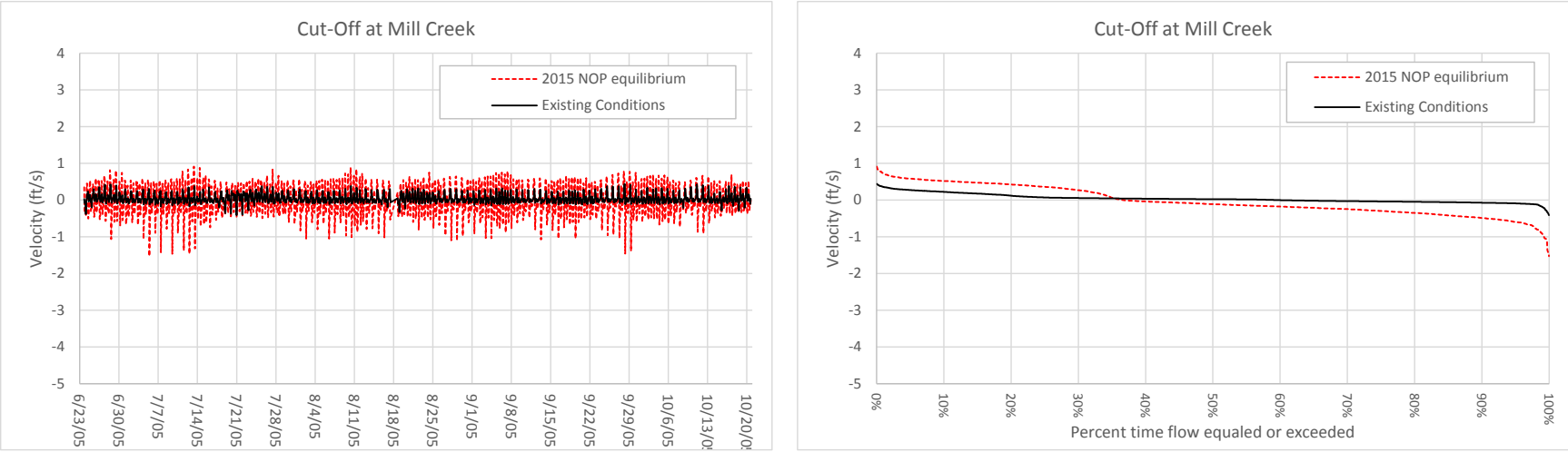


FIGURE 56 a: Simulated pre- and post-project velocities in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated velocity time-series graphs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

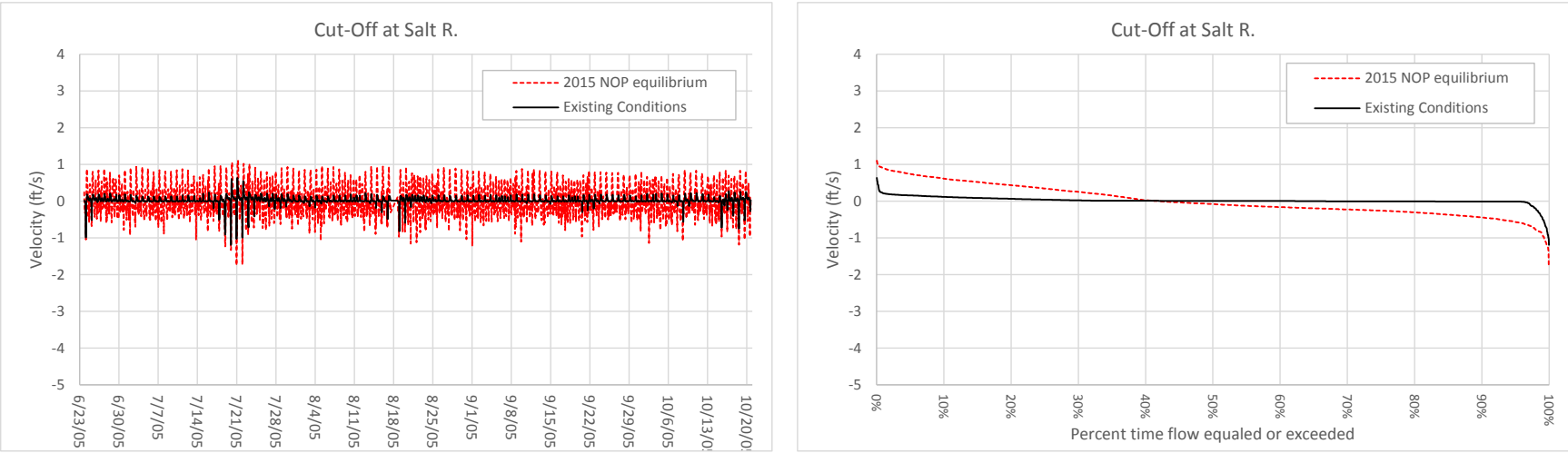


FIGURE 56 b: Simulated pre- and post-project velocities in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated velocity time-series graphs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

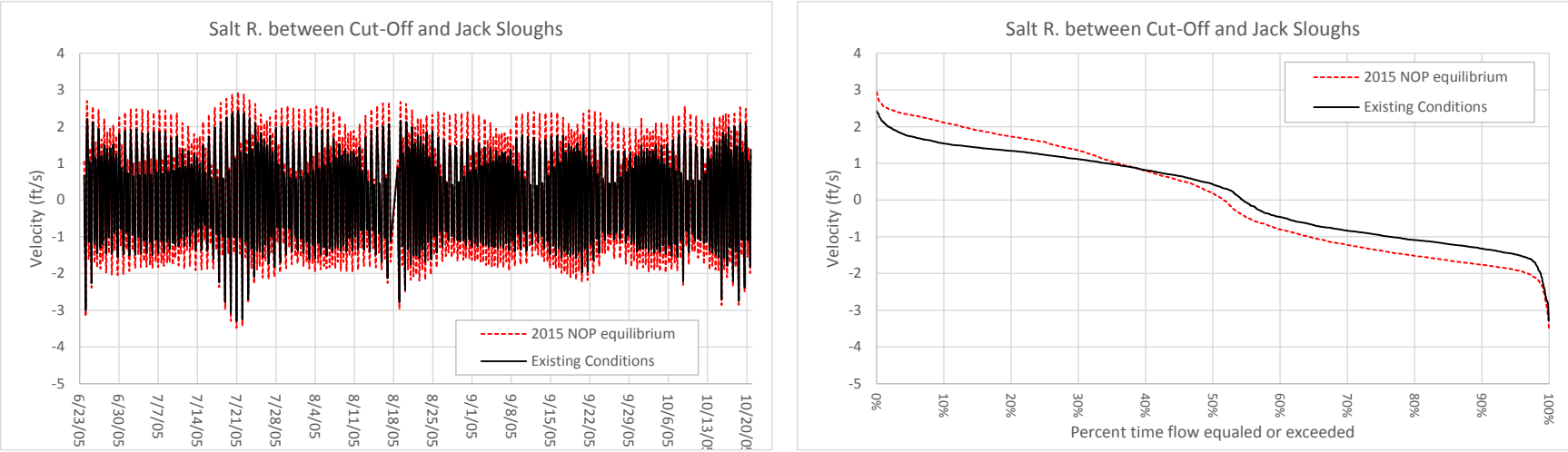


FIGURE 56 c: Simulated pre- and post-project velocities in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated velocity time-series graphs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

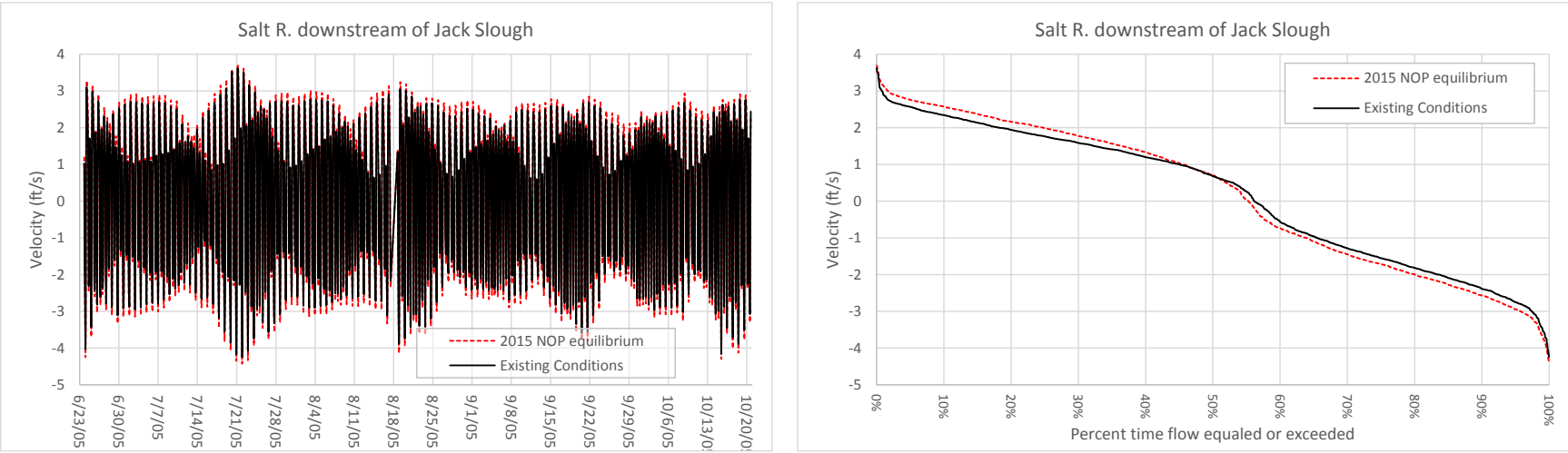


FIGURE 56 d: Simulated pre- and post-project velocities in Cut-Off Slough and Salt River downstream of Project Area for the 2005 summer period. See Figure 54 for site locations. Graphs on the left are simulated velocity time-series graphs for Existing Conditions and 2015 NOP Equilibrium alternatives. Graphs on the right are velocity exceedance probability curves for each of the periods simulated in the left-hand graphics.

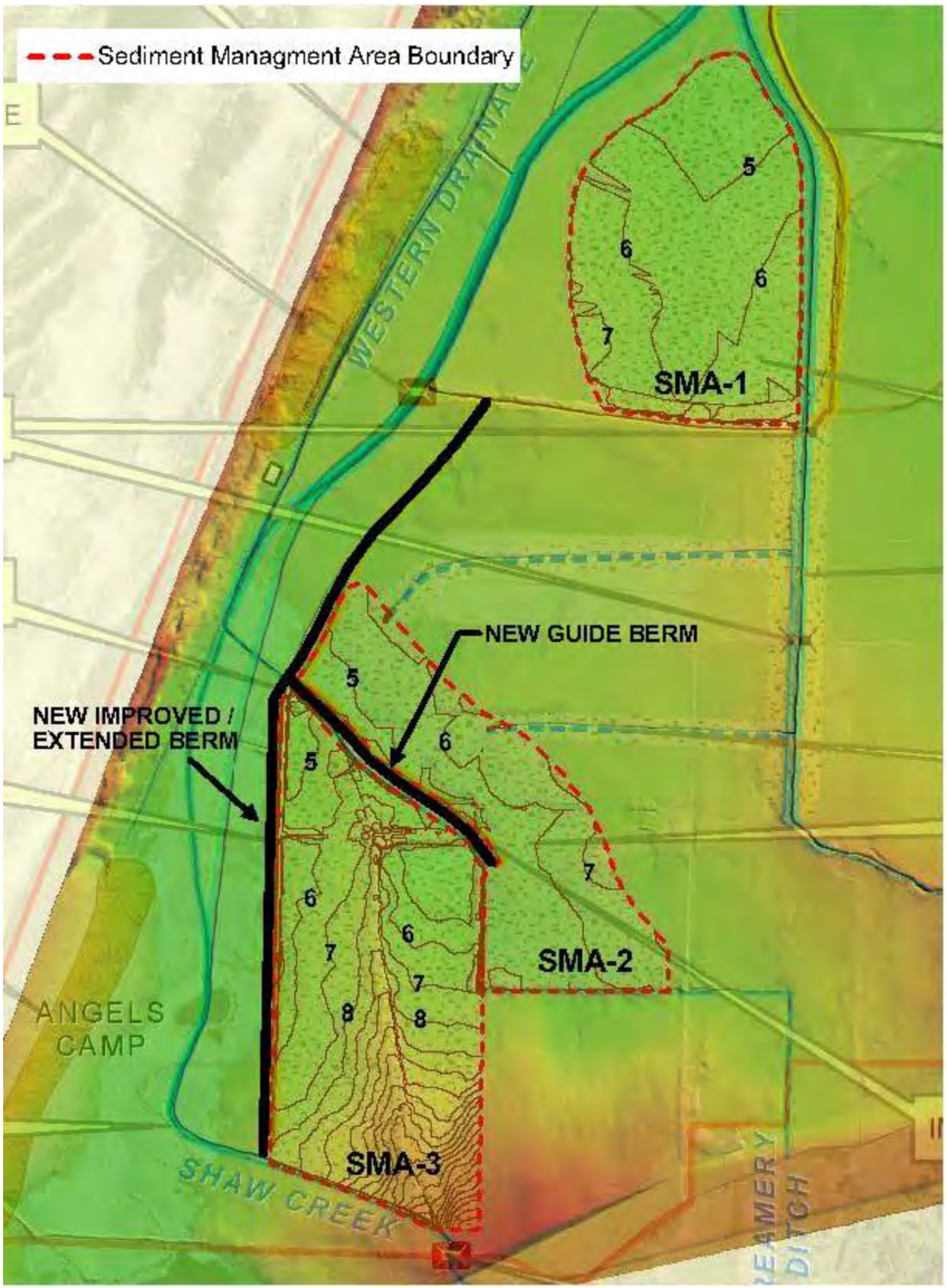
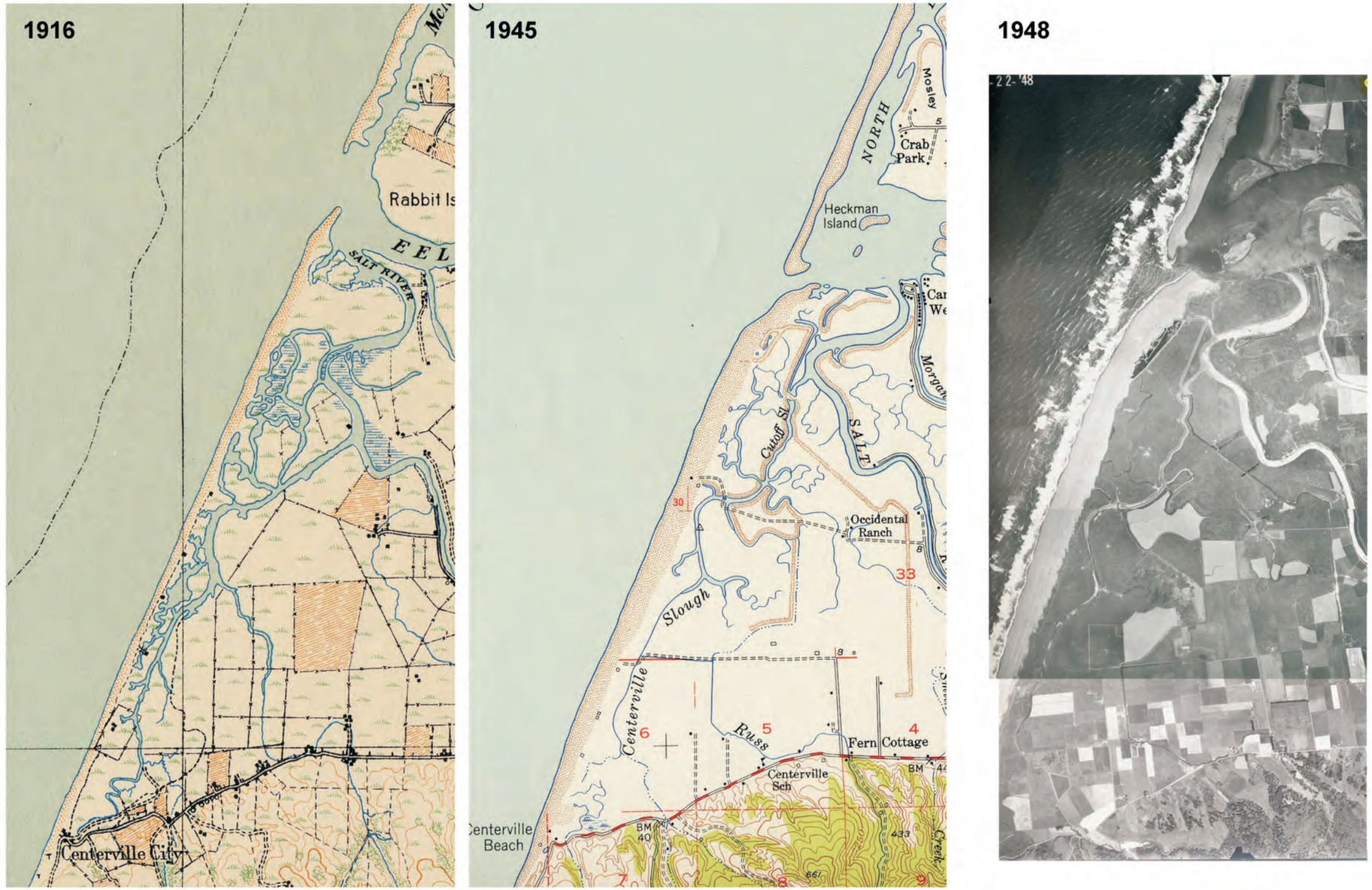


FIGURE 57: Proposed Sediment Management Area (SMA) locations – 2015 NOP alternatives. Contour interval 1-foot.

APPENDIX A:
Imagery Depicting Land Use Change – 1945 to 2012



KAMMAN HYDROLOGY & ENGINEERING, INC.

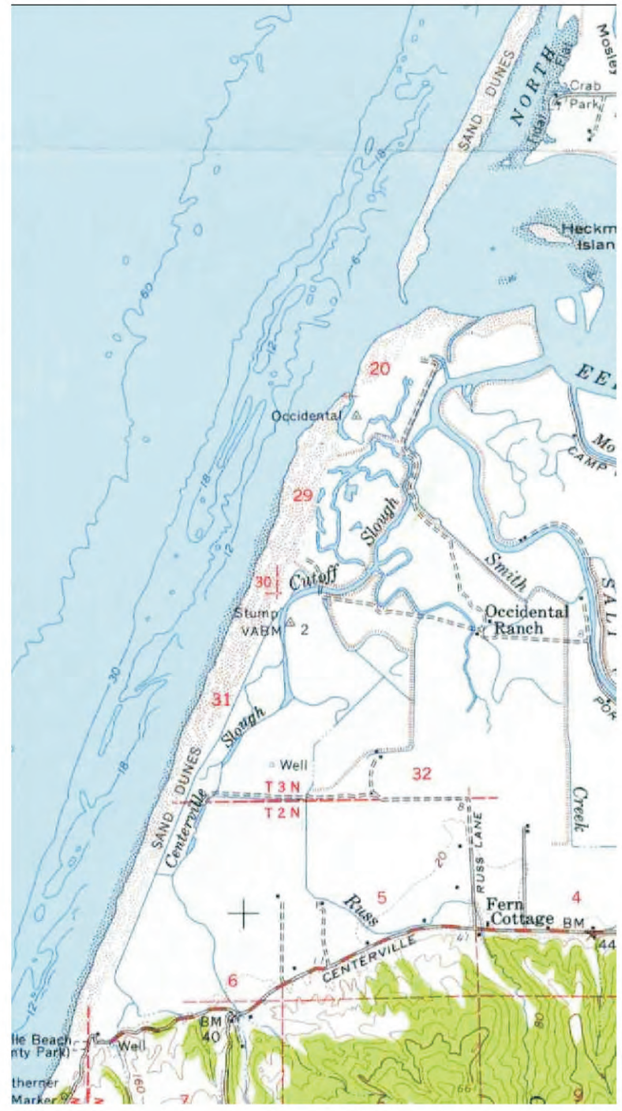
Historic Conditions (1916-1948)

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

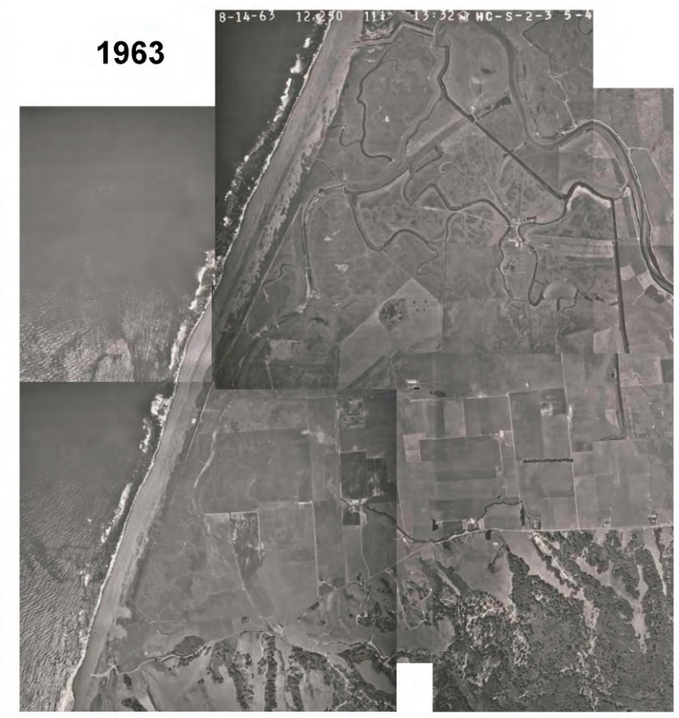
FIGURE 8a

1955
Flood
Area

1959



1963



KAMMAN HYDROLOGY & ENGINEERING, INC.

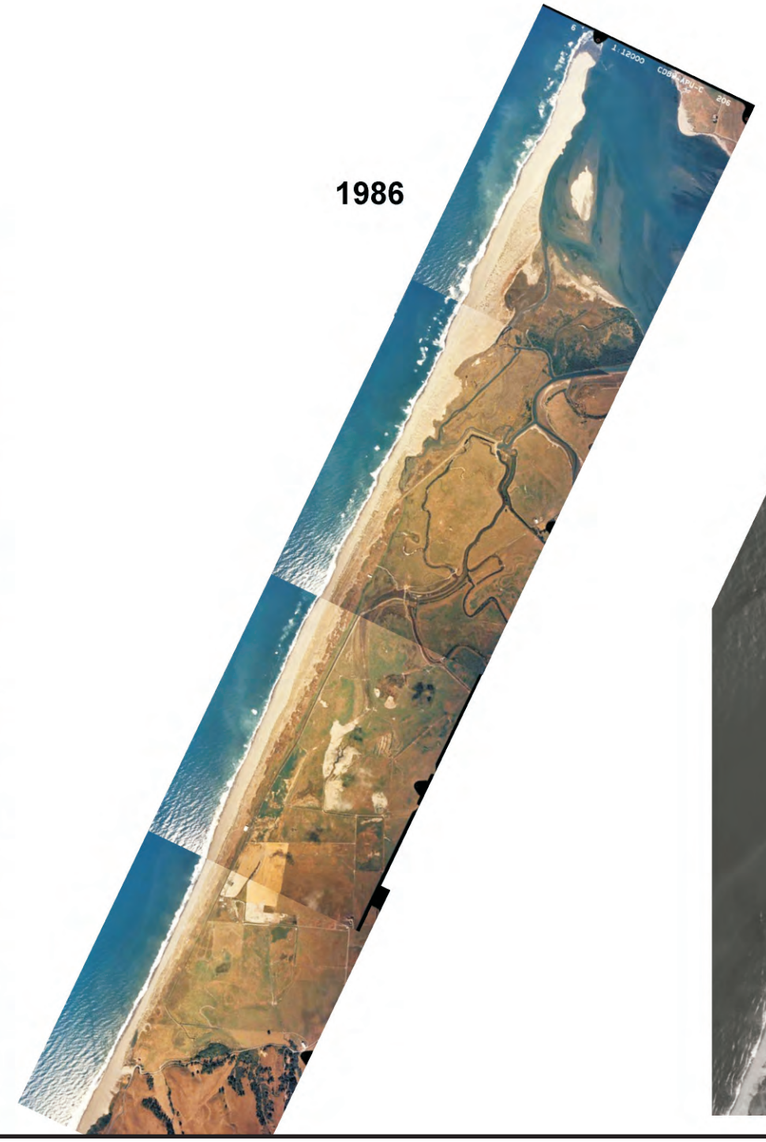
Historic Conditions (1955-1963)

Ecosystem Restoration and Flood Hazard Reduction Planning
and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE
8b

1965

1986



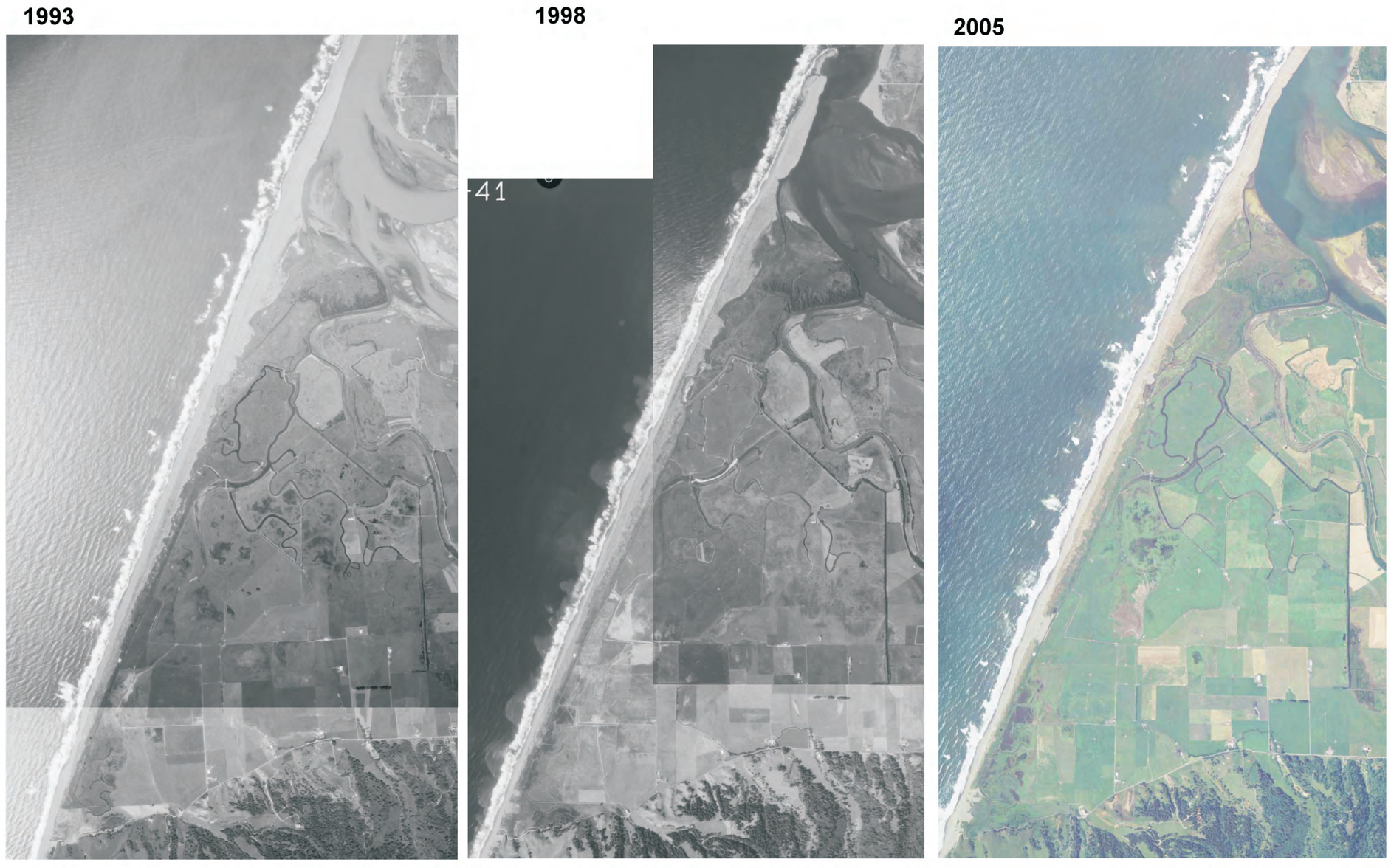
1988

KAMMAN HYDROLOGY & ENGINEERING, INC.

Historic Conditions (1965-1988)

Ecosystem Restoration and Flood Hazard Reduction Planning
and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE
8c

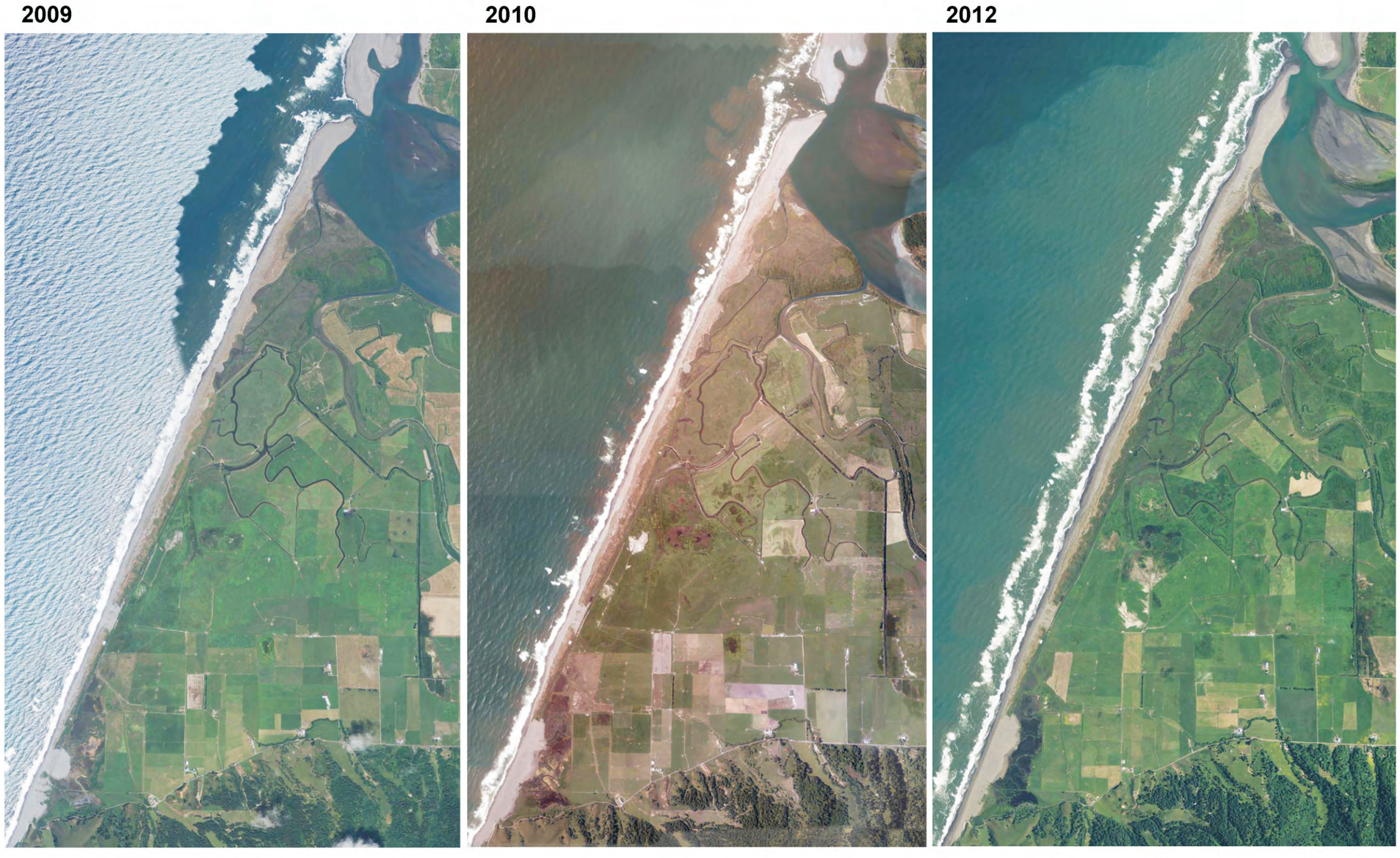


KAMMAN HYDROLOGY & ENGINEERING, INC.

Historic Conditions (1993-2005)

Ecosystem Restoration and Flood Hazard Reduction Planning
and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE
8d

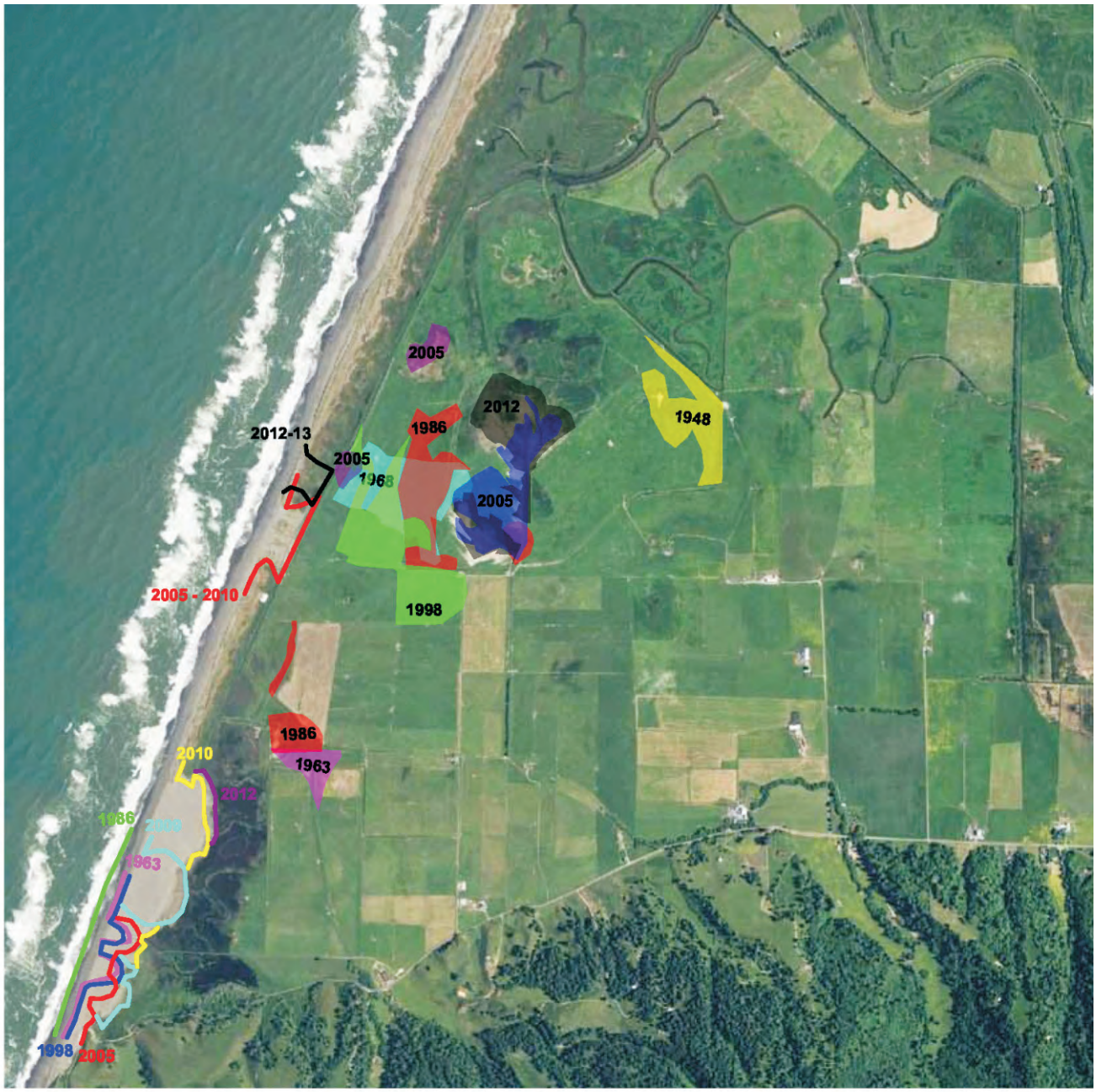


KAMMAN HYDROLOGY & ENGINEERING, INC.

Historic Conditions (2009-2012)

Ecosystem Restoration and Flood Hazard Reduction Planning
and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE
8e



KAMMAN HYDROLOGY & ENGINEERING, INC.

Sedimentation and Dune Overwash Areas

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE 9

APPENDIX B:
Proposed Project Design Components and Preliminary Alternatives

Beginning in the spring of 2011, KHE worked with project stakeholders, including adjacent land owners, to identify potential project elements that could be implemented to achieve project goals and objectives. This planning effort included numerous iterations of meetings and technical feasibility assessments to develop design elements and preliminary alternatives.

1.0 Project Design Components

This section presents the suite of design elements that resulted from this planning process as well as the results of technical feasibility assessments that guided development. These design elements are integrated either independently or in various combinations to define specific project alternatives in the next section of this appendix. At this early stage of project development, the project was focused on enhancements to the TWC property.

A) Muted tidal exchange through existing tide gates.

This design element is intended to introduce muted tidal exchange and fish passage from the Eel and Salt Rivers into Cut-Off Slough through the existing tide gates located on Cut-Off Slough ("Main Tide Gates"). This design element aims at minimizing potential changes and impacts to internal and surrounding drainages as well as productive pasture area by keeping maximum tidal water levels within existing channel banks. Introducing muted tidal exchange at the existing Cut-Off Slough tide gates will provide increases and improvements to aquatic habitat, including potential benefits to existing tidewater goby habitat within the existing (non-tidal) project area.

Currently, maximum summer (i.e., non-flood) water levels in Cut-Off Slough behind the Corp tide gates reach 2.5' in elevation (NAVD88). One or more fish-friendly Muted Tide Regulator (MTR) tide gate structures would be installed within one or more of the existing six tide gate "doors". The MTR style tide gate would close when outer water levels reached 2.5' in elevation. The extent of maximum tidal inundation (20.9-acres at water level 2.5') would extend almost to Angels Camp via the Western Drainage Ditch, as occurs currently (see Figure 1). Slough water levels would display daily diurnal tidal fluctuations between an elevation of 0.5' and 2.5', similar to current conditions, and remain within the top existing channel banks. Salinities within the ditches and channels south of the Corp tide gate, including Western Drainage Ditch, would vary seasonally between fresh and marine, but are anticipated to remain similar to current conditions.

An area approximately 150 acres in size and located west of the Cut-Off Slough tide gates is known the "Inner Marsh". In order to preclude tidal flooding into the Inner Marsh due to the introduction of muted tidal exchange, the culverts bordering Centerville and Cut-Off Sloughs

(Figure 3) would need to be removed and the intervening berm would be filled in between the Slough and Closed Cell. Similarly, the gated culverts at other locations would need to be maintained and/or improved to continue to provide the current level of water restrictions or exchange between the ORF property and Cut-Off Slough.

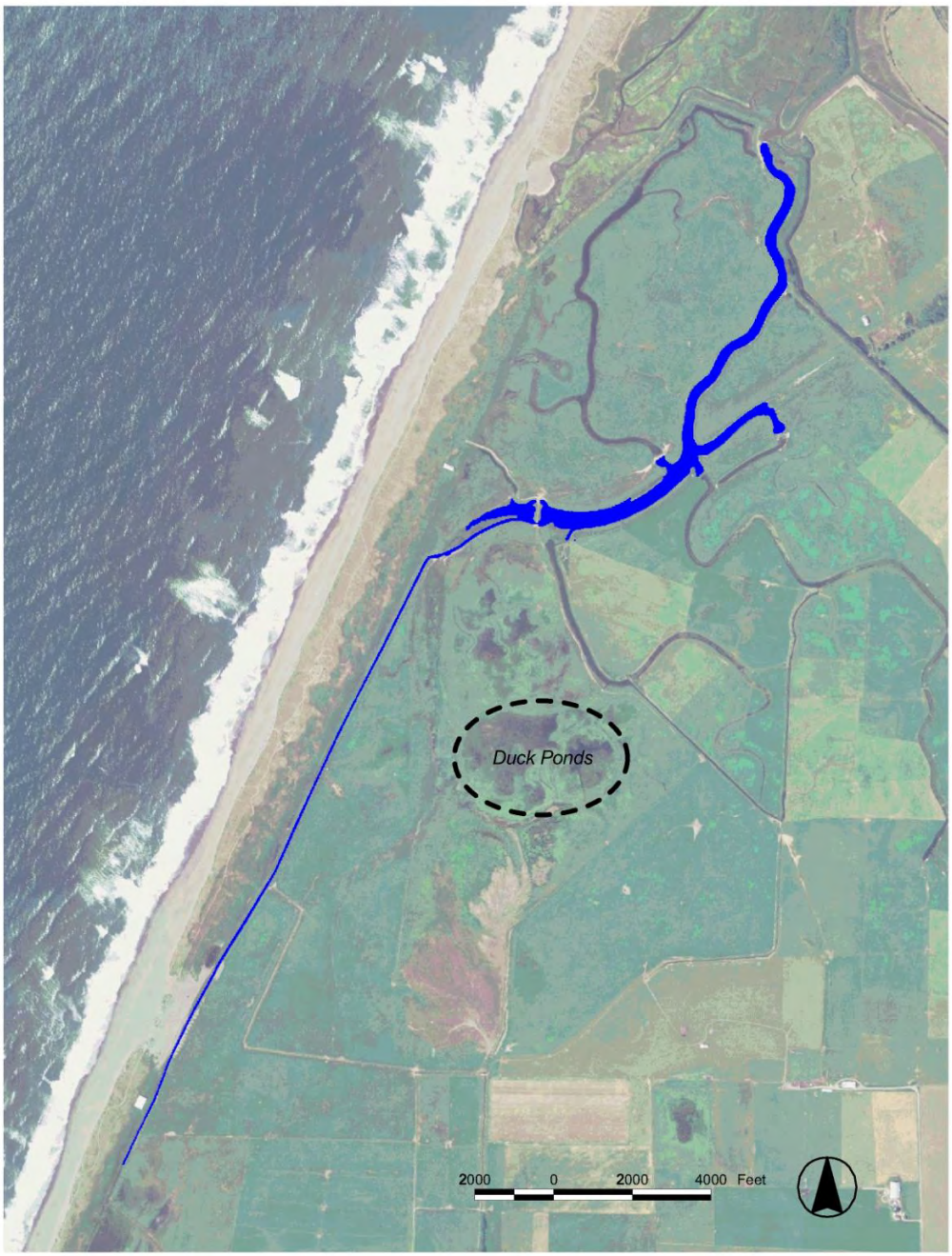


FIGURE 1: Area of influence with muted tidal exchange through Cut-Off Slough tide gate (water level 2.5-feet NAVD88).

B) Introduce muted tidal exchange to Inner Marsh

In order to increase and improve tidal wetland and salmonid rearing habitat, tidal exchange would be reintroduced into the Inner Marsh. Tidal exchange would be introduced from a new system of gated culverts installed through the levee immediately west of the existing Cut-Off Slough tide gates while eliminating exchange to Cut-Off Slough and adjacent owner's property through strategic placement and sizing of tide gates. The tide gate system would need to limit maximum water levels in the Inner Marsh though the installation of at least one MTR. Currently the berm segregating the Inner Marsh from Cut-Off Slough is 5.0' in elevation or higher, which would set the maximum water surface elevation within the Inner Marsh without significant berm improvements. A relatively limited amount of work would be required to raise the entire berm to an elevation of 8.0', allowing for a greater volume of tidal exchange and greater daily water depths. Like Cut-Off Slough, the Inner Marsh would experience daily diurnal tidal fluctuations, but over a greater potential range of elevations, from a minimum of 0.5' to a potential maximum of up to 5.0' (unimproved internal berms) to 8.0'with increased internal berm height. Figure 2 depicts the various areas of inundation at selected water levels and Table 1 presents inundation areas and volumes at different water levels. The inundation areas illustrated on Figure 2 depict the water level at the instant of maximum water level. For example, if managed with a maximum muted tide level of 5.0-feet, the Inner Marsh would only be inundated to this level 25-percent of the time. The remainder of the time water levels would be lower and inundation areas would be less. The "Bath Tub" located in the marsh immediately north of the Inner Marsh levee (Figure 1 of main report) serves as a good reference site as to how the Closed Cell wetland would look and function on a daily and long-term basis. Similar to the Bath Tub and Eel River estuary, salinities in the Closed Cell would vary seasonally between fresh and marine.

A significant constraint to implementation of the Closed Cell wetland is the loss of flood storage capacity to the surrounding and interconnected project area - mostly the ORF property and Russ family lands as well as TWC outside of the Inner Marsh. The loss of flood storage arises from berming off the Closed Cell from flood waters that are typically routed to the Closed Cell via the existing culverts connecting to Centerville and Cut-Off Sloughs.

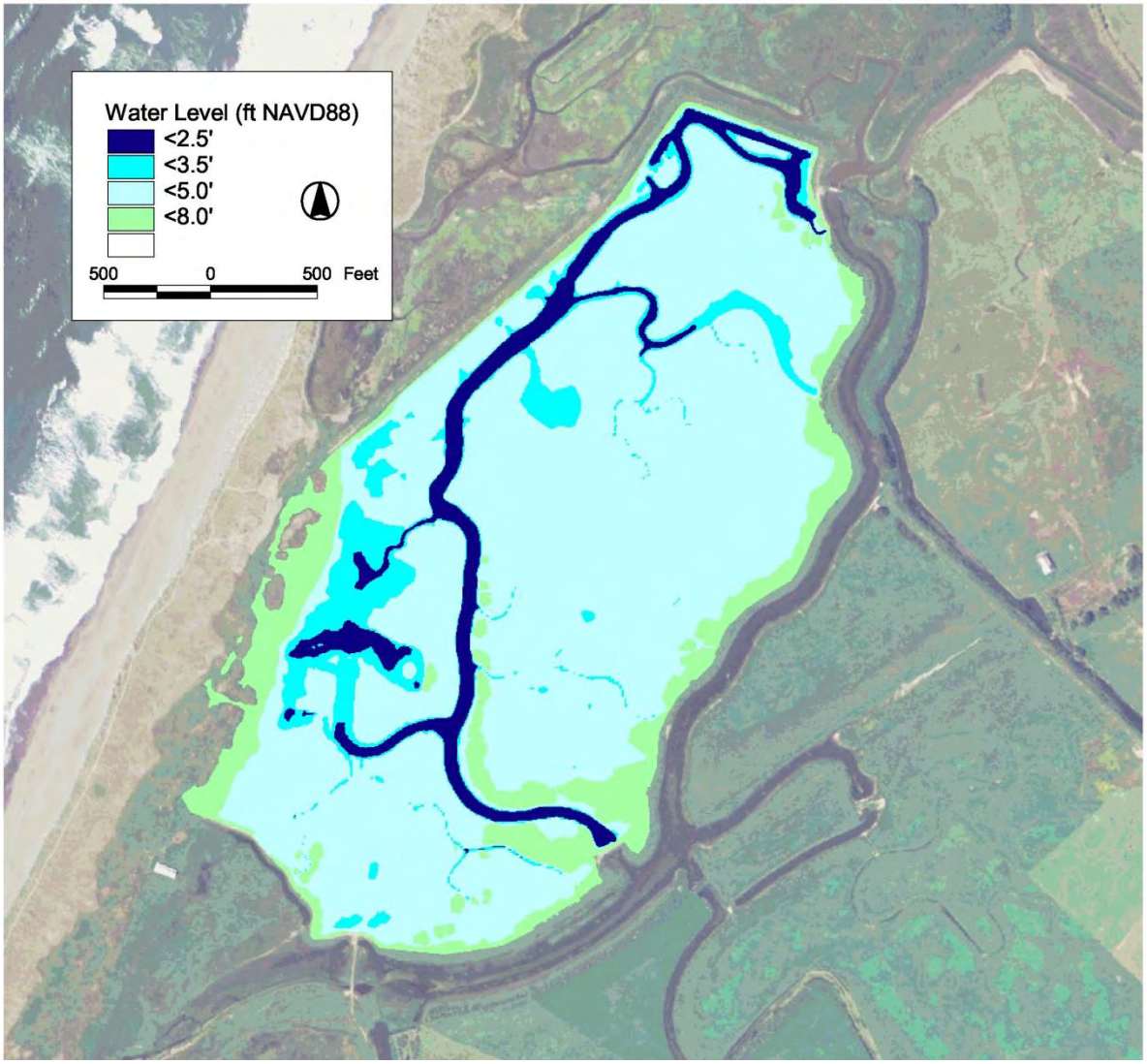


FIGURE 2: Inundation areas of Inner Marsh at varying water levels. Table also presents the associated inundation volumes at varying water levels.

Table 1: Inner Marsh Inundation Areas and Volumes.

Water Level (ft NAVD88)	Inundation Area (acres)	Inundation Volume (acre-feet)
0.0	1.0	0.3
0.5	1.3	0.9
1.0	6.4	1.6
1.5	7.0	5.0
2.0	9.4	8.6
2.5	11.4	13.8
3.0	18.5	20.1
3.5	24.8	30.8
4.0	83.9	45.2
4.5	101.4	91.5
5.0	139.6	146.3
6.0	151.8	291.1
7.0	155.3	444.4
8.0	160.4	600.8

C) Restoration of Centerville Slough

Historically, Centerville Slough was the primary western waterway connecting Angels Camp area to Cut-Off Slough (see Figure 2 main report). Over time much of the southern portion has filled in and the Western Drainage Ditch has replaced it as the primary north-south drainage way. In order to increase aquatic habitat and enhance the movement of water and wildlife between north and south, the project proposes to restore the main Centerville Slough by excavating a channel along its historic alignment. The south end of the proposed Centerville Slough alignment may deviate slightly from the historic alignment in order to better reconnect with the existing alignment of Russ Creek.

This design element may also include excavating additional new tributary channels off and parallel to the main Centerville Slough channel, to mimic the historic slough channel network. Because Centerville Slough was located further east than the existing Western Drainage ditch, it will be less susceptible to filling from dune sand (the restoration of the central dune blowout will also reduce sand supply to drainages lying immediately east). Material excavated from the channel will be reused on site to construct any new or refurbished berms or reused in upland areas. The new slough channel would convey muted tides from Cut-Off Slough as well as be the primary water course receiving and conveying

runoff from Russ Creek, Shaw Creek and the Creamery Ditch. It would also improve the opportunity for fish passage to the tributary creeks.

D) Enhance Existing Freshwater Ponds

There are several existing freshwater depressions within the central portion of the TWC property (see Figure 1) that have historically hosted duck hunting clubs. It is assumed that these features have been created or enhanced through grading. In addition to receiving season winter runoff, the ponds receive perennial runoff from a pair of artesian wells. A likely design element of the project will include protecting and enhancing these features to maintain their current habitat condition. Measures to achieve this objective may include precluding the introduction of seasonally higher salinity tidal waters into the pond area and incorporating drainage improvements that increase seasonal freshwater runoff into the ponds.

E) Create Brackish Off-Channel Habitat

Review of historical aerial imagery and topographic maps (Appendix A) indicates the presence of numerous on- and off-channel ponds within the historic back-dune Centerville Slough channel system, especially over the central and northern portions of the TWC parcel. Development of the project area has led to the loss of tidal exchange to these features as well as filling. The introduction of muted tidal exchange introduces the opportunity to recreate these types of features and the associated wetland habitats. Due to the relatively low amplitudes of restored tidal action, recreating brackish marsh will necessitate lowering (excavating) down into the muted tidal range. Brackish marsh/ponds will likely be sighted in relatively low, off-channel lying areas and connected to created project slough channels by excavation of relatively small connector channels.

F) Stabilization of Dune Blowouts

Currently, there are expanding dune blowout/overwash areas located in the central and southern portions of the dune bordering the project area. Sand from these dune areas is migrating eastward and filling the Western Drainage ditch, inhibiting channel connectivity within the project area, as well as drainage from the south (including Angels Camp, Shaw Creek, and Creamery Ditch). Maintaining drainage through the Western Drainage ditch is a necessity in managing upstream lands for grazing/agricultural purposes, and for providing enhanced aquatic habitat within the project area. Because of the Russ Creek alluvial delta that has formed a drainage divide through the project area, the ditch is currently the only pathway for tidal waters and associated aquatic organisms to move from north to south through the project area and vise-versa. Therefore, the project includes efforts to stabilize the dunes through large- and small-scale efforts aimed at trapping and retaining sand in a manner that rebuilds the dune to former and surrounding heights. Likely approaches to this work include placing large wood structures and strategic placement of snow/sand fence to reinforce sand buildup in, around and on-top of the large wood. Other dune stabilization

strategies that would be implemented include: revegetation and stabilization of dunes using native dune plants; restriction of ORV traffic; and implementation of a long-term monitoring and management program. See the dune enhancement report prepared by KHE (2015) for more information regarding background information and dune reconstruction opportunities.

G) Russ/Shaw Creek realignment and sediment management

Historically, Russ and Shaw creeks deposited large sediment loads onto the Eel plain in the form of large, well dispersed alluvial fans located at the foot of the Wildcat Mountains. At least three historical creek configurations are readily apparent near the point at which Russ Creek leaves the Wildcat Hills and enters the Eel plain. Currently, Russ and Shaw Creeks continue to disperse large volumes of sediment and water on top of low-relief alluvial fan lobes, which have built up over time. However, the creek channels are maintained in a relatively static position on the apex of alluvial fan lobes through dredging and levees, extending the creek mouths well out onto the delta plain. Once creek flows reach the end of their maintained channels (or avulse out of channel during storm flows), much of the water and sediment is dispersed across broad flat areas resulting in sheet flow and sediment splays. In an effort to concentrate flow and improve the fluvial and geomorphic character of the Creeks, this element of the project includes redirecting the creeks along steep, more sustainable alignments and converging the flows (including Creamery Ditch) into a single release at the upstream end of Centerville Slough. Based upon review of historic maps and site topography, this appears to be a more historic and natural alignment than that currently in place. This work is also intended to increase the amount of freshwater introduced into Centerville Slough with the intent of improved water quality and habitat conditions. Currently, flows that are dispersed across broad and distal pasture areas can acquire poor water quality characteristics before entering a channel.

An important component over the sustainability of the creek realignment is the development and implementation of a Sediment Management Plan, which focuses on capturing sediment and decanting off clean water prior to discharging to Cut-Off Slough. One potential creek alignment could be through a large low lying area where the creeks and Creamery Ditch converge off of steeper gradients. This Sediment Management Area is well suited for the establishment features that capture sediment. Creating a sediment management area in this location would require approval and coordination from the land owner and other stake holders. It is envisioned that this sediment management plan would, like the Salt River Project, provide for prior and predictable permitting of maintenance activities in conformance with a pre-approved plan.

An alternate sediment management area could be located in a more gently depressed area where Russ Creek crosses onto the TWC parcels. A sediment management area in this

location would likely require more grading and channel creation in order to separate sediment and water.

H) Controlled retreat from Angels Camp flooding

The largest dune overwash in the project area is located adjacent to Angels Camp. The breach has been moving steadily northward since 1998, allowing large volumes of sand and water to invade eastward into adjacent pasture lands. Due to significant ponding of salt water that accumulates behind this overwash, large portions of the Angels Camp area have reverted to salt marsh vegetation and standing water. Drainage from Angels Camp has diminished over this time due to overwash infilling the Western Drainage Ditch with sand. According to local area residents, all of the area was free of flooding and actively grazed prior to 1990. In order to restrict further eastward migration of the evolving salt marsh and associated loss of pasture land, the project could include constructing a low relief berm (crest height of 8.0') east of and parallel to the overwash. This work would require retaining existing drainages from pastures lying to the west of the berm via gated culverts through the berm. The berm would tie-into adjacent 8.0' grades. The berm would buffer more productive grazing lands from the adverse effects of salt water overwash and thwart the eastward migration of wetland. The former pasture land located west of the berm would likely continue to evolve into a dynamic mix of fresh, brackish and salt marsh and provide habitat for associated species. It is anticipated that the berm would be revegetated with wetland plant communities.

2.0 Preliminary Project Alternatives

A brief description of each alternative including preliminary earthwork cut and fill volumes, wetland area of impact and resulting tidal inundation areas are provided in Table 2. Figures illustrating the normal tidal inundation areas under each alternative are presented below and fall into the following three categories.

A) Alternatives That Extend Off-Site But Don't Alter Flood Hazard

- Alternative TWC-1 (Figure 3)
- Alternative TWC-2 (Figure 4)

B) Alternatives and Effects Restricted to TWC Property

- Alternative TWC-3 (Figure 5a-5b)
- Alternative TWC-4 (Figure 6)

C) Most Self-Maintaining Alternative

- Alternative TWC-5 (Figure 7)

TABLE 2: WETLAND RESTORATION ALTERNATIVES INFORMATION

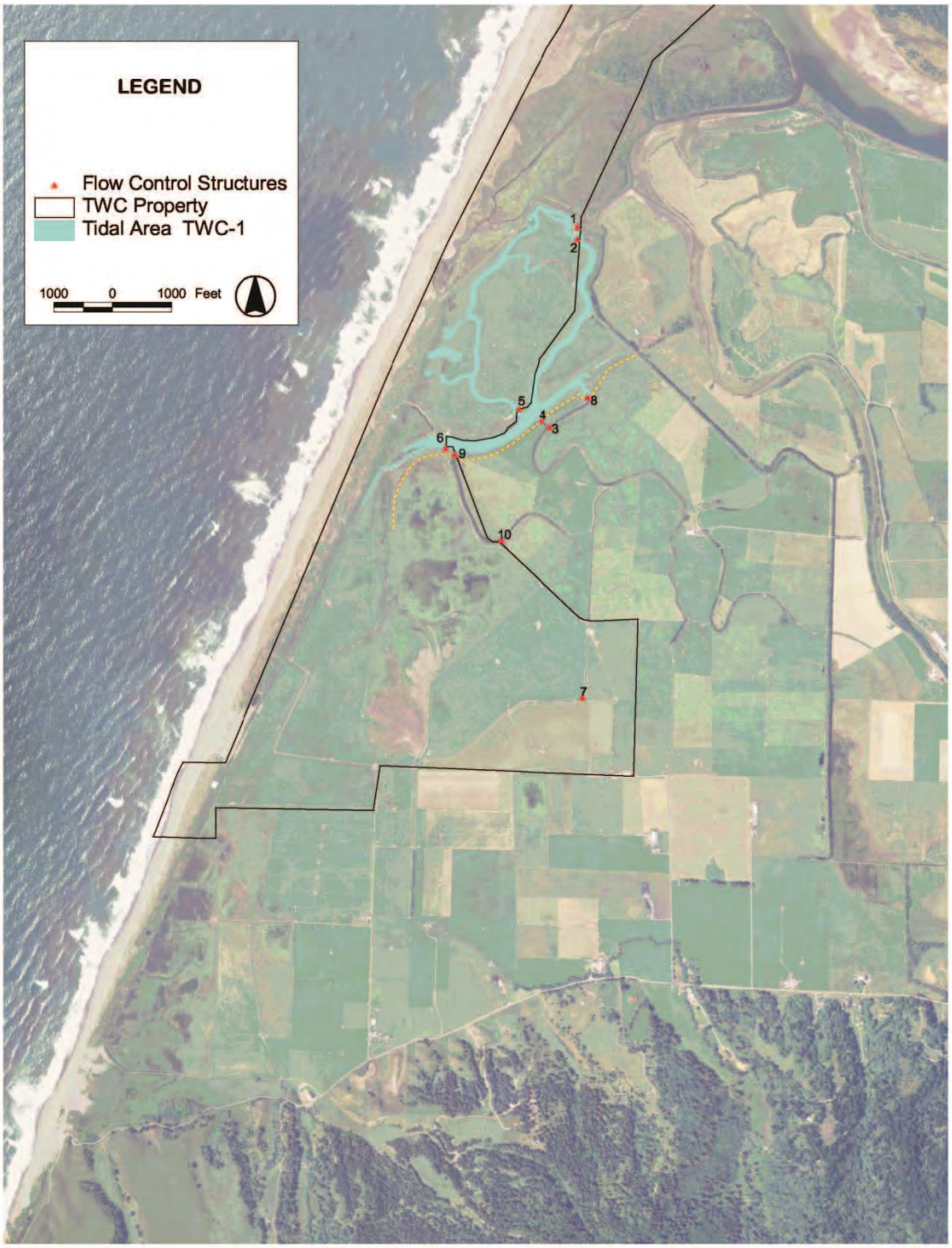
Alternative/ Condition	Max. Tide Level (feet NAVD88)	Fill Volume (CY)	Fill Area (acre)	Cut Volume (CY)	Cut Area (acre)	Modify Control Struct. (#)	Max. Inundatn. Area (acre)	Max. Tidal Prism (AF)	Notes:
Existing Condition	2.5	n/a	n/a	n/a	n/a	n/a	29.9	47.9	• Inundation area calculated for area NW of Control Structures 8, 4, and 9.
TWC-1	3.0	0	0.00	233	0.04	1	34.4	63.6	• Modify Corps tide gate(s) (Control Structure 1) to allow for muted tidal exchange; • Remove internal channel constrictions at Control Structure locations 2 and 5 (assume bridge installed at Control Structure location 6); • Preclude increased flooding on adjacent properties.
TWC-2	5.0	396	0.30	233	0.04	1, 8, 4, 9	187.7	277.0	• Modify Corps tide gate(s) (Control Structure 1) to allow for muted tidal exchange; • Remove internal channel constrictions at Control Structure locations 2 and 5 (assume bridge installed at Control Structure location 6); • Increase tidal exchange/flooding with minimal fill placement to raise berm crest at Control Structures 8, 4 and 9; • Preclude increased flooding on adjacent properties.

TABLE 2 (continued): WETLAND RESTORATION ALTERNATIVES INFORMATION

Alternative/ Condition	Max. Tide Level (feet NAVD88)	Fill Volume (CY)	Fill Area (acre)	Cut Volume (CY)	Cut Area (acre)	Modify Control Struct. (#)	Max. Inun-dation Area (acre)	Max. Tidal Prism (AF)	Notes:
Existing Conditions (Closed Cell)	2.5	n/a	n/a	n/a	n/a	n/a	11.4	13.8	• Existing inundation area within Closed Cell area.
TWC-3 (Closed Cell)	5.0	0	0.00	178	0.08	New Structure	139.6	146.3	• Install new gated culvert through levee to outboard marsh to allow for muted tidal exchange with Closed Cell; • No modification to perimeter levee/berm; • Seal off any hydraulic exchange to Cutoff Slough via Control Structures 2 and 5; • No impact to adjacent properties.
TWC-4 (Closed Cell)	7.5	804	0.50	178	0.08	New Structure	156.5	522.4	• Install new gated culvert through levee to outboard marsh to allow for muted (near full) tidal exchange with Closed Cell; • Raise perimeter levee/berm heights in selected locations to accommodate maximum tidal flooding to 7.5-feet in elevation; • Seal off any hydraulic exchange to Cutoff Slough via Control Structures 2 and 5; • No impact to adjacent properties.

TABLE 2 (continued): WETLAND RESTORATION ALTERNATIVES INFORMATION

Alternative/ Condition	Max. Tide Level (feet NAVD88)	Fill Volume (CY)	Fill Area (acre)	Cut Volume (CY)	Cut Area (acre)	Modify Control Struct. (#)	Max. Inun-dation Area (acre)	Max. Tidal Prism (AF)	Notes:
TWC-5	7.5	5085	1.83	178	0.08	New Structure	522.5	1178.4	• Install new gated culvert through levee to outboard marsh to allow for muted (near full) tidal exchange with Closed Cell; • Raise perimeter levee/berm heights within Closed Cell, adjacent to Cutoff Slough at selected locations to accommodate maximum tidal flooding to 7.5-feet in elevation; • Seal off any hydraulic exchange to Cutoff Slough via Control Structures 2 and 5; • Construct new berm across Cutoff Slough at Control Structure 6 - eliminate hydraulic connection through existing culvert; • Construct new berm with crest elevation at 8-feet along east side of Western Drainage Ditch between Russ Creek fan/drainage divide and Control Structure 6 to allow exchange of tidal waters southward to Angels Flat depression; evaluate if increased tidal prism to Angels Flat will maintain Western Drainage Ditch.

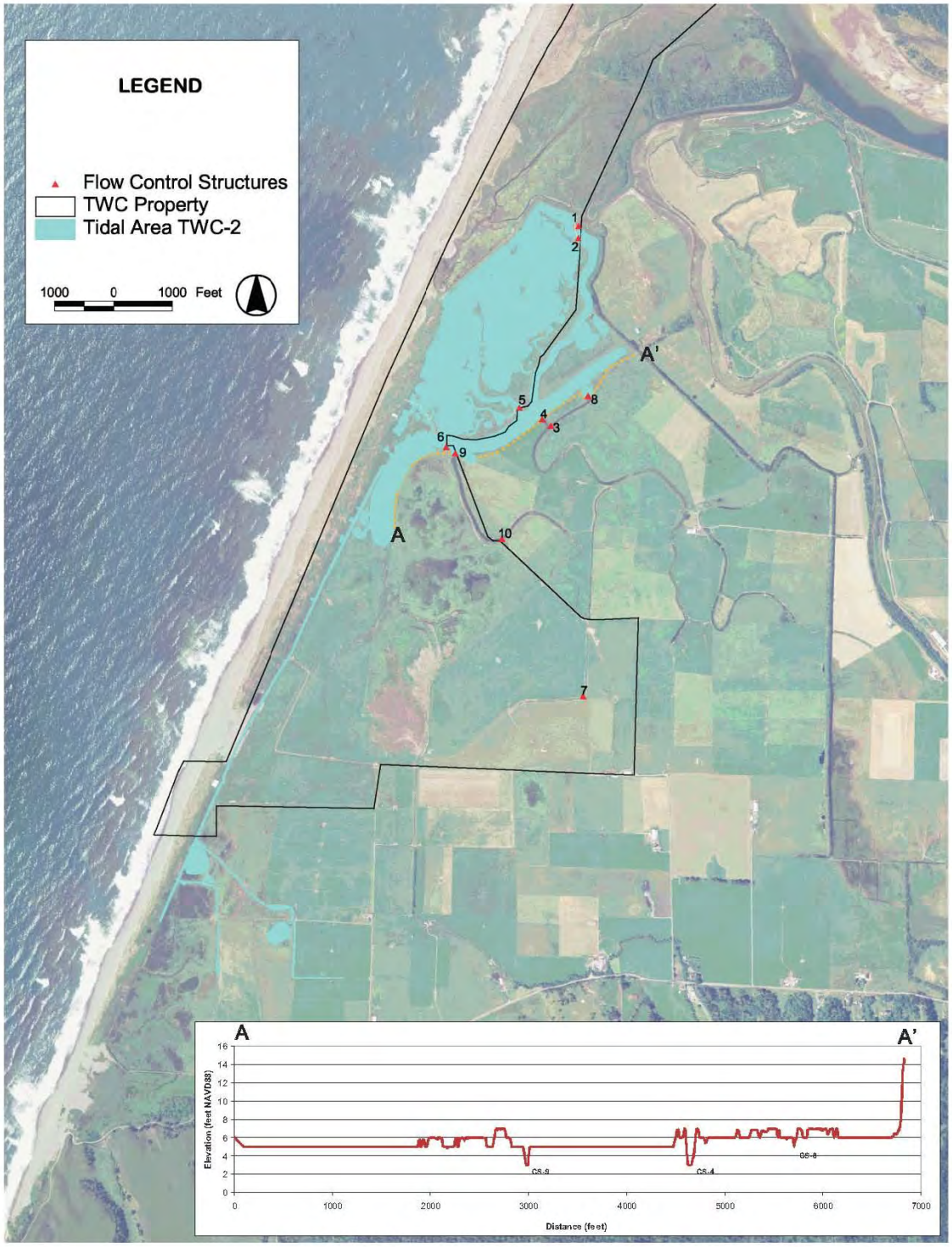


KAMMAN HYDROLOGY & ENGINEERING, INC.

Restoration Alternative TWC-1

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE 3



KAMMAN HYDROLOGY & ENGINEERING, INC.

Restoration Alternative TWC-2

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

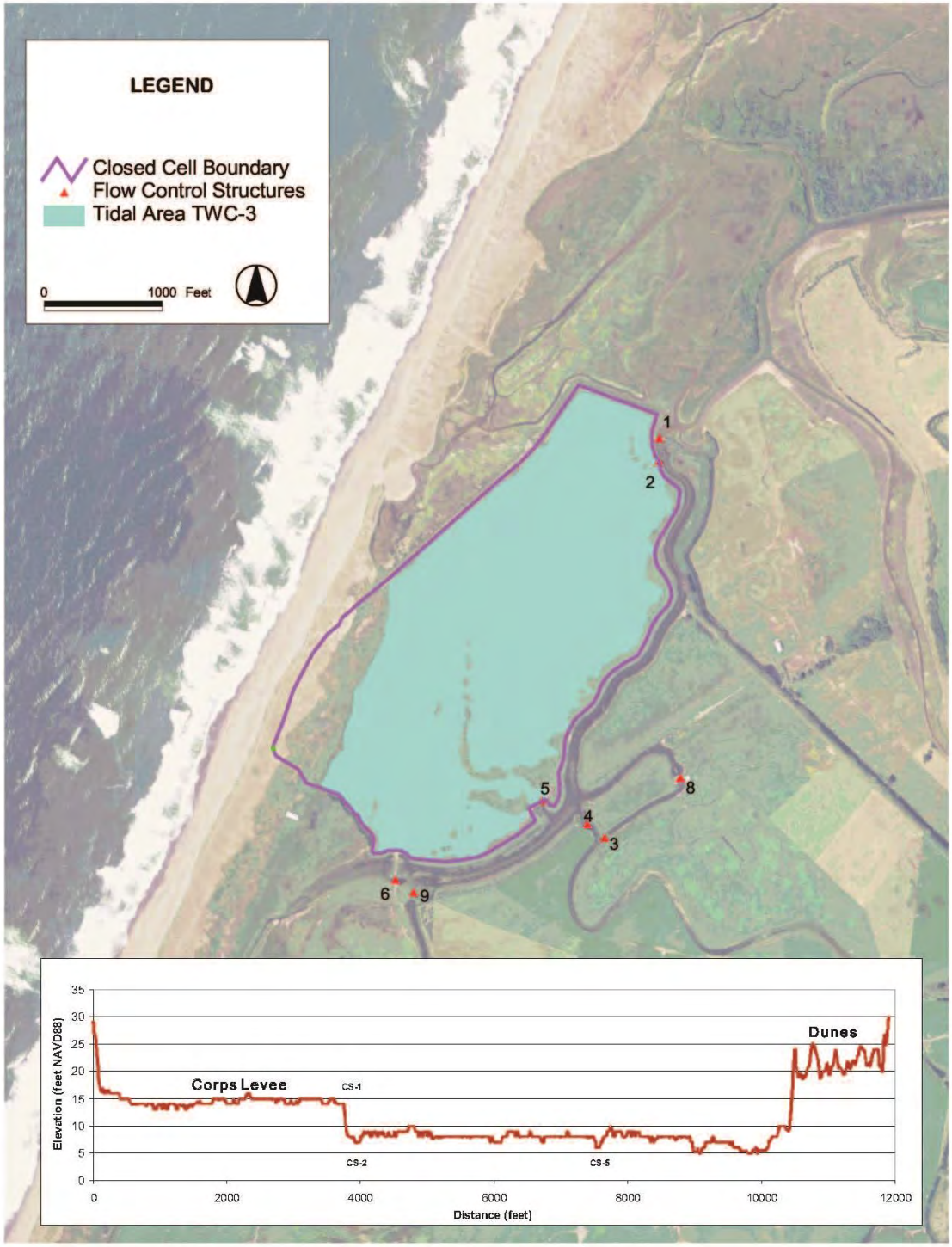
FIGURE 4

KAMMAN HYDROLOGY & ENGINEERING, INC.

Existing Inundation Area in Closed Cell

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE 5a



KAMMAN HYDROLOGY & ENGINEERING, INC.

Restoration Alternative TWC-3

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

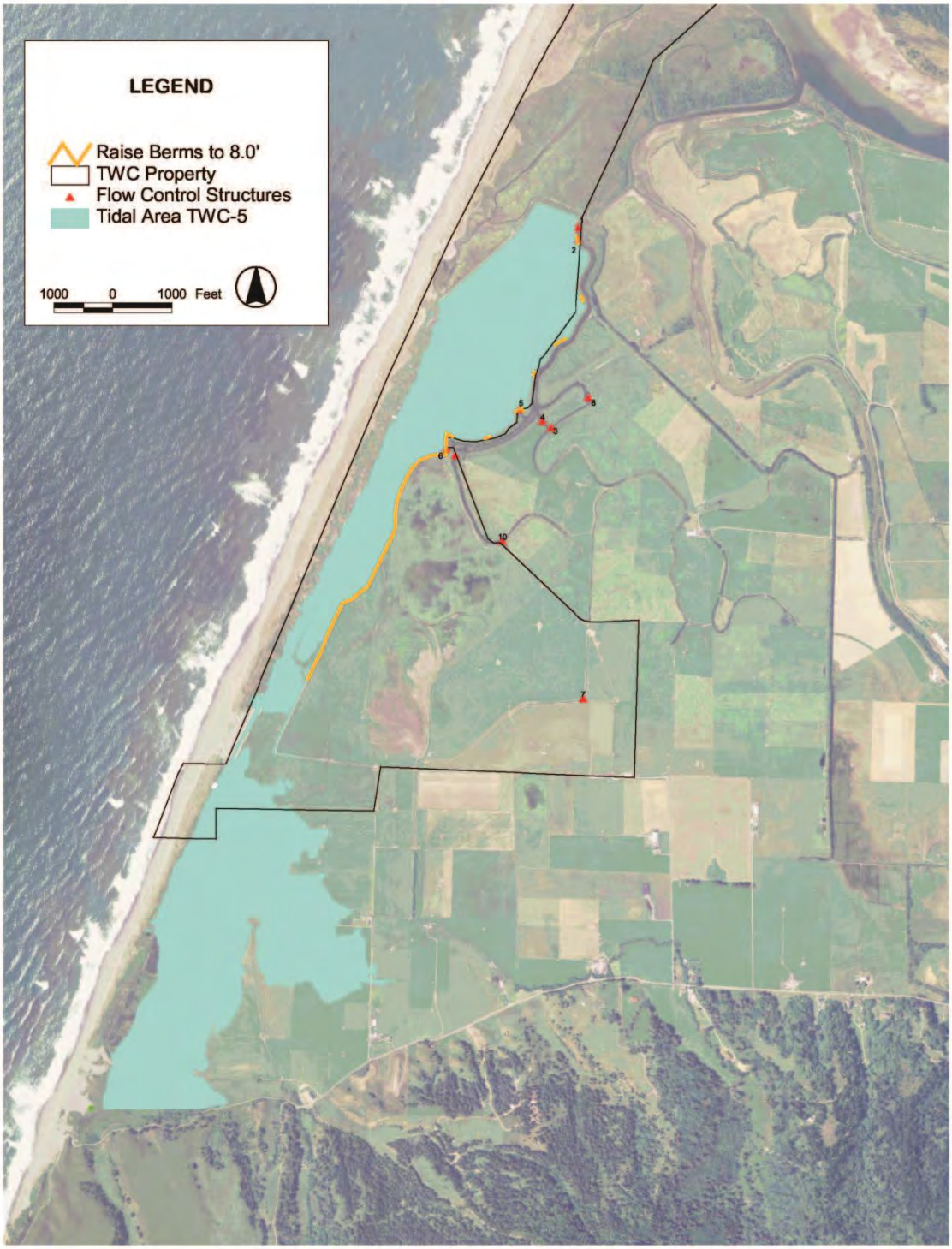
FIGURE 5b

KAMMAN HYDROLOGY & ENGINEERING, INC.

Restoration Alternative TWC-4

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE 6



KAMMAN HYDROLOGY & ENGINEERING, INC.

Restoration Alternative TWC-4

Ecosystem Restoration and Flood Hazard Reduction Planning and Feasibility Assessment, Connick Ranch and Russ Properties

FIGURE 7

APPENDIX C:
Topography and Bathymetry of Project Site

1.0 Coastal Conservancy LiDAR

Detailed existing site topography was derived from integrating land-based survey data sets with publically available LiDAR data. The 2009-2011 California Coastal Conservancy LiDAR Project data was used to develop a site digital elevation model (DEM) and one-foot contour map. The data coverage includes the entire California coastline and extends landward 500 m from the shoreline. Data was collected between September 2009 and October 2010. The Conservancy's LiDAR has resulted in the collection and processing of high resolution 1-meter nominal post spacing. The horizontal datum for the control was the North American Datum of 1983 (NAD83, NSRS2007).The vertical datum was the North American Vertical Datum of 1988 (NAVD88). The Conservancy's LiDAR ground-return point data was obtained via the USGS's Center for LiDAR Information Coordination and Knowledge (CLICK; http://lidar.cr.usgs.gov/).

Light Detection and Ranging (LiDAR) data is remotely sensed high-resolution elevation data collected by an airborne collection platform. This LiDAR dataset is a survey of Coastal California. The project area consists of approximately 2616 square miles. The project design of the LiDAR data acquisition was developed to support a nominal post spacing of 1 meter. Fugro EarthData, Inc. acquired 1546 flight lines in 108 lifts between October 2009 and August 2011. This collection was a joint effort by the NOAA Coastal Services Center (CSC); the California State Coastal Conservancy (SCC) Ocean Protection Council (OPC); Scripps Institution of Oceanography; and the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX). The data coverage extends landward 500 m from the shoreline, along the entire California coastline. The data collection was performed with two Piper Navajo twin engine aircrafts, utilizing a Leica ALS60 MPiA sensor; collecting multiple return x, y, and z as well as intensity data. The data were classified as Unclassified (1), Ground (2), Low Point (Noise) (7), Water (9), Mudflats (10), and 12 (Overlap). Only the Unclassified (1), Ground (2), Water (9), and Overlap (12) points are available for download from the NOAA CSC Digital Coast. The range of dates/times that LiDAR data was collected includes: *Beginning Date:* 200909 and *Ending Date:* 201110

Attribute Accuracy Report:

During LiDAR data collection the airborne GPS receiver was collecting data at 2 Hz frequency and the Dilution of Precision (PDOP) was monitored. One GPS base station was also running at the operation airport and was recording data at 1 Hz. The airborne GPS data was post-processed in DGPS mode together with the base station data to provide high accuracy aircraft positions. The GPS trajectory then was combined with the IMU data using loosely coupled approach to yield high accuracy aircraft positions and attitude angles. Then the LiDAR data was processed using the aircraft trajectory and raw LiDAR data. After boresighting the LiDAR data, the ground

control points were measured against the LiDAR data by technicians using TerraScan and proprietary software and the LiDAR data was adjusted vertically to the ground control. Independent ground control check points were used to ensure vertical accuracy of the data. The horizontal datum for the control was the North American Datum of 1983 (NAD83, NSRS2007).The vertical datum was the North American Vertical Datum of 1988 (NAVD88). The vertical datum was realized through the use of the published/calculated ellipsoidal heights of the base station to process the aircraft trajectory and then later applying the GEOID09 model to the processed LiDAR data to obtain orthometric heights.

Logical Consistency Report:
Compliance with the accuracy standard was ensured by the collection of ground control and the establishment of a GPS base station at the operation airport. The following checks were performed: 1) The LiDAR data accuracy was validated by performing a full boresight adjustment and then checking it against the ground control prior to generating a digital terrain model (DTM) or other products. 2) LiDAR elevation data was validated through an inspection of edge matching and visual inspection for quality (artifact removal).

Completeness Report:
The following methods are used to ensure LiDAR data accuracy: 1) Use of a ground control network utilizing GPS survey techniques; 2) Use of airborne GPS and IMU in conjunction with the acquisition of LiDAR; and 3) Measurement of quality control ground survey points within the finished product. The following software is used for the validation: 1) Terrascan and 2) Fugro EarthData Proprietary Software.

Positional Accuracy:
LiDAR data acquisition was developed to support a nominal post spacing of 1 meter between October 2009 and August 2011. This collection was a joint effort by the NOAA Coastal Services Center (CSC); the California State Coastal Conservancy (SCC) Ocean Protection Council (OPC); Scripps Institution of Oceanography; and the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX). The data coverage extends landward 500 m from the shoreline, along the entire California coastline. The horizontal datum for the control was the North American Datum of 1983 (NAD83, NSRS2007).The vertical datum was the North American Vertical Datum of 1988 (NAVD88). The vertical datum was realized through the use of the published/calculated ellipsoidal heights of the base station to process the aircraft trajectory and then later applying the GEOID09 model to the processed LiDAR data to obtain orthometric heights.

2.0 Land-Based Topographic and Bathymetry Surveys

The LiDAR-derived contour map was edited and refined within the Eel River Ecological Preserve slough and creek corridors using land-based bathymetry survey data collected by Spencer Engineering and LACO Associates and provides more detailed and better resolution of slough/creek channel bathymetry than the LiDAR data, which does not resolve submerged areas. Spencer Engineering completed bathymetric channel surveys within the Connick Ranch property between 2005 and 2006. Spencer surveys were tied to County survey control points in NGVD29 vertical datum. Correction of the Spencer data to NAVD88 vertical datum was based on resurvey of County bench marks by LACO Associates in 2010. LACO completed supplemental bathymetric and ground surveys of selected project locations in 2013 and 2014. All LACO surveys were completed relative to the NAVD88 datum. Figure 1 depicts survey point locations completed by Spencer and LACO. The resulting topographic/bathymetric map provides the basis for project design and numerical model development. Figure 2 is a shaded-relief map derived from the final project digital elevation model (DEM) derived from the topographic/bathymetric map.

Finally, Russ Ranch & Timber completed detailed surveys of many portions of their property in April of 2014. Although not integrated into the project DEM, selected portions of these data were integrated into the numerical model, especially Russ Creek profiles and sections.

FIGURE 2: Land-based topographic and bathymetric survey points.

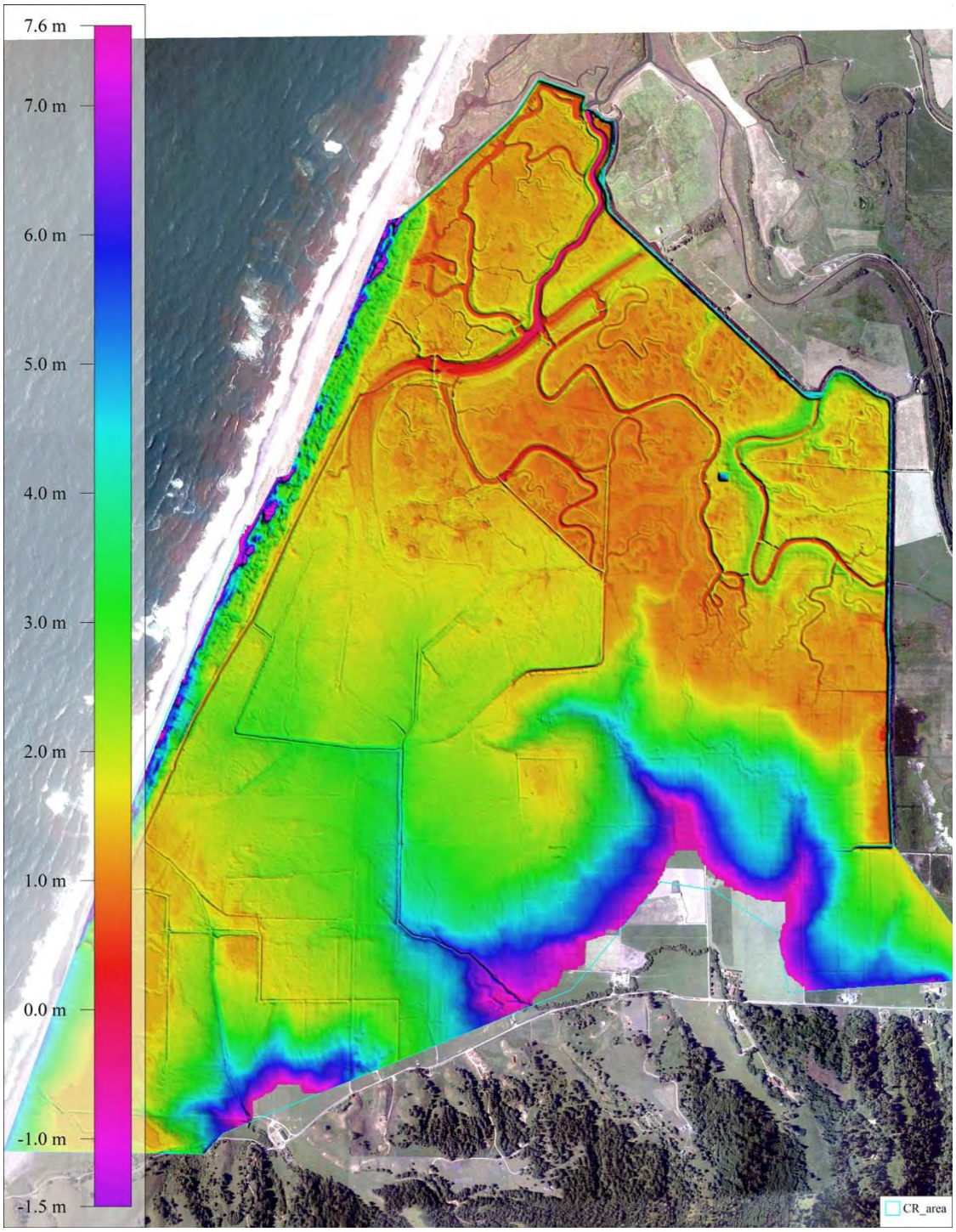


FIGURE 3: Shaded relief map of project area topography and bathymetry. Note elevations in meters.

APPENDIX D:
Water Level and Salinity Monitoring

This appendix presents the history and summary of hydrologic and water quality monitoring at the project site. These data are presented throughout the report and used to develop model input boundary conditions data sets.

1.0 2005 Water Level Monitoring by KHE

Salinity and water level data were collected by Kamman Hydrology & Engineering, Inc. (KHE) from the Eel River Estuary and the lower Salt River system during the period June 23, 2005 through October 20, 2005, in order to characterize the variation of water levels and salinity over the range of tidal phases and to document the longitudinal variation of tidal exchange along the lower Salt River corridor. As part of this effort, KHE established and collected data from gauges located within Cut-Off Slough on the upstream and downstream sides of the Cut-Off Slough tide gate structure (Figure 1). Gauging stations were equipped with electronic water level and water quality monitoring instruments. Most instruments continuously recorded measurements of water level, temperature, and conductivity[11] (LTC) at 15-minute time increments. Salinity was calculated from measurements of conductivity and temperature.

KHE constructed a time series of water surface elevations for each Cut-Off Slough gauge utilizing water level (depth) data collected by the LTC recorders. An incremented staff gage placed at each gaging station was used to record observations of water level during site visits. Spencer Engineering, under the direction of KHE, performed a total station survey to determine the absolute elevation of each staff gage (NGVD29) pursuant to local area County survey control points installed in 1968. Comparison of water level (depth) data with concurrent staff gage observations defined the vertical adjustment factors used to align the water level data from the LTC recorders to a common vertical datum[12].

Gauging stations incorporated a single-stage design to record near-bottom salinity. Each station was equipped with a PVC stilling wells and an electronic LTC recorder was deployed in each well. The fixed LTC recorder measured fluctuations in water level associated with tidal exchange and salinity characteristics of the lower portions of the water column near the channel bed. Gaging station locations were inspected during regular site visits and repairs were made, if necessary.

[11] Conductivity measures the ability of a substance to carry an electric current. In general, higher concentrations of dissolved salts in a body of water yield higher electrical conductivity.
[12] Elevation surveys in the field referenced the NGVD29 vertical datum, but elevations were converted to the North American Vertical Datum of 1988 (NAVD 88) by adding 3.22-feet.

The 2005 KHE monitoring program was successful in capturing simultaneous measurements of water surface elevations (i.e., water levels between KHE maintained tide gauges were in close agreement). Recorded water levels for the inner and outer Cut-Off Slough gauges are plotted on Figure 1. Results indicate a full unimpeded tidal signature for the estuary with a maximum tidal range of approximately 9-feet. Eel River flows did not have an effect on measured water levels in the estuary as they compare closely to water levels within the Pacific Ocean as represented by the recorded tides at the Humboldt Bay South Spit gauge. The recorded water levels for inner and outer Cut-Off display the effect of the tide gates, which essentially restrict all but a little exchange upstream of the (leaky) gates. These data indicate that the water levels in the channels upstream of the ACOE gates are kept at or slightly below a maximum elevation of 2.5-feet NAVD88 throughout the summer. The daily fluctuations are attributable to leakage through the gates (based on visual), while groundwater and surface water inflows also fill channels as they drain during low tide

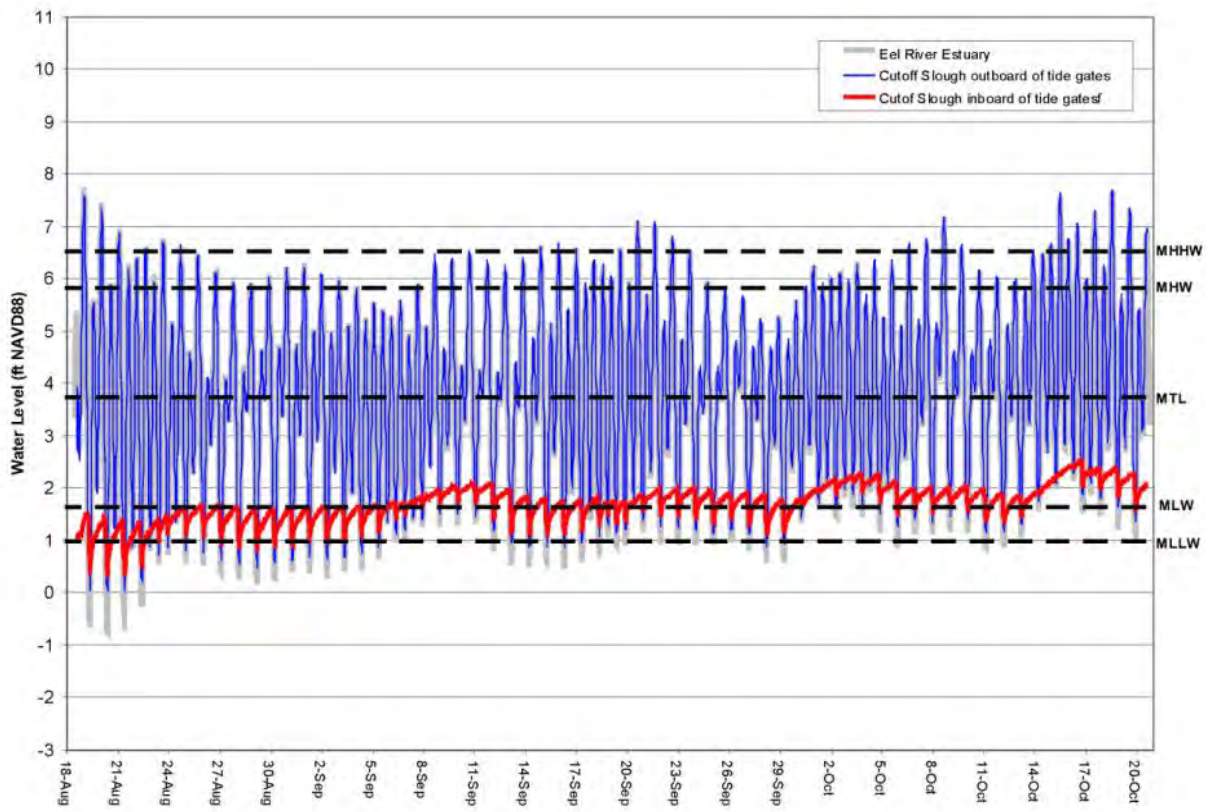


FIGURE 1: Water level hydrographs measured in 2005 at the inner and outer Cut-Off Slough gauges with computed tidal datums (see Table 1).

2.0 2005 Salinity Monitoring Results

During the summer and fall of 2005, KHE completed a comprehensive salinity monitoring program in the lower, tidally-influenced reach of the Eel and Salt Rivers. As part of this investigation, continuous salinity monitoring was completed within the Eel/Salt River estuary. Depth discrete salinity measurements were also repeatedly collected at up to 14 sites within the lower Salt River, including the inner and outer Cut-Off Slough gauges, on a near-monthly basis.

Salinity and water level monitoring within the estuary was revealing of the overall downstream salinity conditions and seasonal changes of the Eel and Salt River system. Figure 2 presents general estuary salinity concentrations over the June 23, 2005 through October 20, 2005 monitoring period. Water year 2005 was a wet year within the watershed, sustaining relatively high Eel River inflow rates of 6000 to 5000-cfs to the estuary late into June. The long-term average June flow rate into the estuary, as measured at the USGS Scotia gauge is 1290-cfs[13].

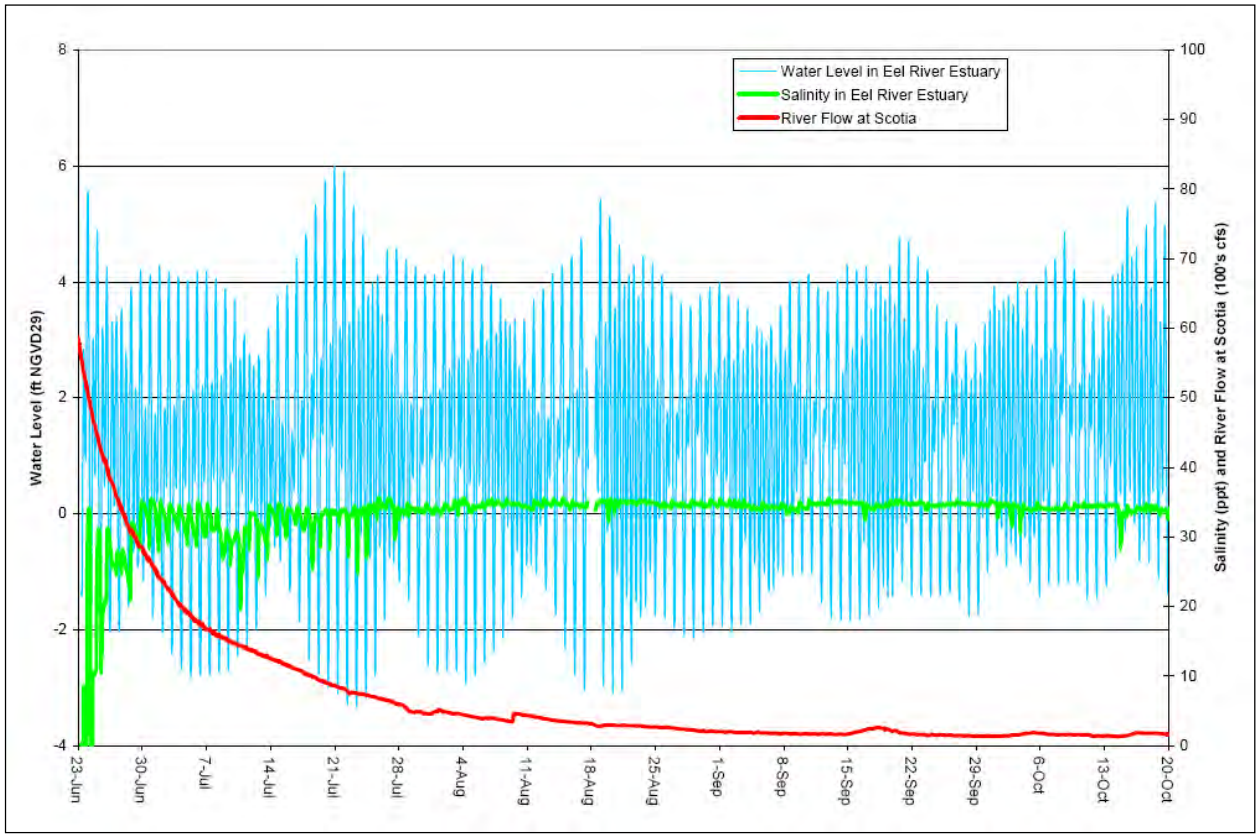


FIGURE 2: Eel River water level, flow and salinity conditions – June 23 to October 20, 1005.

[13] Mean daily flow data for the Scotia gauge as measured by the USGS for the period 1911 through 2008 was obtained from the National Water Information System web site at: http://waterdata.usgs.gov/ca/nwis/sw

As a result of the high Eel River inflows in June, salinity concentrations in the estuary were very low with concentrations at or below 1-part per thousand (ppt). As inflow rates decreased, estuary salinity concentrations quickly rose to marine concentrations, stabilizing to around 32-ppt by late July (Figure 2). Over the interim period, concentrations fluctuated daily in response to competing tidal and freshwater inflow processes.

Early season estuary salinity concentrations (June 24, 2005) are also presented on the top graph of Figure 7, which presents the vertical salinity profiles in the estuary measured at the mouth of the Salt River as well as at the Cut-Off Slough tide gate gauges. Within the estuary, the June 2005 estuary salinity profile indicates a strongly stratified estuary with a surficial lense of fresh water above a high salinity bottom layer. The upper graph also presents the evolution of the estuary salinity structure into late summer and fall (repeat vertical salinity profiles measured on August 17, September 23 and October 20), with a decrease in stratified structure to near homogeneous marine salinities through the water column experienced by October 20, 2005. The middle and lower graphs in Figure 3 present the present vertical salinity profiles at the outer and inner Cut-Off Slough tide gate gauges. In general, these results indicate: seasonal salinity concentrations with lower salinity during winter and higher during summer; more consistent vertical salinity concentrations, suggesting more thoroughly mixed water column; and slightly lower average concentrations during each monitoring date.

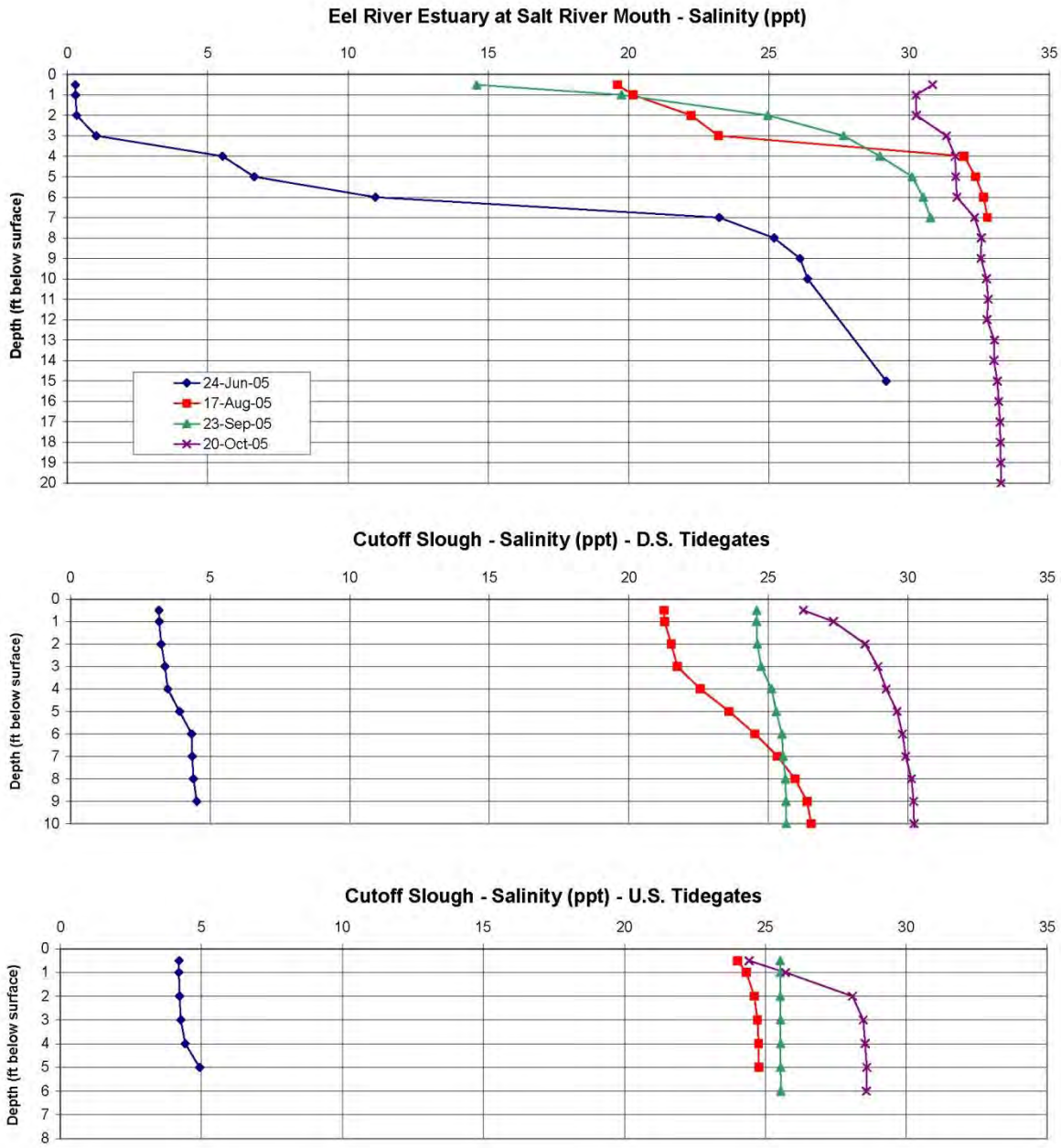


FIGURE 3: Salt River salinity profiles – 2005.

3.0 2009 Water Level and Salinity Monitoring by USFWS

To better understand how water quality changes within the Eel River estuary with varying discharge and tidal exchange during the spring-summer transition, H.T. Harvey & Associates (working on behalf of the U.S. Fish and Wildlife Service - USFWS) deployed automated water quality sensors at 1 location and 2 depths (near bottom, near surface) to evaluate fresh/marine

water dynamics. The sondes were attached to an anchor, and via a dual float system, one datasonde was deployed to float about 2 feet (60 cm) above the bottom and the other deployed to float about a foot (30 cm) below the surface.

The datasondes were deployed by boat on 29 April 2009. A large storm occurred in early May resulting in a large increase in Eel River discharge. The datasondes being swept toward the mouth of the river and retrieved on 8 May 2009. The data were downloaded and the datasondes were redeployed with an additional anchor on 13 May 2009. Final retrieval occurred on 12 August 2009. The data capture the early May 2009 storm except for a portion of the receding limb of the flow hydrograph. Results of water level monitoring during the 2009 period are presented in H.T. Harvey's 2009 memorandum included as Appendix E.

4.0 2014-2015 Continuous Water Level and Salinity Monitoring by KHE and TWC

Additional water level data were collected by KHE with the assistance of the Wildlands Conservancy (TWC) staff at the upstream and downstream sides of the Cut-Off Slough tide gate structures, between the time period of November 13, 2013 and April 22, 2015. Similar to 2005 monitoring, LTC instruments were used to continuously record measurements of water level, temperature and conductivity at 15-minute increments on the downstream (outboard) side of the tide gates, while only water level and temperature were measured on the upstream (inboard) side.

KHE performed a total station survey of each inboard and outboard Cut-Off Slough gauge on November 13, 2013 to determine the absolute elevation of each staff gauge (feet NAVD-88) pursuant to local area control points established by LACO Associates installed during the 2014 survey. An additional staff gauge survey was performed by KHE on August 16, 2014 after the gauges were removed for cleaning and maintenance. The same LACO control point was used for this survey. Comparison of water level (depth) data with concurrent staff gauge observations defined the vertical adjustment factors used to align the water level data from the LTC recorders to a common vertical datum.

Four different gauges were utilized to collect data on the outboard side of the Cut-Off Slough tide gate structure during this monitoring period due to malfunctioning or misplaced outboard LTC instruments. Missing periods of record for the outboard gauge due to the gauge malfunction or misplacement include January 17, 2014 – April 30, 2014 and July 21, 2014 – November 19, 2014. The inboard gauge was successful in capturing a time series of water surface elevations with the same LTC gauge through the entire duration of inboard monitoring.

Inboard Logger:

The same inboard gauge was used for the entire duration of water level monitoring. This period of record for inboard monitoring is from 11/13/2013 through current. Two sets of vertical correction factors were used due to the June 1st removal of the casing/gauge for cleaning. A Pre

June 1st, 2014 correction factor was calculated from the first KHE staff plate survey performed in November 13th, 2013. This survey used the LACO survey Control point 105 that had a vertical elevation in NAVD88-ft of 12.444-feet. A pre-June 1st survey indicated that 0.00' on the staff plate was equal to 0.014 feet (NAVD88-ft) with a vertical correction factor for logger readings of 0.716-feet (add this to barometric-corrected logger readings). The post June 1st survey indicated that 0.00' on the inboard staff plate was equal to 0.023 feet (NAVD88-ft) with a vertical correction factor for the logger readings of 0.814-feet (add this to barometric-corrected logger readings).

Outboard Logger:
A total of four (4) different continuous loggers were utilized to obtain a partial period of record for water level and salinity monitoring for the outboard gauge between 11/13/2015 through current (1/26/2015). Numerous gauges were needed to continue monitoring due to malfunctioning or missing gauges. Figures 4a through 4c below show a visual detail on 2013-2014 monitoring for both inboard and outboard gauges. Three of the loggers were Solinst-brand loggers that measured water depth in feet, temperature, conductivity (both specific and absolute). The fourth logger utilized was a Global Logger brand that only measured water depth during the time period of 11/19/2014 through 12/19/2014 to capture the December 2014 storm events. All loggers were set to record at 15-minute increments.

The first logger (Solinst SN 1069412) was damaged or missing, post 1/27/14 and replaced by another gauge (Solinst SN 1070027) on April 30th, 2014. Pre June 1, 2014 vertical correction factors were applied to data through April 30th, 2014 based on the November 13th, 2013 survey conducted by KHE. This survey utilized the same LACO survey control point (CP105) at an elevation of 12.444' (NAVD88-ft) located at the tide gate deck. The logger and casing was removed on June 1, 2014 for maintenance and cleaning and reinstalled on June 11th, 2014. A different vertical correction factor was implemented from a second (August 16th, 2014) KHE survey for data between June 11th, 2014 and July 21, 2014. Data went missing post July 21, 2014 due to a leak that occurred in the gauge. A new gauge (Global Logger) was installed on the outboard side on 11/19/2014 to capture December 2014 storm events, and the vertical correction factor was determined based on water level measurements at the outboard stilling well, again based on the August 16th, 2014 KHE survey. A fourth Solinst gauge (SN 1070765) replaced the Global logger gauge on December 9th, 2014. A new vertical correction factor was applied after December 9th, 2014 based on water level measurements made relative to the tide gate structure at a LACO survey point located on the North-West corner of the tide gate. All water levels are now being vertically adjusted according to water level readings relative to this location. A fifth correction factor had to be applied to the outboard data, post December 21st, 2014 due to "bending" (damage/displacement) of the well casing, reported by Dave Erickson Preserve Manager of the Eel River Estuary Preserve at The Wildlands Conservancy. In summary, a total

of five (5) separate correction factors were used to vertically rectify the 2013-2014 outboard monitoring data.

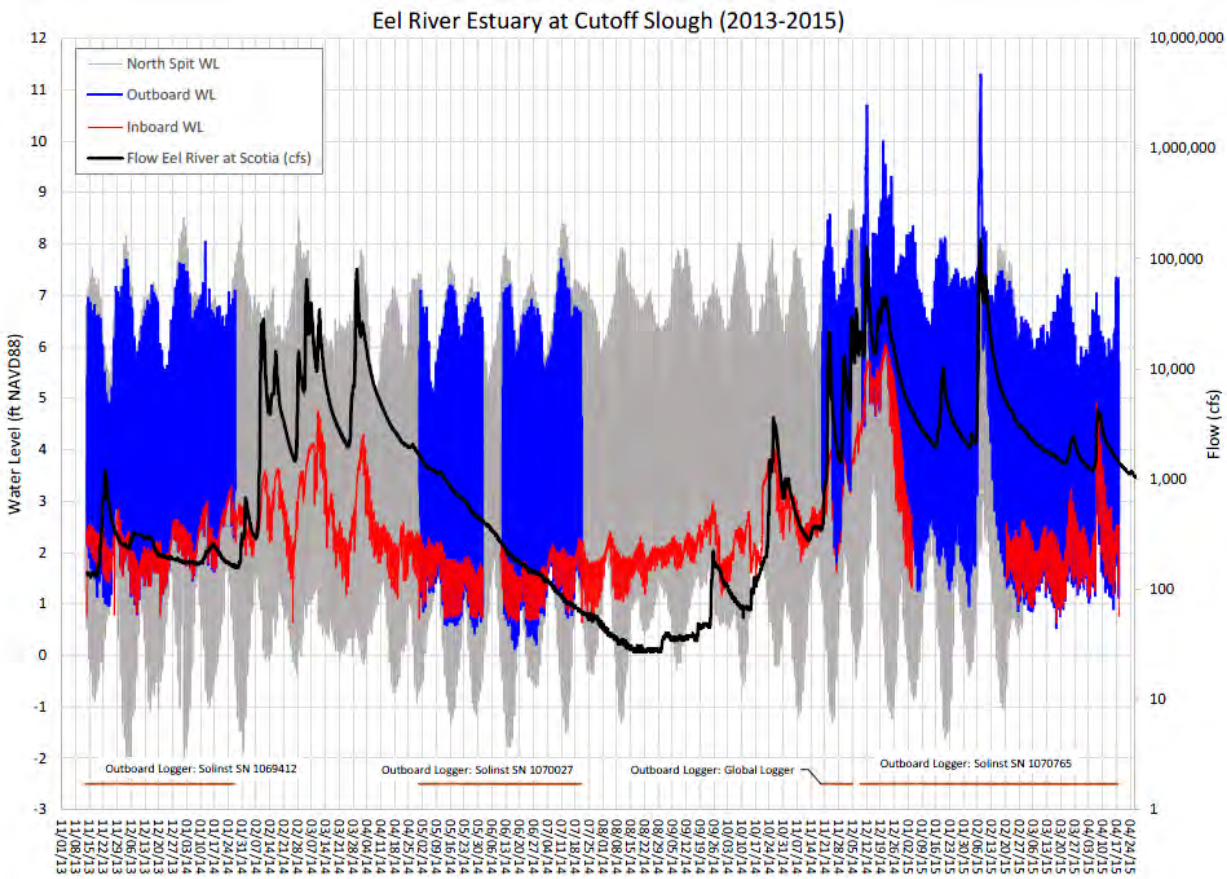


FIGURE 4a: Water level hydrographs measured in 2013-2015 at the inner and outer Cut-Off Slough gauges.

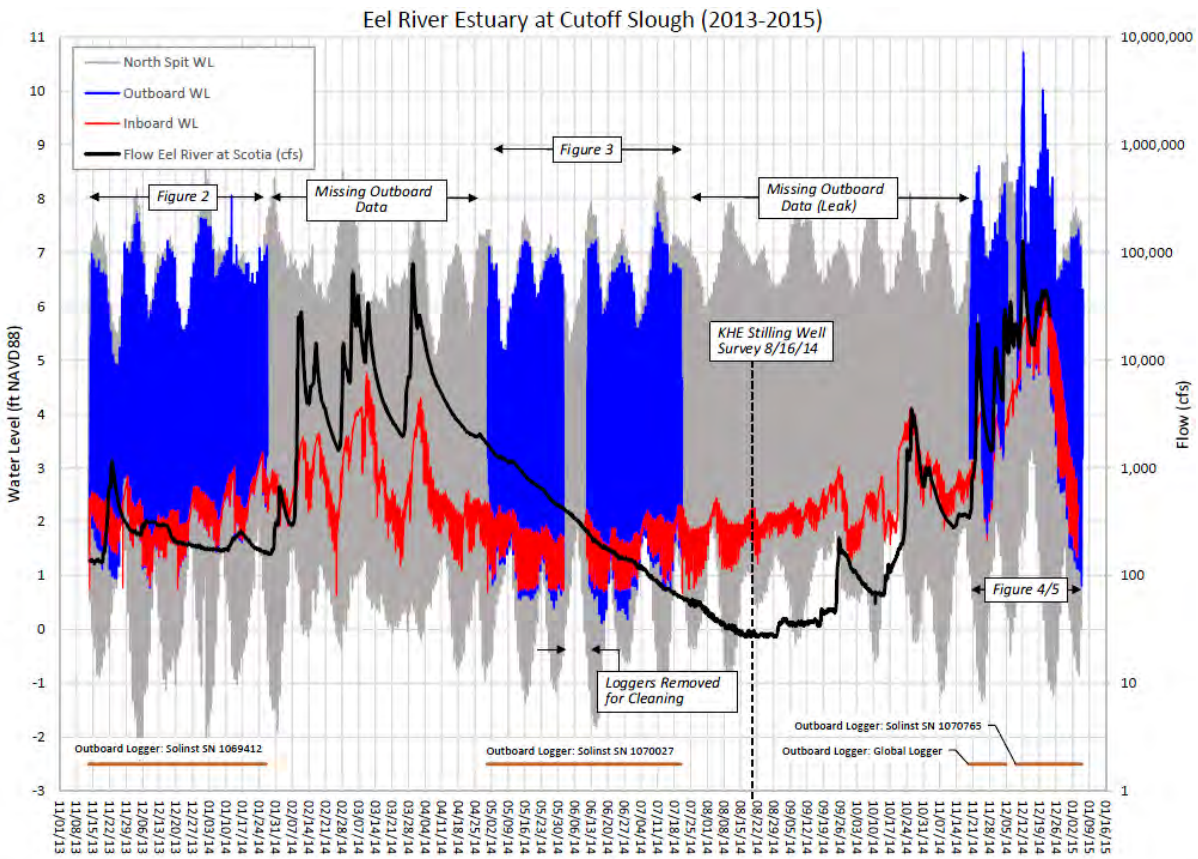


FIGURE 4b: Water level hydrographs measured in 2013-2015 at the inner and outer Cut-Off Slough gauges.

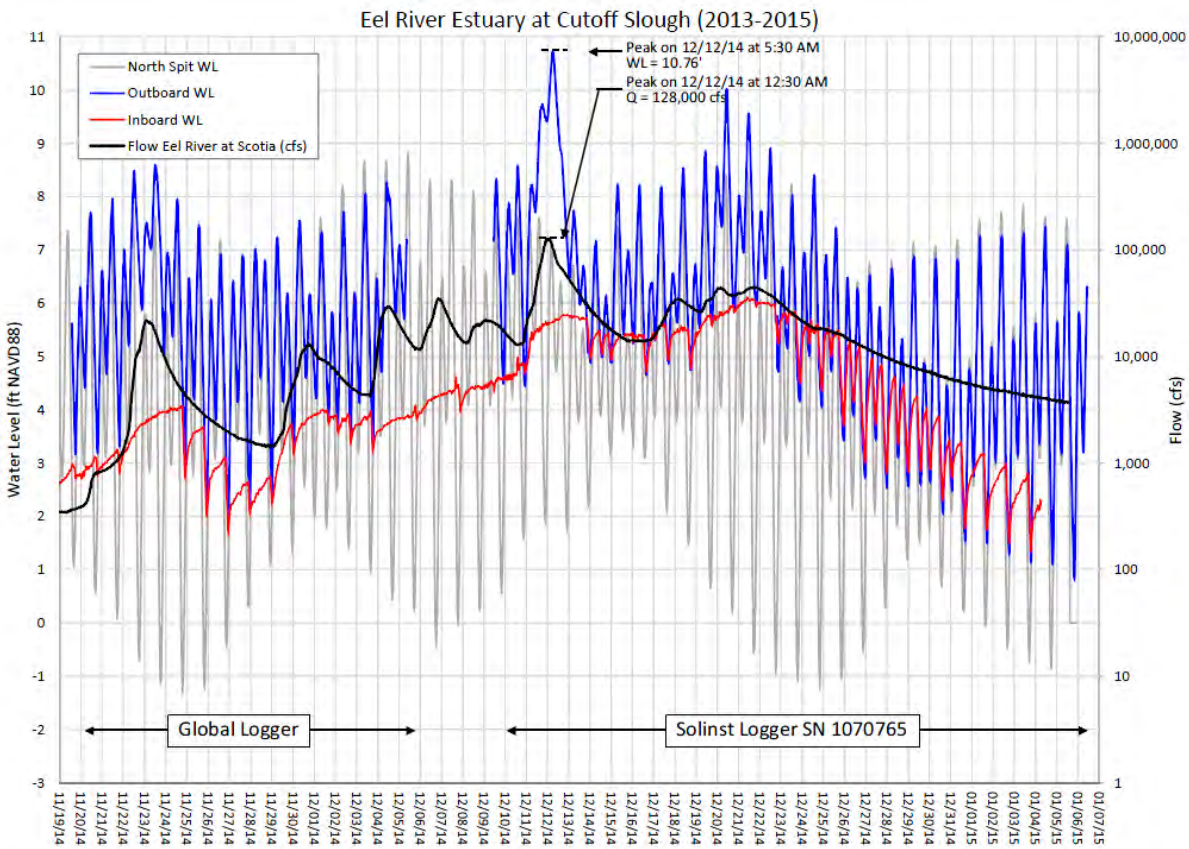


FIGURE 4c: Water level hydrographs measured the winter of 2014/15 at the inner and outer Cut-Off Slough gauges.

5.0 2014-2015 Discrete Water Quality Monitoring by KHE and TWC

Discrete water quality measurements were collected on August 20th, 2014 by KHE staff at 30 locations within the TWC project area. A location map of each of the 30 sites are presented in Figure 26 of the main report. Table 1 provides results from the readings including the easting and northing[14] of each location. Water quality measurement parameters focused on salinity and temperature. Data was obtained using YSI 556 MPS Multi Probe System instrumentation.

Post August 20th, 2014, TWC took over the work of collecting discrete water quality measurements on an approximate 1-month basis, at the same 31 sites. The time period of these readings was between November, 2014 and January, 2016. Monitoring results are summarized below and presented in Table 2.

<u>Salinity</u>

Water quality in site drainages is controlled by the mixing of a variety of source waters, including: 1) seasonally varied amounts of rainfall and freshwater inflow from the Wildcat

[14] Northings and eastings are referenced to a horizontal projection of California State Plane Zone 1 - feet (NAD83)

tributaries having salinity less than one part per thousand (ppt) (Figure 5); 2) shallow unconfined groundwater displaying relatively constant salinity concentrations, which vary spatially from brackish to marine[15] across the site; 3) freshwater inflow from the three artesian wells; and 4) leakage from the Cut-Off slough tide gates that displays seasonal salinities that are generally fresh in winter and marine in summer. Except for the Easter Drainage, salinities across the site display seasonal variability – fresh to brackish concentrations vary spatially and temporally through the winter, but return to near marine conditions throughout the summer. Freshwater runoff from artesian wells maintain perennial freshwater conditions in the southern half of the Eastern Drainage.

In general, the shallow groundwater table beneath the site occurs at an elevation of 2.5-feet NAVD88. This depth to water is very shallow, especially in low-lying areas. There appears to be a strong E-W summer salinity concentration gradient within the shallow groundwater, with salinity ranging from 24- to 25-ppt immediately behind the dunes (MW-4), decreasing to around 10- to 15-ppt at MW-2 and MW-3 and to 5-ppt further east at MW-1 (Figure 6). Seasonally, shallow groundwater salinity immediately behind the dunes only decreases to around 20-ppt, but can drop to between 1- and 5-ppt at the other more eastern wells during the wet winter period. The high salinities near the dunes are attributable to seepage of Ocean water eastward through the dunes. There is also some residual salinity locked into the fine-grained site soils that leaches salts into the shallow groundwater. The seasonal fluctuations in shallow groundwater salinity concentrations reflect winter freshwater recharge to the shallow groundwater. Because many internal ditches and remnant slough channels are deeper than the shallow water table, groundwater discharges into the channels and contributes to surface water salinity. The freshwater from the artesian wells originates from a much deeper confined aquifer(s). Salinity concentrations from the artesian aquifer(s) is constant (e.g., WQ-2 [irrigation well] in Figure 6) and does not vary seasonally as the aquifer(s) is too deep to be influenced by seasonal recharge at the site.

Along the western boundary of the site, summer salinity in the southern half of the Western Drainage ditch is marine due to a high percentage of ocean water seepage through the dunes (Figure 7). During the winter wet season, maximum salinity concentrations generally decrease to between 10- and 20-ppt in the downstream (northward) direction through the Western Drainage ditch into the middle portion of Cut-Off slough. During the most extreme winter high flow periods, the salinities decrease to as low as 2-ppt throughout the interconnected Western/Centerville/Cut-Off Slough drainage, but salinities quickly rebound to intermediate concentrations during runoff recession and between storm events (Figure 7). Salinities can remain below 5-ppt for extended wet periods, however by summer they return to seasonal

[15] For purposes of this report, marine salinity refers to salinities that range from 25- to 32-ppt in concentration. Hypersaline salinities are those greater than 32-ppt and reflect the concentration of salts in stagnant waters due to evaporation.

maximums between 30- and 32-ppt. Salinity concentrations throughout lower Cut-Off Slough and the Inner Marsh are very similar and display the same seasonal and storm-response patterns to those observed in the Western Drainage and Centerville Slough (Figure 8).

The salinity within the Easter drainage ditch is heavily influenced by runoff from Russ Creek and discharge from the artesian "irrigation supply well". Runoff in the Eastern drainage ditch flows from south to north. As a result, waters in the southern half of the ditch display freshwater salinity throughout the year (Figure 9). The exchange of higher salinity waters with Centerville Slough at the south end of the Eastern drainage leads to increased salinity concentrations through the northern half of the ditch, especially during the summer months or prolonged dry periods.

Temperature

Surface water temperatures display a seasonal trend of warmest during July and August and coolest temperatures occurring in early January. The temperature of freshwater inflow from Russ Creek generally ranges between 10- and 20-degrees Celsius (C) or 50- to 68-degrees Fahrenheit (F) although temperatures as low as 5-degrees C° (41° F) were recorded in early January 2016 (Figure 10a). Temperature ranges on other surface waters within the project area follow a similar trend except summer peak temperatures can approach over 25° C (77°) within the Inner Marsh and Cut-Off Slough at the north end of the project area (Figures 10b through 10d).

Water temperatures in the shallow unconfined groundwater display less seasonal variability than surface waters with temperatures generally ranging from 12°C (54°F) in winter and up to 17°C (63°F) in summer although temperatures as low as 8°C (46°F) were recorded in early January 2016 (Figure 11). The water temperature in the deeper confined aquifer remained constant at 13°C (55°F) over the monitoring period.

TABLE 1: Water quality monitoring results and site descriptions August 20, 2014.

Kamman Hydrology & Engineering, Inc.

WATER QUALITY MONITORING RESULTS 08/20/14 - CONNICK RANCH

Location ID	Easting	Northing	Description	Sample Date/Time	Salinity (µS/cm)	Salinity (PPT)	Temperature (˚C)	pH
WQ-1	5919490	2104425	Where Russ Ln. crosses Russ Creek @ Russ Ln. Bridge	2014-08-20/16:23:13	617	0.39	13.44	9.93
WQ-2	5916983	2108410	Irrigation supply well @ Tractor pump	2014-08-20/16:42:49	719	0.47	11.97	8.41
WQ-3	5915447	2107672	Monitoring Well B1	2014-08-20/16:54:01	19385	14.65	14.82	7.50
WQ-4	5915144	2107411	Bridge just west of Monitoring Well B1 @ Russ Creek	2014-08-20/17:09:39	658	0.39	15.73	10.16
WQ-5	5913133	2107832	Monitoring Well B2	2014-08-20/17:31:56	21057	15.80	15.38	7.22
WQ-6	5911766	2106885	Western Drainage Ditch - Just south of large barn	2014-08-20/17:49:05	38028	30.37	15.25	8.31
WQ-7	5917965	2108587	Bridge just North of new WC barn @ 90˚ angle of irrigation supply well ditch	2014-08-20/18:17:22	808	0.50	14.52	9.68
WQ-8	5916394	2111247	At bend on dirt road on way to centerville slough	2014-08-20/18:27:30	50126	37.11	19.67	8.59
WQ-9	5916347	2111203	Just US of CRWQ8 - near culvert @ dirt road	2014-08-20/18:30:11	54935	40.25	20.66	8.87
WQ-10	5915674	2112818	Bridge @ Centerville Slough - East side	2014-08-20/18:36:43	46350	35.35	18.01	9.02
WQ-11	5915662	2112818	Bridge @ Centerville Slough - West side	2014-08-20/18:36:54	45198	33.92	18.58	9.10
WQ-12	5914874	2112936	Monitoring Well B4	2014-08-20/18:51:56	26366	20.95	14.00	7.92
WQ-13	5914622	2112513	Junction of proposed Centerville Slough @ west drainage ditch	2014-08-20/18:57:20	41068	32.18	16.33	8.23
WQ-14	5915473	2113160		2014-08-20/19:07:34	54946	39.74	21.21	10.08
WQ-15	5917028	2113401	East of centerville slough culvert	2014-08-20/19:24:20	48974	36.28	19.57	9.93
WQ-16	5916843	2113602	West of centerville slough culvert	2014-08-20/19:29:19	50073	37.32	19.40	9.98
WQ-17	5917918	2116566	Inboard tide gate	2014-08-20/20:00:00	39254	33.29	13.09	8.90
WQ-18	5917934	2116586	Outboard tide gate	2014-08-20/20:02:23	39460	32.11	14.64	9.31
WQ-19	5917400	2116905	Northern most slough of proposed marsh	2014-08-20/20:16:35	45022	33.62	18.79	9.83
WQ-20	5916291	2115776	Northwestern slough of proposed marsh	2014-08-20/20:25:10	51230	36.60	21.39	10.04
WQ-21	5917698	2116893	Northern most levee, outboard of proposed marsh	2014-08-20/20:39:28	43095	32.77	17.81	9.28
WQ-22	5917546	2116050	Inner slough, ~1000 ft south of tide gate @ Elev <3.0	2014-08-20/20:53:25	60266	38.93	26.66	10.95
WQ-23	5918010	2115220	Center of cutoff slough - near large eukalyptus	2014-08-20/21:07:01	46911	33.65	20.59	9.87
WQ-24	5915754	2112592	South of Centerville Slough bridge,	2014-08-20/21:21:33	57479	36.50	27.12	10.72
WQ-25*	5914581	2111032	Monitoring Well B3 ***Muddy sample! - could be a bad reading ~8" of mud water @ boc	2014-08-20/21:37:59	20199	12.79	22.31	7.90
WQ-26	5918049	2109191	Irrigation well supply ditch - Northern end	2014-08-20/22:09:41	948	0.56	16.80	9.00
WQ-27	5918076	2109729	Irrigation well supply ditch - Northern most end	2014-08-20/22:14:57	2785	1.75	16.88	7.85
WQ-28	5917974	2108592	@ 90˚ bend of well supply ditch	2014-08-20/22:22:15	834	0.51	15.09	8.29
WQ-29	5917999	2103861	Upper Rush Creek - at Centerville Rd.	2014-08-20/22:49:16	648	0.40	14.84	7.31
WQ-30	5913197	2101693	Upper Shaw Creek - at Centerville Rd.	2014-08-20/22:57:36	472	0.28	16.27	8.18

*Well sample was muddy water and is likely a bad reading

TABLE 2: Discrete salinity and temperature measurements by TWC, sites WQ-1 through WQ-31 between November 2014 and January 2016.

	CRWQ Site Discrete Salinity Measurments (PPT)																											
Date	WQ-1	WQ-2	WQ-3	WQ-4	WQ-5	WQ-6	WQ-7	WQ-8	WQ-9	WQ-10	WQ-11	WQ-12	WQ-13	WQ-14	WQ-15	WQ-16	WQ-17	WQ-18	WQ-19	WQ-20	WQ-21	WQ-22	WQ-23	WQ-24	WQ-25	WQ-26	WQ-27	WQ-28	WQ-31
11/10/2014		0.5	5.4	0.4	16.5	26.4	0.5	2.3		22.0	10.4	23.4	7.4				27.4	27.7	24.8						9.2		8.4	0.5	
11/17/2014	0.40	0.5	5.8	0.4	16.2	28.3	0.5	1.7	1.5	13.9	13.1	24.3	21.7	14.9		22.0	23.8	23.8	24.9	23.3				16.7	8.8	0.6	10.0	0.5	
11/24/2014		0.5	4.8	0.2	16.5	11.6	0.5		0.6	13.5	13.2	23.1	0.5										0.8	0.7	12.3			0.5	
11/25/2014																17.3	12.1	6.4	17.3	17.3	6.4					0.6	0.5		
11/30/2014	0.20	0.5	5.0	0.2	16.4	10.8	0.6	0.5	0.6	1.8	1.7	23.9	5.4		1.7	11.1	8.5	10.3	12.0	12.8	8.1	16.3	2.7	0.4	9.1	0.7	0.5	0.6	
12/14/2014	0.20				13.1	2.1				1.4	1.2	24.2	2.2		0.9	4.9	1.7	1.7	3.7	3.1	1.9			0.5	9.3				
12/28/2014							0.4	0.3	0.3	2.9	3.3	23.9	5.8		3.2	3.1	2.1	1.9	3.3	3.3	1.9		3.2	0.5		0.4	0.4	0.4	1.7
1/5/2015		0.6	4.1	0.3	13.5	8.8	0.4	0.5	0.4	4.9	4.9	22.7	14.0		4.0	4.1	6.5	8.9	6.4	6.9	8.5		5.2	7.6	9.5	0.4	0.4	0.4	4.0
2/1/2015	0.30	0.6	3.9	0.3	13.8	29.2	0.7	0.6	0.5	17.6	14.7	22.2	16.0		9.3	9.3	19.0	13.9	13.3	16.0	13.6		10.7	6.1	9.5	0.8	0.7	0.7	3.5
2/17/2015		0.7	3.5	0.2	13.0	11.5	0.3	0.3	0.2	5.6	3.8	21.5	7.1		0.9	0.9	1.1	3.6	2.0	2.4	1.0		1.1	0.4	9.1	0.3	0.3	0.3	0.4
4/8/2015	0.10	0.8	0.1	0.1	2.9	1.3	0.1	0.2	0.3	1.4	1.4	22.2	1.4		3.9	5.4	2.2	2.0	3.2	10.5	2.3		1.6	0.2	8.8	0.1	0.1	0.1	0.3
4/25/2015		0.7	3.2	0.3	1.1	15.0	0.8	0.3		15.9	15.0	21.6	22.2		13.4	12.0	23.1	17.9	24.6	20.5	17.9		20.5	12.8	8.9	0.8	0.8	0.8	2.9
5/18/2015		0.7	8.6	0.4	2.9	28.9	0.7	0.8	0.8	23.6	24.7	22.2	25.2		18.1	18.1	27.6	29.3	25.0	29.5	22.9		23.2		10.1	0.7	0.7	0.7	0.8
6/6/2015		0.7	10.0	0.4	5.2	29.6	0.7	1.3	1.3	20.7	26.5	22.2	27.4		20.0	20.0	27.5	27.5	28.1	32.9	25.9		26.5	2.8	9.7	0.7	0.7	0.7	0.7
6/20/2015		0.7	10.7	0.4	13.8	30.4	0.7			19.8	29.3	21.6	26.7		24.4	23.8	28.1	28.1	29.3	45.2	27.5		24.6	3.4	8.1	0.8	0.7	0.7	
7/15/2015		0.7	10.6	0.4	15.4	25.1									26.5	27.2	30.0	29.2		26.6	27.5	23.9	29.4		15.7				
7/16/2015							0.7	16.0		20.4	30.7	21.1	30.6											24.2		0.7	0.7	0.7	0.9
7/28/2015		0.7	10.7	0.4	15.6	30.2									32.2	34.4	30.5	31.1	31.2		29.7		31.5		15.8				
7/29/2015	0.40						0.7	32.6	33.3	18.8	32.6	20.6	31.5											33.2		0.7	0.7	0.7	1.2
8/12/2015	0.40						0.7	21.5	23.5	20.1	31.1				32.2	26.6	30.3	29.8	31.2	33.8	31.2		31.6	30.7		0.7	0.7	0.7	8.5
8/18/2015		0.7	10.3	0.4	15.8	30.2						18.6	28.2												15.5				
8/29/2015	0.40	0.7	9.8	0.4	15.8	28.6	0.7	33.3		31.0	31.0	18.1	26.5		30.7	30.8	30.3	30.5	31.7	57.7	29.3		30.8	27.3	14.7	0.7	0.7	0.7	1.8
9/16/2015	0.40	0.7	15.7	0.4	16.0		0.8	28.5	26.9	31.4	31.1	18.4	30.2		31.6	30.9	30.4	30.5	30.8	51.0	30.7		30.9	31.0	14.7	0.7	0.7	0.7	1.1
10/3/2015	0.40	0.7	8.2	0.5	15.6	29.2	0.7	30.6	29.9	28.7	28.7	19.2	27.3		28.8	30.6	30.4	29.7	30.9	51.1	30.1		30.6	29.2	15.2	0.7	0.8	0.7	14.8
10/17/2015		0.7	16.3	0.4	16.0	28.7	0.7	30.5	29.2	30.3	29.7	20.1	30.5		30.7	30.2	30.3	30.5	30.3	45.2	30.4		30.9	27.6	15.4	0.7	0.7	0.7	22.5
11/7/2015		0.8	8.0	0.5	16.0	28.4																			14.8				
11/8/2015	0.50						0.8	26.5	25.9	27.0	27.8	22.3	26.7		24.0	26.8	29.1	29.7	28.0	32.8	29.7		27.9	25.8		0.8	0.8	0.8	
11/20/2015		0.8	6.5	0.5	15.6	22.8	0.8	15.7	3.0	20.1	19.9				17.9	18.4	24.5	22.8	23.1	23.8	22.6		20.9	13.2	7.3	0.8	0.8	0.8	14.0
11/21/2015	0.60											21.1	20.6																
12/5/2015	0.40	0.8	5.6	0.3	16.1	28.5	0.8	18.8	19.0	22.2	21.4	25.0	2.8		22.6	22.3	20.9	14.4	21.9	17.6	14.5		19.1	23.8	14.1	0.8	0.8	0.8	6.5
12/19/2015	0.10	0.8	5.1	0.1	13.0	4.7	0.4	2.2	0.2	4.9	5.6	25.2	5.4		5.4	5.3	5.5	1.1	8.1	6.1	1.5		5.2	0.6	7.3	0.4	0.4	0.4	1.3
1/2/2016		0.8	5.1	0.2	8.5	8.4	0.4	0.6	0.6	7.3	5.6	22.9	12.3		2.8	2.9	3.1	3.1	3.9	5.9	3.0		2.9	1.9	4.0	0.4	0.4	0.4	0.4
1/15/2016	0.10	0.9	5.2	0.1	11.5	0.8	0.2	0.3		1.2	1.2	22.4	0.4		2.0	2.0	0.8	0.3	2.8	2.7	0.3		1.4	0.8	6.7	0.2	0.3	0.2	0.4
1/30/2016	0.10	1	5.2	0.1	12.2	2.3	0.2	0.2	0.2	2.5	1.1		24.7		2.3	2.8	3.9	0.1	2.5	2.2	0.1		3.1	0.8	3.4	0.2	0.3	0.2	0.4

	CRWQ Site DiscreteTemperature Measurments (degrees C)																											
Date	WQ-1	WQ-2	WQ-3	WQ-4	WQ-5	WQ-6	WQ-7	WQ-8	WQ-9	WQ-10	WQ-11	WQ-12	WQ-13	WQ-14	WQ-15	WQ-16	WQ-17	WQ-18	WQ-19	WQ-20	WQ-21	WQ-22	WQ-23	WQ-24	WQ-25	WQ-26	WQ-27	WQ-28	WQ-31
11/10/2014		13.0	15.1	13.4	15.4	13.6	13.5	16.6		15.7	18.1	13.8	14.5				14.1	13.8	17.4						14.9		15.4	13.5	
11/17/2014	9.80	13.0	14.2	9.1	15.1	11.0	11.1	13.9	14.2	11.8	11.6	13.5	11.6	13.4		14.4	13.2	13.2	13.5	15.3				16.4	13.6	12.7	13.6	11.1	
11/24/2014		13.0	13.9	11.2	15.3	11.9	11.7		14.3	13.5	13.5	13.1	11.2										11.1	14.4	14.4			11.3	
11/25/2014																13.9	14.0	12.2	14.4	15.7	12.7					12.5	11.6		
11/30/2014	10.50	13.0	13.2	10.4	15.1	10.9	12.0	13.4	13.4	10.6	10.7	13.2	11.1		11.8	12.9	12.2	12.1	13.0	12.8	12.2	12.9	12.1	11.2	13.1	12.6	12.0	11.9	
12/14/2014	10.50				13.3	9.6				9.8	9.9	12.9	10.1		10.1	10.8	10.4	10.4	10.6	10.0	10.6			9.8	12.6				
12/28/2014							9.7	12.6	13.2	9.5	9.5	12.8	10.0		8.7	8.6	8.8	8.8	9.2	10.1	9.6		8.7	10.3		11.3	9.4	9.6	11.5
1/5/2015		13.0	10.8	7.2	11.7	8.9	8.8	10.9	11.0	7.8	7.8	11.2	12.7		9.3	9.9	9.7	9.3	9.5	11.5	9.5		10.5	10.9	10.8	9.3	10.0	8.7	9.1
2/1/2015	9.80	13.0	12.2	10.4	12.4	13.8	11.2	11.4	11.7	10.2	10.3	11.7	12.7		11.7	11.8	11.8	11.8	12.5	12.7	11.7		12.8	11.2	12.1	11.6	11.7	11.4	11.3
2/17/2015		13.0	12.5	11.7	12.6	12.7	13.2	14.2	14.5	12.7	12.8	11.8	12.7		13.6	13.8	13.8	12.2	13.8	12.9	12.7		13.8	13.1	12.5	13.3	13.8	13.2	13.3
4/8/2015	11.50	13.0	11.7	10.4	13.0	13.3	16.3	19.7	19.0	15.3	15.1	11.8	15.1		14.8	12.3	13.4	13.6	15.1	16.7	14.0		14.1	16.4	12.6	15.1	15.0	16.2	14.3
4/25/2015		13.0	13.1	12.4	13.3	18.7	13.4	13.8	14.0	14.4	14.2	11.8	13.2		15.6	14.8	13.5	13.4	13.9	16.0	13.9		15.0	16.2	14.2	14.4	14.4	13.4	14.5
5/18/2015		13.0	13.7	13.3	13.9	15.2	13.2	18.3	17.1	20.3	20.2	11.9	14.1		18.1	18.6	12.0	11.1	18.6	17.5	14.1		17.2		14.1	16.5	15.8	14.1	17.1
6/6/2015		13.0	14.5	15.9	14.6	14.1	14.8	16.3	18.1	26.7	20.7	12.5	13.8		19.5	19.5	17.5	17.5	18.1	19.6	18.1		18.6	18.6	14.4	14.9	16.4	14.9	16.1
6/20/2015		13.0	15.4	16.6	14.5	19.6	14.5			29.2	19.6	12.4	19.6		20.3	20.5	18.0	18.0	19.0	19.6	18.3		19.7	23.1	15.1	19.3	15.7	14.6	
7/15/2015		13.0	16.1	18.6	15.1	19.1									26.8	25.2	20.3	17.8		28.6	19.6	48.1	22.6		15.2				
7/16/2015							14.6	19.2		30.6	20.4	13.1	19.2											24.0		16.5	15.3	14.5	15.2
7/28/2015		13.0	16.7	19.6	15.7	18.8									26.8	25.8	16.9	15.0	25.5		22.2		23.7		15.8				
7/29/2015	14.90						13.8	17.1	17.2	33.3	19.8	13.4	19.6											18.0		14.9	15.1	14.0	15.1
8/12/2015	16.10						14.4	19.5	17.7	31.1	20.0				23.5	21.2	18.2	17.8	19.1	21.7	18.5		20.4	21.6		13.3	16.1	14.7	23.9
8/18/2015		13.0	16.8	16.4	15.9	14.3						13.1	14.7												16.3				
8/29/2015	17.40	13.0	17.0	18.1	16.6	17.9	15.8	23.2		20.8	20.6	14.1	15.3		23.3	23.1	17.3	17.1	21.7	22.1	18.6		21.7	22.7	17.0	16.1	16.9	15.3	19.6
9/16/2015	13.90	13.0	15.9	13.3	16.3		12.7	16.8	15.6	14.4	14.4	13.5	16.0		15.1	15.7	13.6	13.6	14.1	15.3	13.6		14.5	14.2	16.7	12.6	12.8	12.5	14.8
10/3/2015	13.30	13.0	16.6	14.5	16.4	13.0	13.2	16.3	15.7	17.0	17.2	13.6	14.4		15.4	17.1	14.1	14.9	15.3	17.6	14.9		16.7	16.7	16.3	13.2	13.6	13.2	20.9
10/17/2015		13.0	15.9	14.9	16.4	15.0	13.7	17.1	17.3	16.9	16.7	13.7	17.9		19.0	18.9	15.2	14.8	18.0	21.0	15.3		18.2	17.3	16.4	14.5	14.5	13.7	17.3
11/7/2015		13.0	16.2	10.6	16.1	13.1																			16.0				
11/8/2015	11.80						12.6	12.9	13.1	13.4	13.4	13.6	14.2		11.2	12.8	12.1	12.3	13.1	13.1	12.3		13.1	13.4		11.8	11.4	12.3	
11/20/2015		13.0	15.2	11.9	15.7	13.6	12.5	15.6	14.5	13.9	13.7				13.8	13.7	12.7	13.0	14.5	14.5	13.1		14.1	14.5	13.7	12.7	12.8	12.7	15.0
11/21/2015	11.60											12.8	13.2																
12/5/2015	9.10	13.0	13.2	9.5	15.3	12.5	11.0	12.6	12.5	11.6	11.6	12.6	9.6		10.9	10.8	11.6	10.6	10.1	11.5	10.4		10.0	12.1	14.2	10.2	10.2	11.0	11.7
12/19/2015	9.50	13.0	12.5	9.6	13.6	9.2	9.5	11.0	10.3	10.1	10.2	12.5	10.5		10.6	10.7	10.6	9.5	11.7	12.7	10.2		10.7	9.9	12.1	10.3	10.6	9.5	11.2
1/2/2016		13.0	11.0	4.2	10.5	4.1	5.3	5.6	5.6	4.4	4.4	8.8	6.1		4.5	4.5	4.8	4.7	5.1	6.0	4.7		4.9	5.0	8.1	6.0	5.6	5.7	5.7
1/15/2016	9.30	13.0	10.8	9.4	11.4	8.6	8.9	8.9		8.9	8.9	10.2	9.2		9.1	9.1	8.8	8.6	9.5	9.6	8.8		9.3	9.2	11.2	8.8	8.8	8.8	9.6
1/30/2016	10.20	13	11.7	9.7	12.4	9.9	11	11.2	11	10.9	11.5		11.5		12.2	11.8	11.9	11	11.6	13.3	11		12.2	10.8	10.7	10.7	10.9	11	12.1

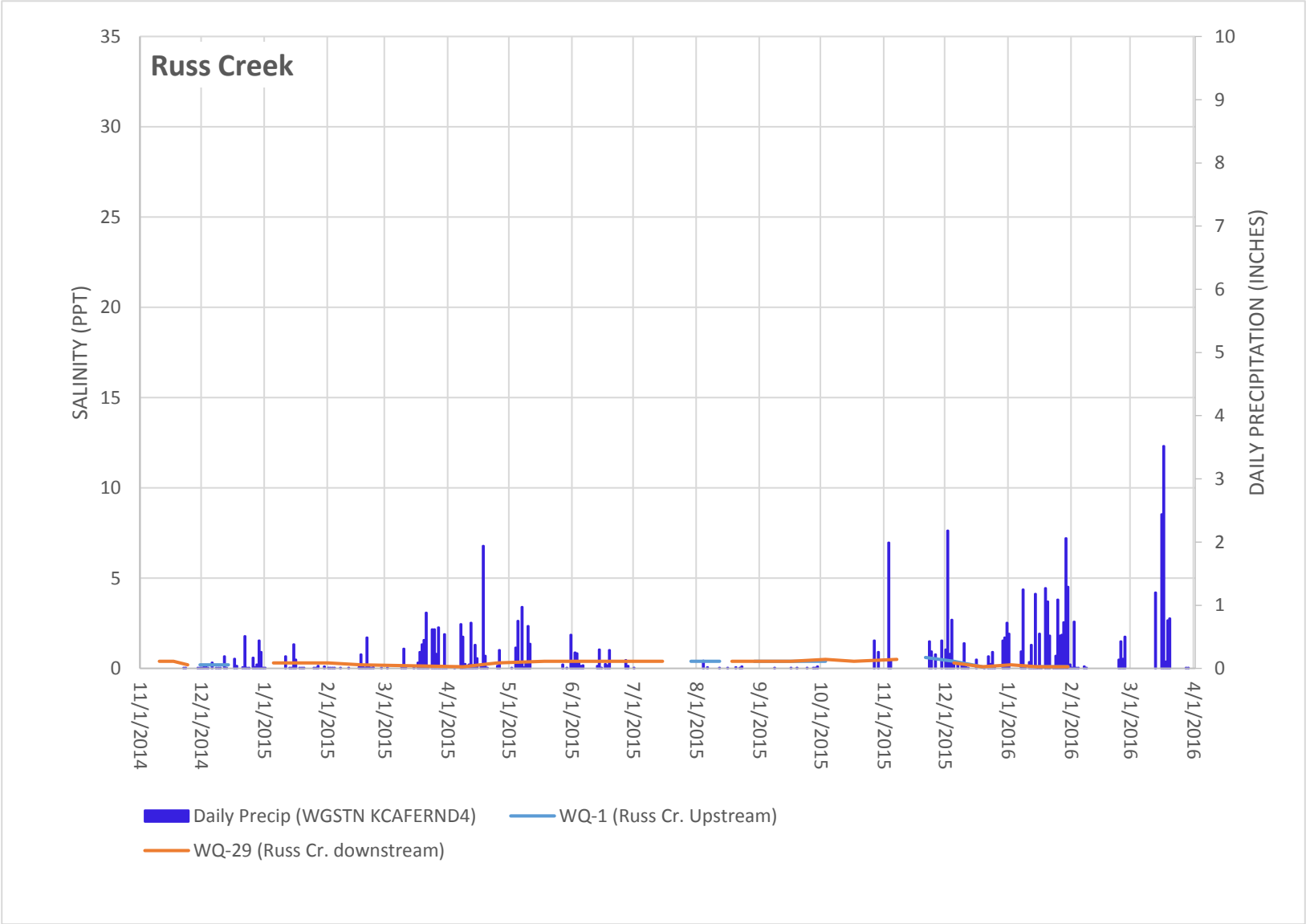


FIGURE 5: Salinity measurements from Russ Creek.

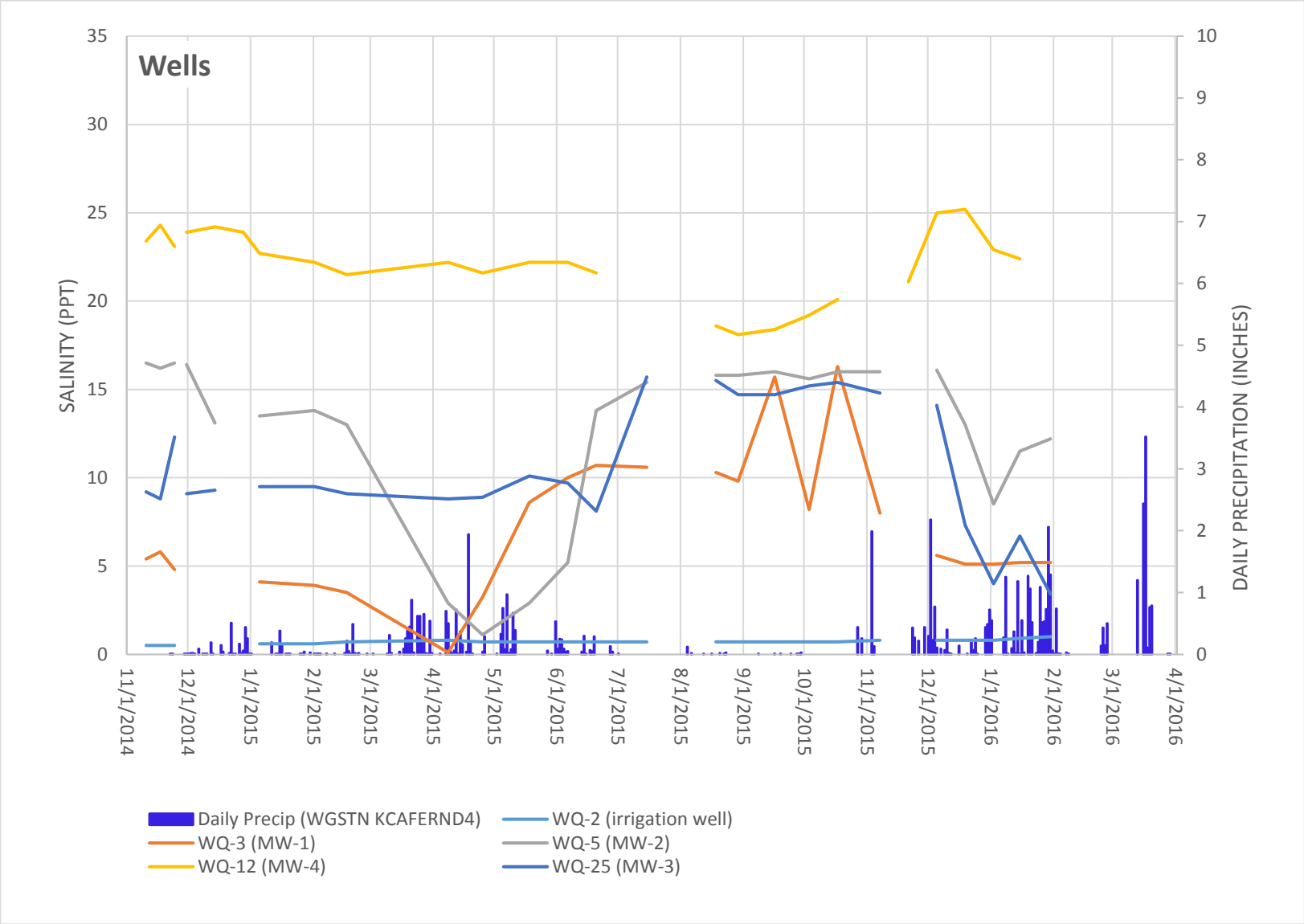


FIGURE 6: Salinity measurements from site wells.

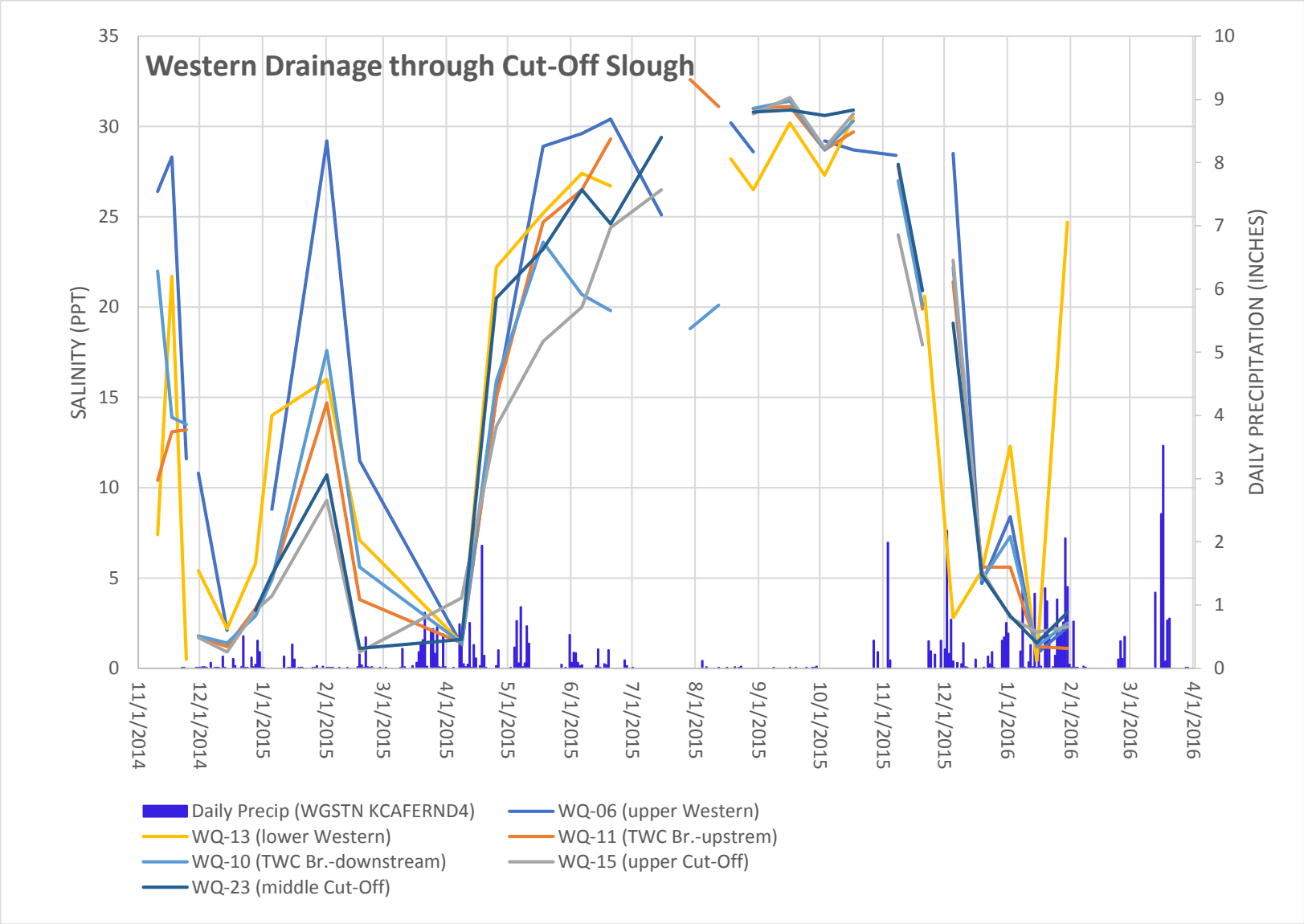


FIGURE 7: Salinity measurements from Western Drainage ditch and Upper Cut-Off Slough.

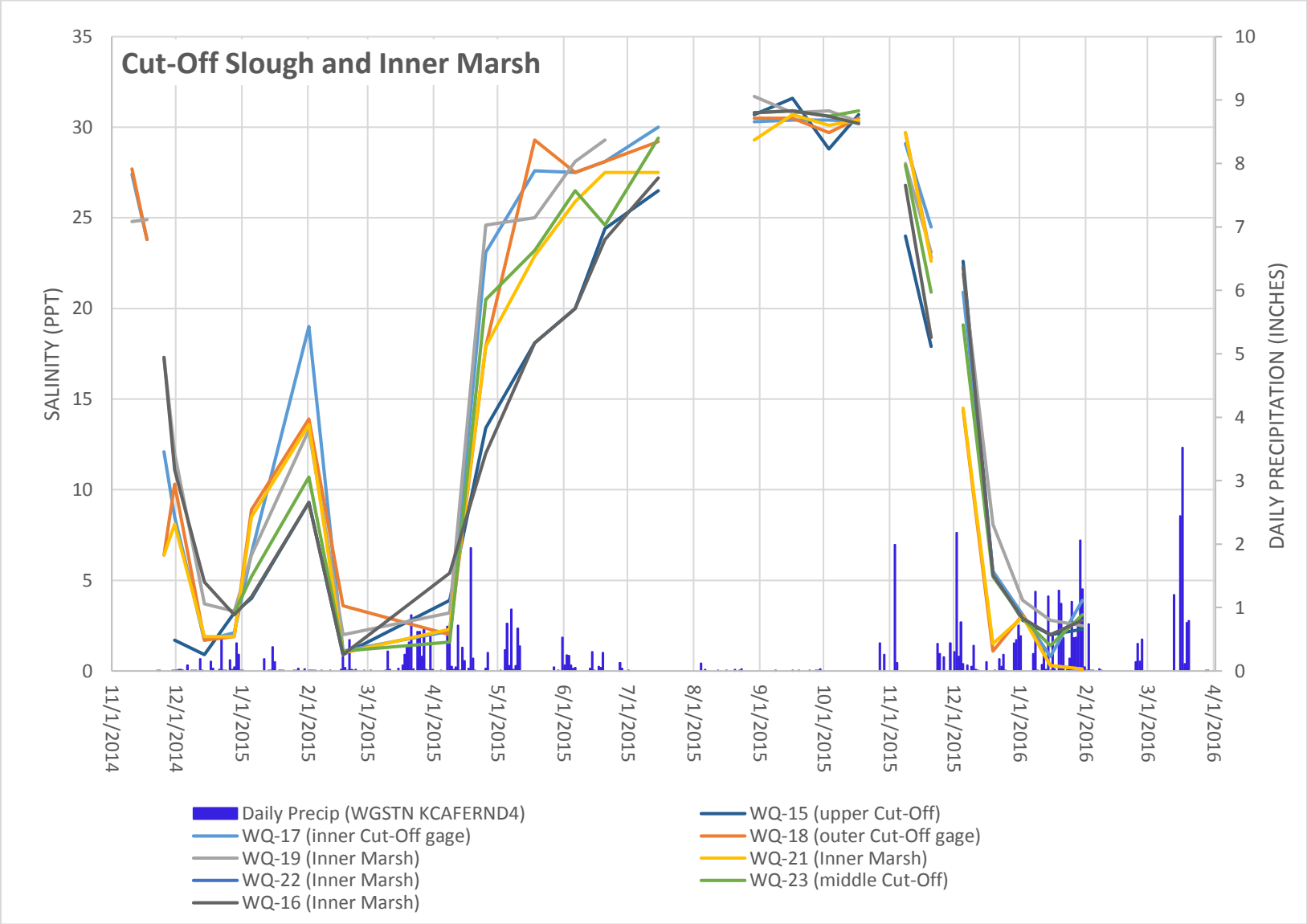


FIGURE 8: Salinity measurements from Lower Cut-Off Slough and the Inner Marsh.

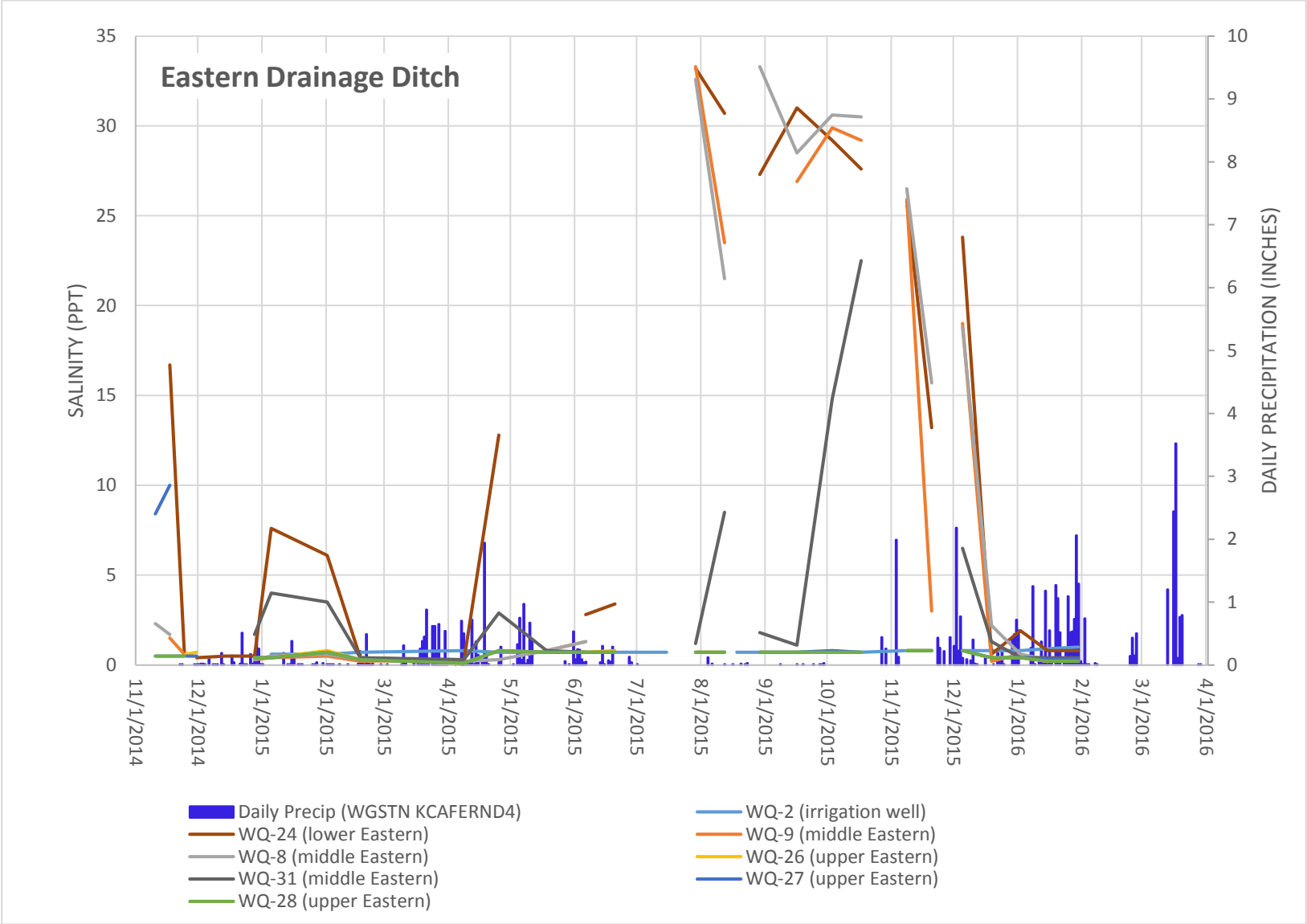
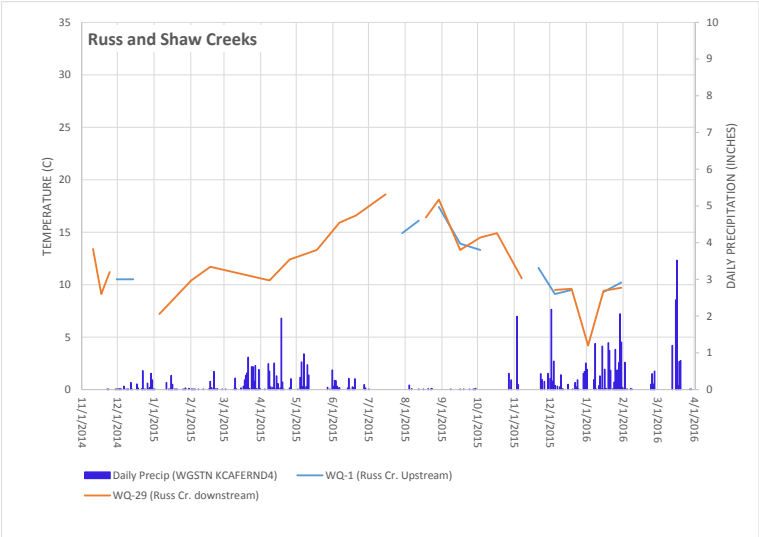
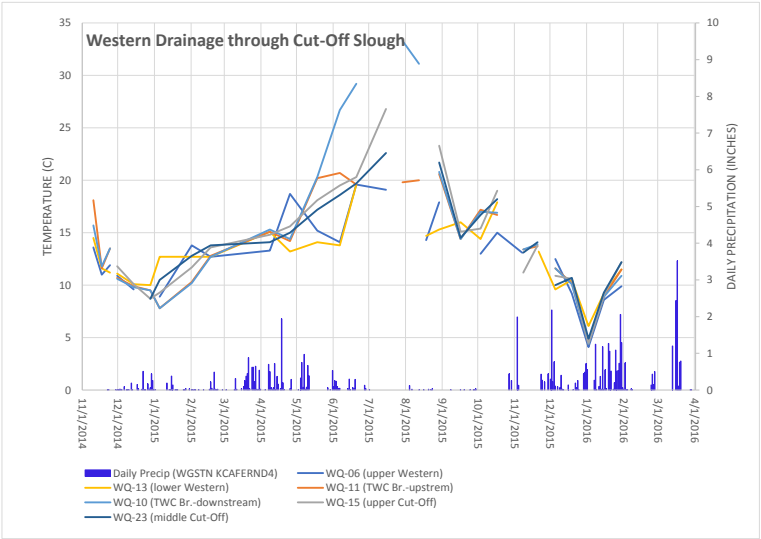


FIGURE 9: Salinity measurements from Eastern Drainage ditch.

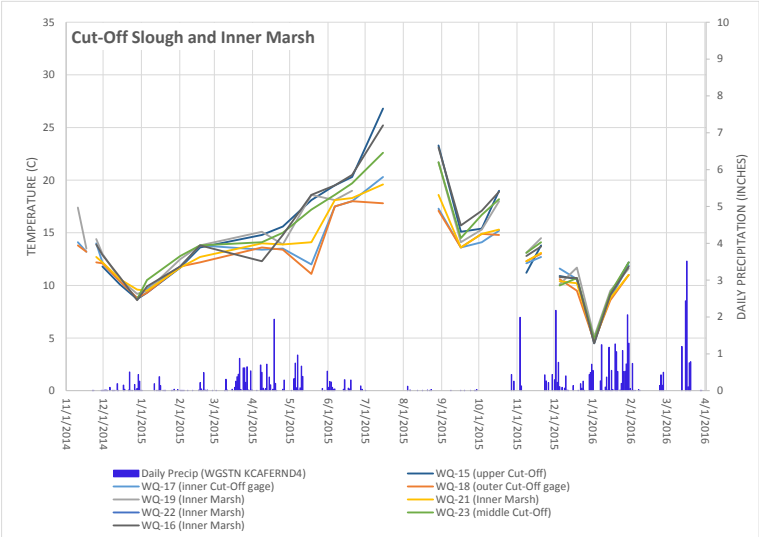
1. a)



b)



c)



d)

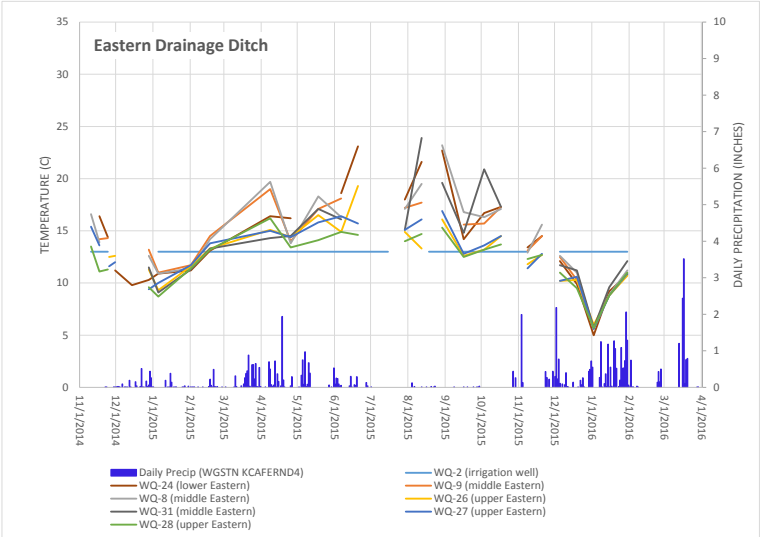


FIGURE 10: Surface water temperature measurements from the Project area.

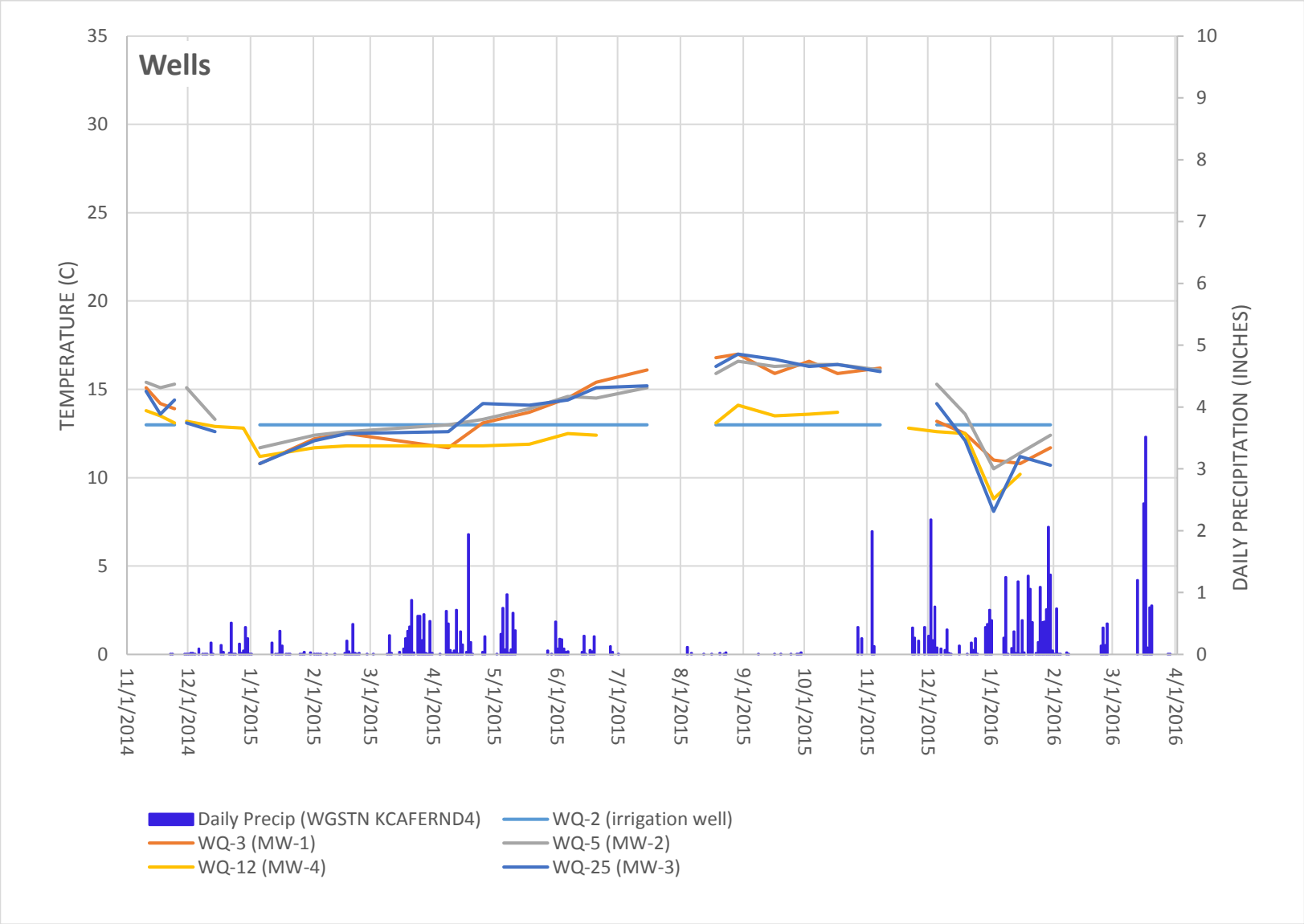


FIGURE 11: Groundwater temperature measurements from the Project area.

6.0 Tidal Reckoning and Tidal Datums

Predicted tidal datums for Salt River estuary were developed following the procedures outlined in NOAA Technical Report, *NOS 64: Variability of Tidal Datums and Accuracy in Determining Datums from Short Series of Observations* (Swanson, 1974). The estimate is based on:

- Measured water levels within the estuary between July and October 2005 with gauges tied to local County survey control points;
- Observed water levels at the NOAA Crescent City gage (Station ID: 9429750);
- Tidal datums for the Crescent City gage as report by NOAA for the 19 year tidal epoch 1983 to 2001.

Table 2 summarizes the tidal statistics for the observed data at both Salt River Estuary and Crescent City. A correction factor developed by comparing the short and long term records at Crescent City is applied to the Salt River data in an effort to develop tidal statistics that are reflective of longer term average conditions. The result is a less than 0.1 ft shift in the observed datum planes.

TABLE 2: Computed Tidal Datums for Eel-Salt River estuary (far right column).

	Humboldt Bay, North Spit NOAA Stn. ID: 9418767 Datum Elevation (ft NAVD88)	Eel-Salt R. Estuary Computed Tidal Datum Elevation (ft NAVD88)
MHHW	6.53	6.52
MHW	5.82	5.83
MTL	3.37	3.73
MLW	0.93	1.64
MLLW	-0.33	0.98

APPENDIX E:
H.T. Harvey Memorandum Presenting 2009 Estuary Water Level Monitoring

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

MEMORANDUM

PROJECT #2934-01

27 October 2009

TO: **Paula Golightly (U.S. Fish and Wildlife Service)**

FROM: **John Bourgeois and Sharon Kramer**

SUBJECT: **Eel River Water Quality Datasonde Deployment Summary (2009)**

Introduction

The majority of tidal wetlands in the Eel River estuary have been diked and converted to pasture and agricultural land during the past 150 years. The pre-1850 Eel River Estuary tidal area was estimated to be close to 10,000 acres, however as a result of sedimentation and reclamation activity, the estuary tidal area of the Eel River today is approximately 40% of its former size (USDA-SCS 1989; Higgins 1991).

The majority of the historic tidal wetland marshes surrounding the Eel River estuary is behind tide gates and has been converted to pasture lands. Restoring these marshes will likely benefit juvenile coho salmon and steelhead, as well as juvenile Chinook salmon, coastal cutthroat trout, and other estuarine fishes, potentially including federally endangered tidewater goby. Fish surveys have found juvenile salmonids, including coho salmon, in or near Salt River and McNulty Slough (Cannata pers. com.; Puckett 1977).

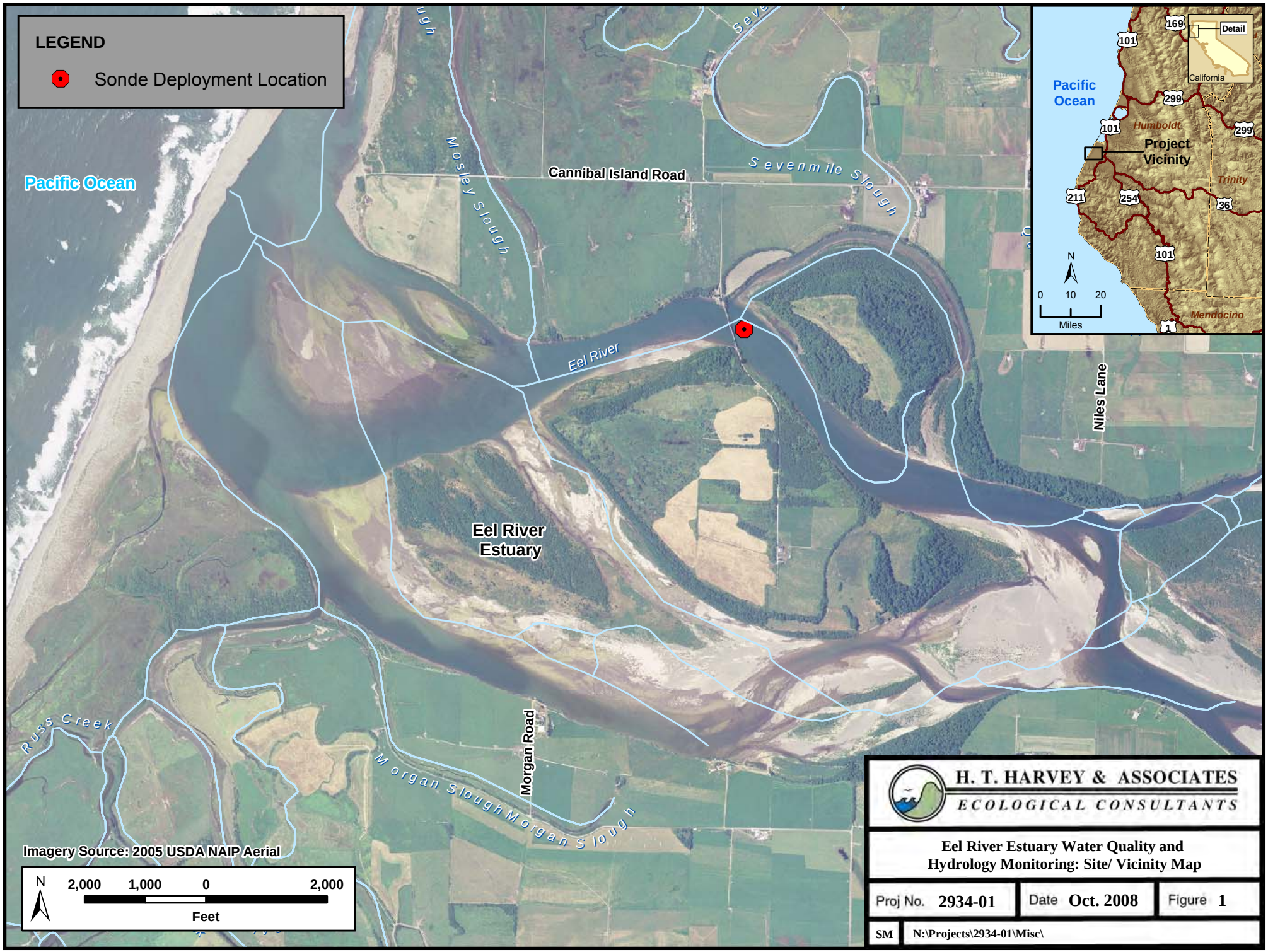
Currently, historic pieces of marshland habitat around the Eel River estuary are being acquired by various public agencies and restoration projects have been completed, or are being planned or implemented. Completed projects include Cock Robin Island riparian and freshwater wetland enhancement (CDFG Wildlife Area). Planned restoration projects include Salt River restoration, and McNulty Slough interior levee repair project on the Ocean Ranch Unit of the CDFG Eel River Wildlife Area.

Recent water quality data are not available for the lower Eel River estuary. It is unknown if water quality conditions are a potential limiting factor to aquatic species in the estuary. Collecting water quality data in the lower estuary will complement efforts to develop water quality models to evaluate effects of large scale restoration projects in the Salt River, including Riverside Ranch.

The project's primary objective is to obtain stratified data on basic water quality parameters such as temperature and salinity at one location in the lower Eel River estuary. Ideally, stratified water monitoring stations at multiple locations throughout the lower estuary would provide a better understanding of the dynamics of the estuary and how water quality changes with Eel River discharge, tide, and location. However, this study is a pilot project to determine the practicality and usefulness of collecting this type of data.

Water quality information in the lower Eel River estuary can help inform or support the following:

- Fish habitat in the Eel River estuary. Basic water quality parameters such as temperature and salinity, in particular, will be needed to evaluate habitat for fishes in the Eel River estuary and to inform restoration planning documents.
- Baseline water quality information for the TMDL, as well as the Salt River and other upcoming restoration projects in the Eel River estuary.
- On-going water quality and hydrologic work in the Salt River and McNulty Slough.


LEGEND
Sonde Deployment Location
Pacific Ocean
Cannibal Island Road
Mosley Slough
Sevenmile Slough
Eel River
Eel River Estuary
Niles Lane
Morgan Road
Morgan Slough
Morgan Slough
Russ Creek
Imagery Source: 2005 USDA NAIP Aerial
N
2,000 1,000 0 2,000
Feet
Pacific Ocean
Humboldt
Project Vicinity
Trinity
Mendocino
California
Detail
169
101
299
211
254
36
1
N
0 10 20
Miles
H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Eel River Estuary Water Quality and Hydrology Monitoring: Site/ Vicinity Map
Proj No. 2934-01
Date Oct. 2008
Figure 1
SM
N:\Projects\2934-01\Misc\

Methods

To better understand the dynamics of the lower estuary and how water quality changes with Eel River discharge and tide during the spring-summer transition, automated water quality sensors were deployed at 1 location and 2 depths (near bottom, near surface) to evaluate fresh/marine water dynamics. The YSI 6920 datasondes measured temperature, salinity and water depth at 20 minute intervals. The data were retrieved and the equipment re-calibrated monthly.

After an unsuccessful deployment in 2008 (see our letter dated 31 October 2008), the datasondes were repaired and the deployment technique refined. With the assistance of Bruce Slocum, we scouted and located an appropriate site for deployment near a large stump immediately upstream of the Cock Robin Island Bridge about 1.9 miles (3.1 km) from the mouth of the estuary (Figure 1). The sondes were attached to an anchor, and via a dual float system, one datasonde was deployed to float about 2 feet (60 cm) above the bottom and the other deployed to float about a foot (30 cm) below the surface.

The datasondes were deployed by boat on 29 April 2009. A large storm occurred in early May resulting in a large increase in Eel River discharge, prompting Mr. Slocum to check the equipment. He found the datasondes being swept toward the mouth of the river and retrieved them on 8 May 2009. The data were downloaded and the datasondes were redeployed with an additional anchor on 13 May 2009. Additional data download and maintenance visits occurred on 12 June and 31 July. Final retrieval occurred on 12 August 2009 at the request of the USFWS in order to be able to finalize this report in September. The length of time between the maintenance visits was also varied to determine if/when biofouling would become an issue to maximize the efficiency of future deployments.

Both datasondes were factory calibrated prior to initial deployment. Quality control procedures included taking independent measurements with a handheld YSI temperature and conductivity meter and a physical measurement of water depth prior to retrieving the datasondes. These measurements were then used as a check on the continuous data and to shift the data in case of observed drift from biofouling. During the data download process, batteries were replaced and all sensors on the datasondes were cleaned.

Results

The site ranged in depth from 2 to over 12 feet (0.6 – 3.6 m) during a rain event when discharge from the Eel River increased (Appendix Figures A1 and A5). The mean water depth for the sampling period (measured at the bottom datasonde and adjusted for the distance off the bottom of the pressure sensor) was 6.2 feet (1.9 m). The surface temperature averaged 2°C (1.8°F) warmer than the bottom temperature (Table 1), with that difference varying by month (Figure 2) and with stage in the tidal cycle (Appendix Figure A2).

Biofouling was observed in the data retrieved on 31 July. The salinity readings showed a sharp decline at approximately week 4 of the datasonde deployment, and were very erratic after that point. A more typical biofouling pattern of a drift in the data was not observed. Therefore,

applying a linear shift to the data did not seem reasonable. Instead, we opted for a conservative approach and removed these data from the analysis.

The temperature data were also suspect, with a noticeable decline observed in July temperatures. However, there is no evidence that the temperature readings were affected by biofouling, and the surface and bottom readings both showed a comparable decrease in July (which was not the case for salinity). These lower estuary temperatures in July likely reflect decreases observed in air and sea surface temperatures from the NOAA buoy off the Eel River (Station 46022) (Appendix A4).

Salinity at the surface averaged over 8 ppt fresher greater than the bottom salinity (Table 1), with that difference varying by month (Figure 3) and with stage in the tidal cycle (Appendix Figure A2). Salinities at both surface and bottom steadily increased throughout the summer (after the rains in early May). The differences between the surface and bottom readings for both temperature and salinity were reduced during low tides.

Table 1. Monthly Means for Temperature and Salinity (May to August, 2009).

	TEMPERATURE (C)				SALINITY (PPT)			
	Bottom	**St. Err**	**Surface**	**St. Err**	**Bottom**	**St. Err**	**Surface**	**St. Err**
May	15.08	0.06	16.52	0.05	5.54	0.20	1.15	0.04
June	15.00	0.05	17.56	0.03	14.13	0.18	6.53	0.12
July	13.23	0.04	15.45	0.04	24.64	0.16	12.11	0.09
August[1]	15.27	0.05	16.67	0.04	32.49	0.18	17.87	0.12
Overall	**14.5**	**0.03**	**16.5**	**0.02**	**16.9**	**0.14**	**8.3**	**0.08**

[1]August data is not for the entire month, but only through 12 August.

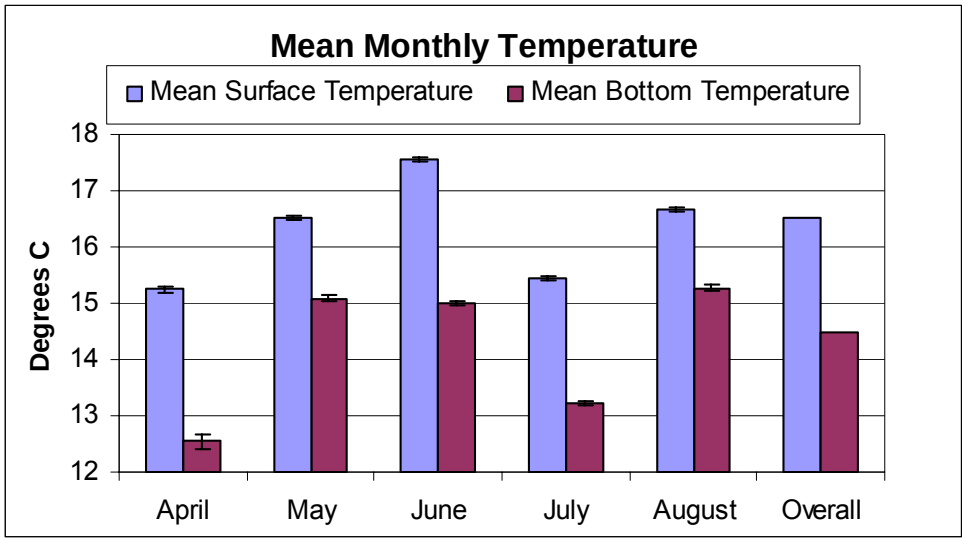


Figure 2. Mean Monthly Temperature at the Surface and at Depth ±1 standard error (note that April and August do not comprise a full moth of data).

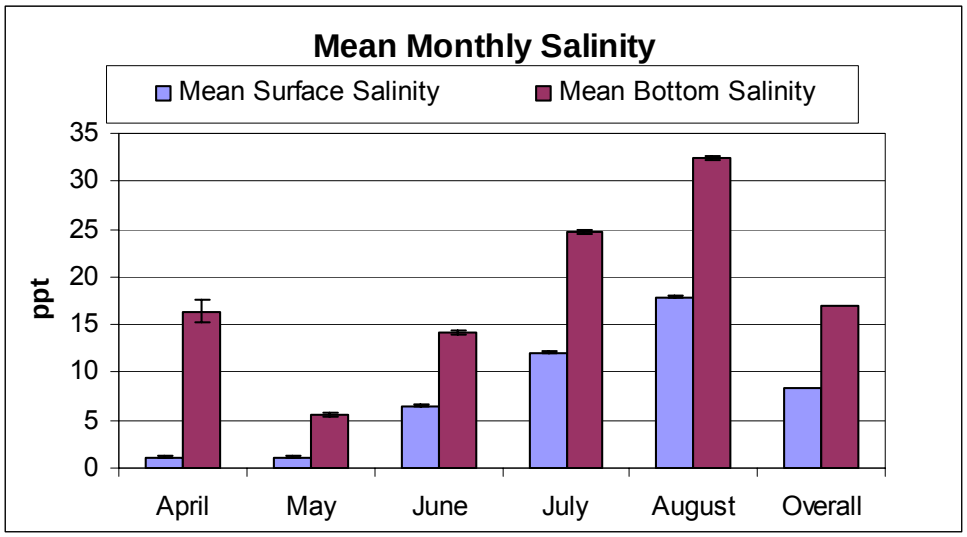


Figure 3. Mean monthly salinity at the surface and at depth ±1 standard error (note that April and August do not comprise a full moth of data).

At the deployment location in the lower estuary, the site rapidly transitions from a fresher/brackish-water estuary to a more marine dominated system from spring to summer (Figure 4). During the low-low tide each day, salinities at the surface and the bottom are both below 5 ppt, and during the high–high tides, the salinities at the surface and at depth are both elevated (>15 ppt), although the surface waters are still slightly fresher. However, during the low–high tides there is a more pronounced halocline, with the surface waters remaining around 5 ppt but the bottom salinities increasing to over 15 ppt. As the Eel River discharge decreases through the summer (Appendix Figure A5), the salinity minimums increase (Appendix Figure A3).

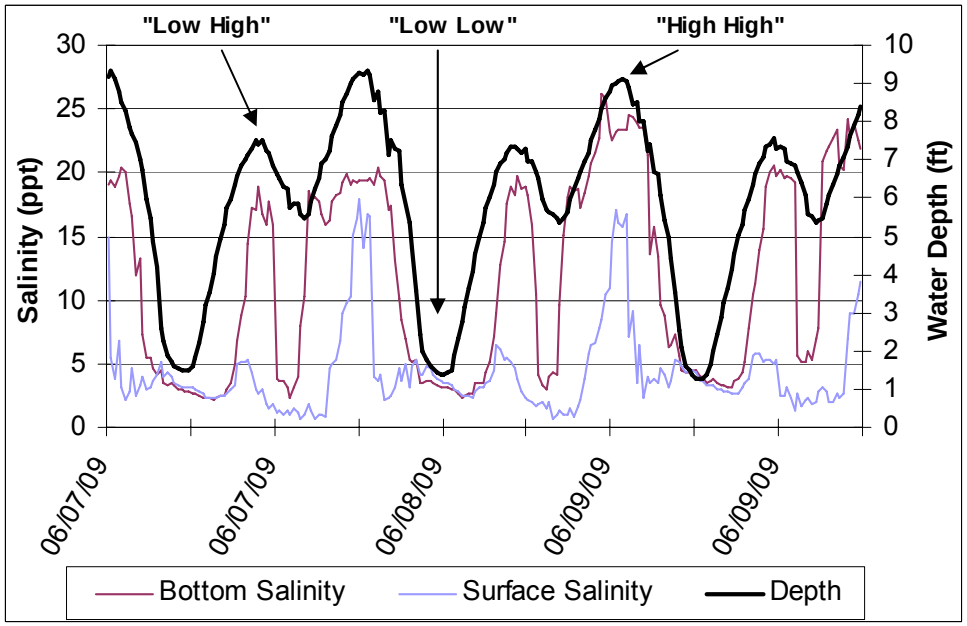


Figure 4. Example of rapid daily shifts in salinity stratification (7 June to 9 June 2009)

Water temperature is known to affect the distribution and habitat quality for juvenile coho salmon in freshwater, and that is likely to be the same for the estuary. The occurrence of juvenile coho salmon in tributaries to the Mattole River was predicted by the maximum weekly maximum temperature (MWMT) or the maximum weekly average temperature (MWAT) during the summer (Welsh et al. 2001); juvenile coho salmon were present only in tributaries where MWMT was 18.0°C or less. The seven days of maximum temperature at the surface occurred from 7 June to 13 June with a mean temperature (MWMT) for the period of 18.6°C (Figure 5). However, the seven days of maximum temperature at the bottom occurred almost a month earlier from 15 May to 21 May with a mean temperature for the period of 17.4°C (Figure 5).

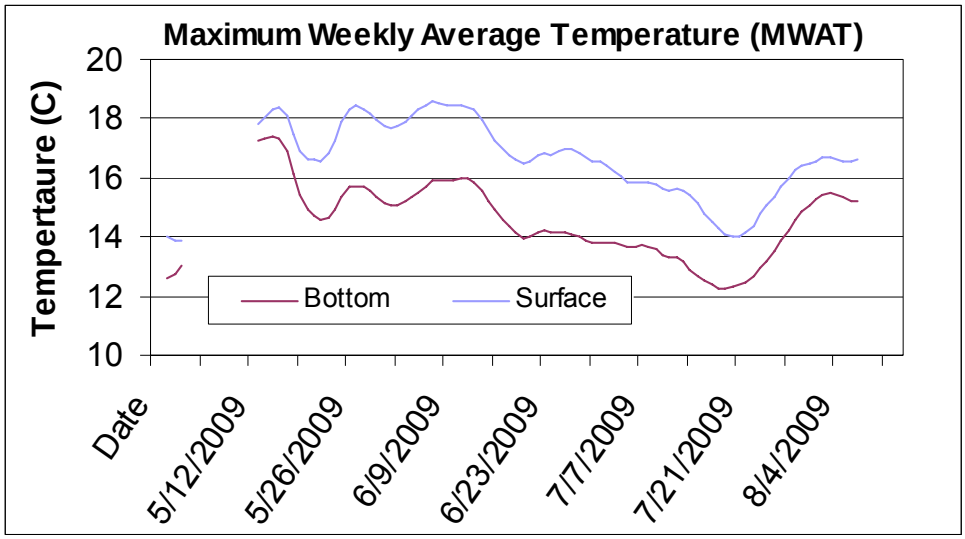


Figure 5. The Maximum Weekly Average Water Temperature (MWAT) at the Surface and at Depth (note May data gap is from when the datasonde was out of the water).

In addition, as with salinity, we observed daily fluctuations in water temperature and the presence of a thermocline with daily tidal fluctuations (Figure 6). At the low–low tides, the temperature between the surface and the bottom were most similar, but the bottom temperatures quickly decreased with the incoming tides reflecting the movement of coastal water into the estuary. We also observed an increase in the surface water temperatures associated most prominently with the low–high tide.

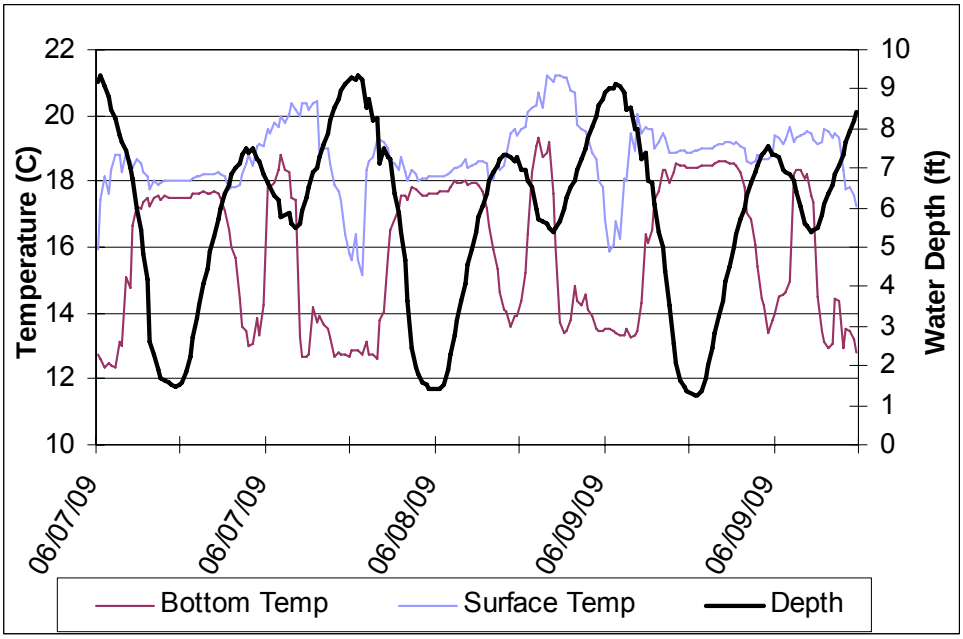


Figure 6. Example of rapid daily shifts in temperature stratification (7 June to 9 June 2009).

Conclusion

The pilot was successful in fine tuning the deployment methods and characterizing the spring-summer transition in the lower estuary. The lower estuary at our sampling site has vertical density variation and is partially or moderately stratified. It is clearly not strongly stratified nor is it well mixed, since a well mixed estuary would not exhibit vertical density (salinity) variations. There is daily variation in the degree of stratification at this location in the Eel River estuary during the summer, and the data illustrate rapid shifts in stratification with the tides in both temperature and salinity. In addition, as discharge decreased through the summer, ocean influence in the estuary increased, resulting in increased salinities in the estuary and a greater influence of the cooler marine waters on bottom temperatures.

Obtaining depth-stratified data at multiple locations in the estuary will give scientists and land use planners a better characterization of the spatial and temporal water quality dynamics, providing information to better understand water quality conditions that support fish habitat in the estuary and understanding of the potential benefits and/or impacts of proposed restoration projects. For example, restoration projects such as Riverside Ranch and the Salt River will increase the tidal influence in the estuary and these changes could be better predicted and understood by 2D or 3D hydrologic modeling using data provided by this project.

Integration of Data. The information obtained by longer term monitoring of this sort would be useful in making science-based management decisions for restoration to benefit fish in the Eel River estuary and could inform decision-making in other estuaries in large watersheds in California. This data would also help inform on-going efforts in the vicinity, such as:

- Eel River Estuary Juvenile Salmonid Habitat Use Monitoring Project
- Salt River Water Quality Monitoring, City of Ferndale

- McNulty Slough Habitat Restoration Monitoring
- TMDL recommended monitoring

However, this pilot study provided the only continuous water quality data of its kind for the Eel River estuary. Jeff Anderson is currently under contract with the Humboldt County RCD to develop a 2D hydrodynamic model for Salt River Restoration. His model will evaluate Salt River restoration hydrodynamics and water quality in the Salt River to its confluence with the Eel. Their concern is the extent of salinity in the Salt River relative to the wastewater treatment plant. The original intent of this data set was to have it overlap temporally with the data Mr. Anderson was collecting in the Salt River. However, due to the equipment problems experienced last year, that overlap was not achieved. However, Mr. Anderson will be able to use the data collected in 2009 to provide boundary conditions for his model. Upon review of the data, he was surprised at the level of stratification (e.g., strong vertical gradient) where our sondes were deployed, and that information is important for his current modeling effort (pers. comm., J. Anderson).

Recommendations. Valuable information was obtained by this pilot study, both in obtaining some basic information about the estuary, but also pertaining to potential future studies. First, lessons were learned regarding deployment and maintenance methodolgies. Given the flow rates in the Eel River, we recommend using multiple anchors and the smallest buoy possible to keep the surface datasonde afloat. We also recommend maintenance and calibration of the sondes at a minimum of every 4 weeks.

We recommend that future monitoring efforts include measurements of pH and DO to improve understanding of water and habitat quality. We also recommend increasing the number of stations in the estuary to better understand the spatial distribution of water quality and deploying stations for a longer time (ideally through an entire year) to better understand seasonal variability. At a minimum, we recommend adding a series of datasondes from our deployment site upstream to where there is a lens of freshwater that does not mix and deploying the sondes for a full year to capture possible low water quality periods in late summer/early fall, as well as the transitions that take place as the rains begin and discharge increases. Fish habitats in the estuary are affected by the changes in water quality associated with tides, discharge and the seasonal variations in salinity, temperature, pH and DO.

Monitoring water quality in the lower Salt River in 2008 indicated that “packets” of freshwater can move back and forth with the tide and retain their character (Jeff Anderson, pers. comm.. 2009). These “packets” don’t appear to mix except at large flood tides, and they appear to have a relatively high residence time, resulting in poor water quality in some circumstances (Jeff Anderson, pers. comm.. 2009). There is concern that the Riverside Ranch Restoration Project has the potential to create an area that has relatively poor water quality that could affect the lower Eel River estuary. To address this concern, we recommend that a hydrodynamic model be developed for the Eel River estuary using more spatially distributed water quality data to predict water quality conditions associated with restoring the Salt River and Riverside Ranch and other CDFG properties; however, these models would also require bathymetric data for the estuary.

Appendix A.
Data

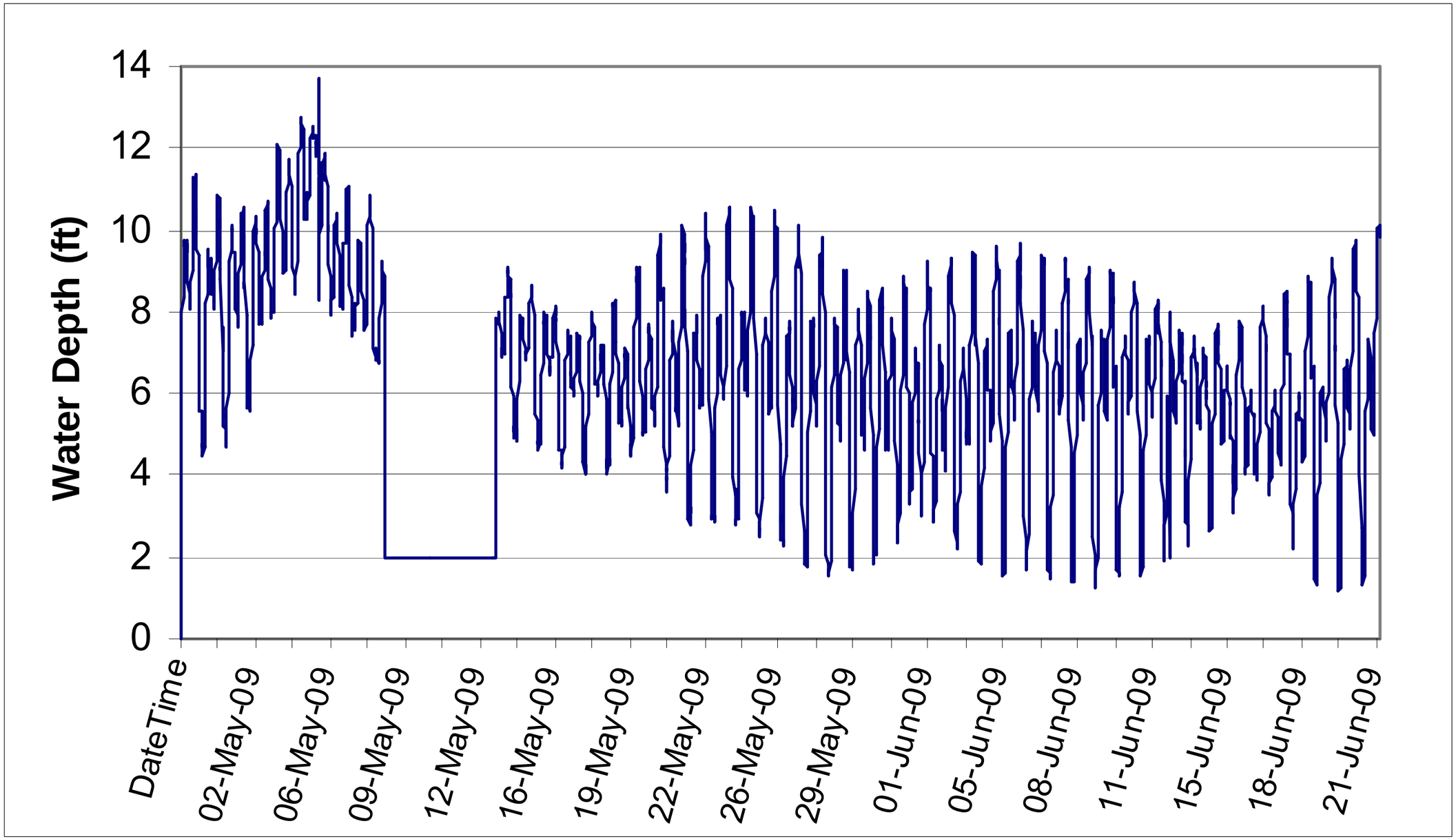


Figure A-1a. Water depth, 4/29/09 to 6/22/09. (Missing data is from when the datasonde was pulled after the storm.)

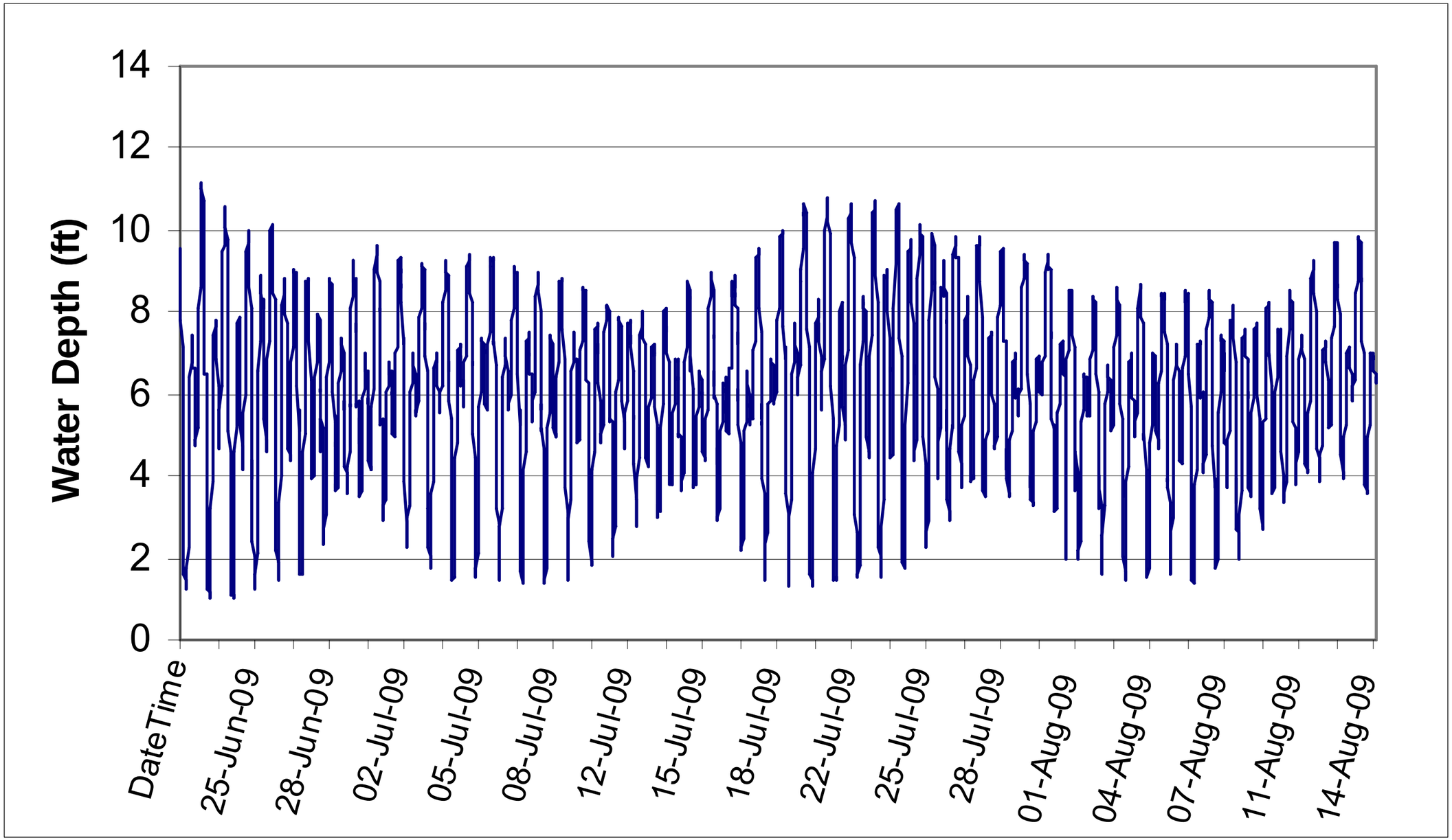


Figure A-1b. Water depth, 6/22/09 to 8/14/09.

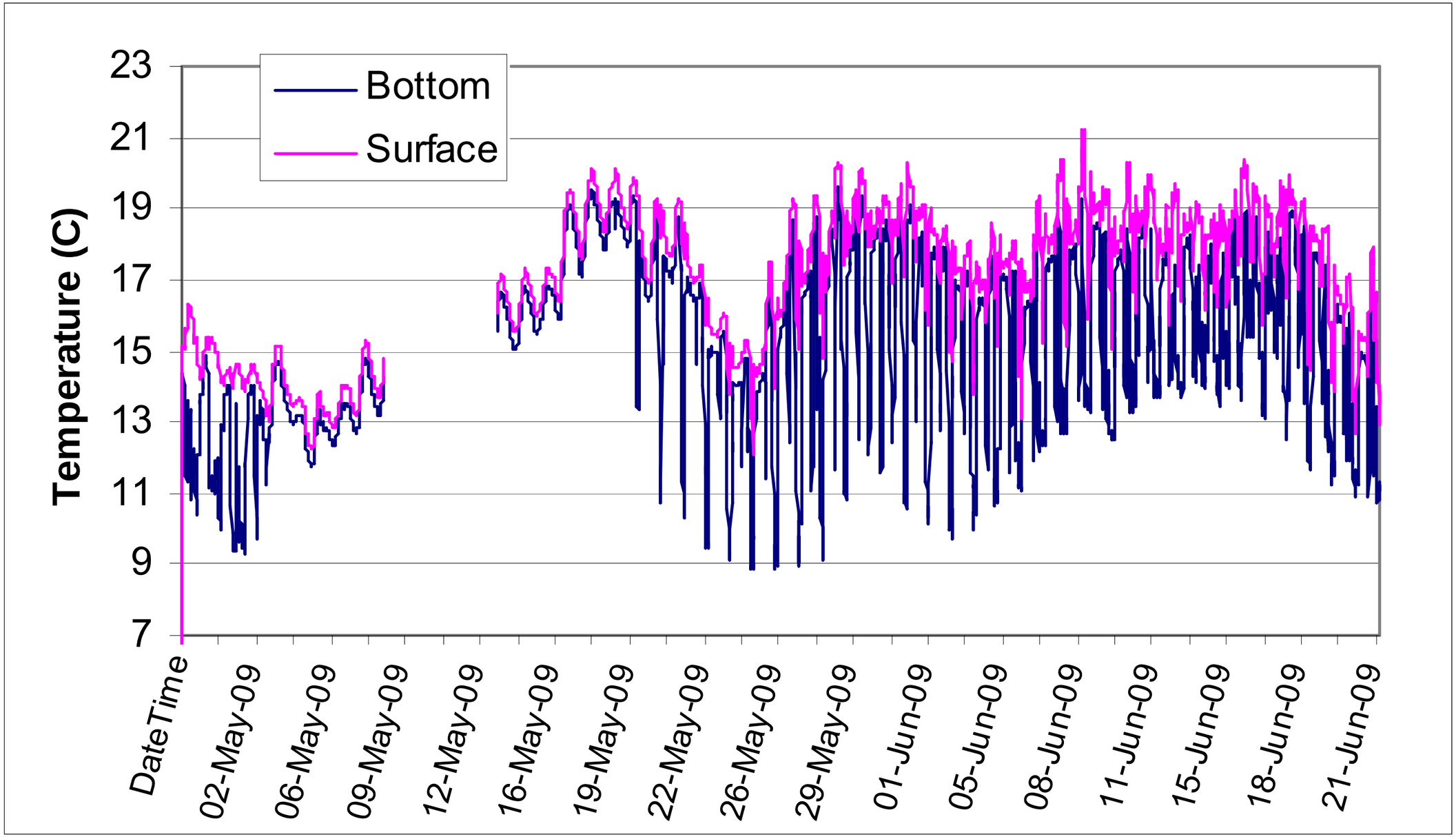


Figure A2a. Water temperature, 4/29/09 to 6/22/09. (Missing data is from when the datasonde was pulled after the storm.)

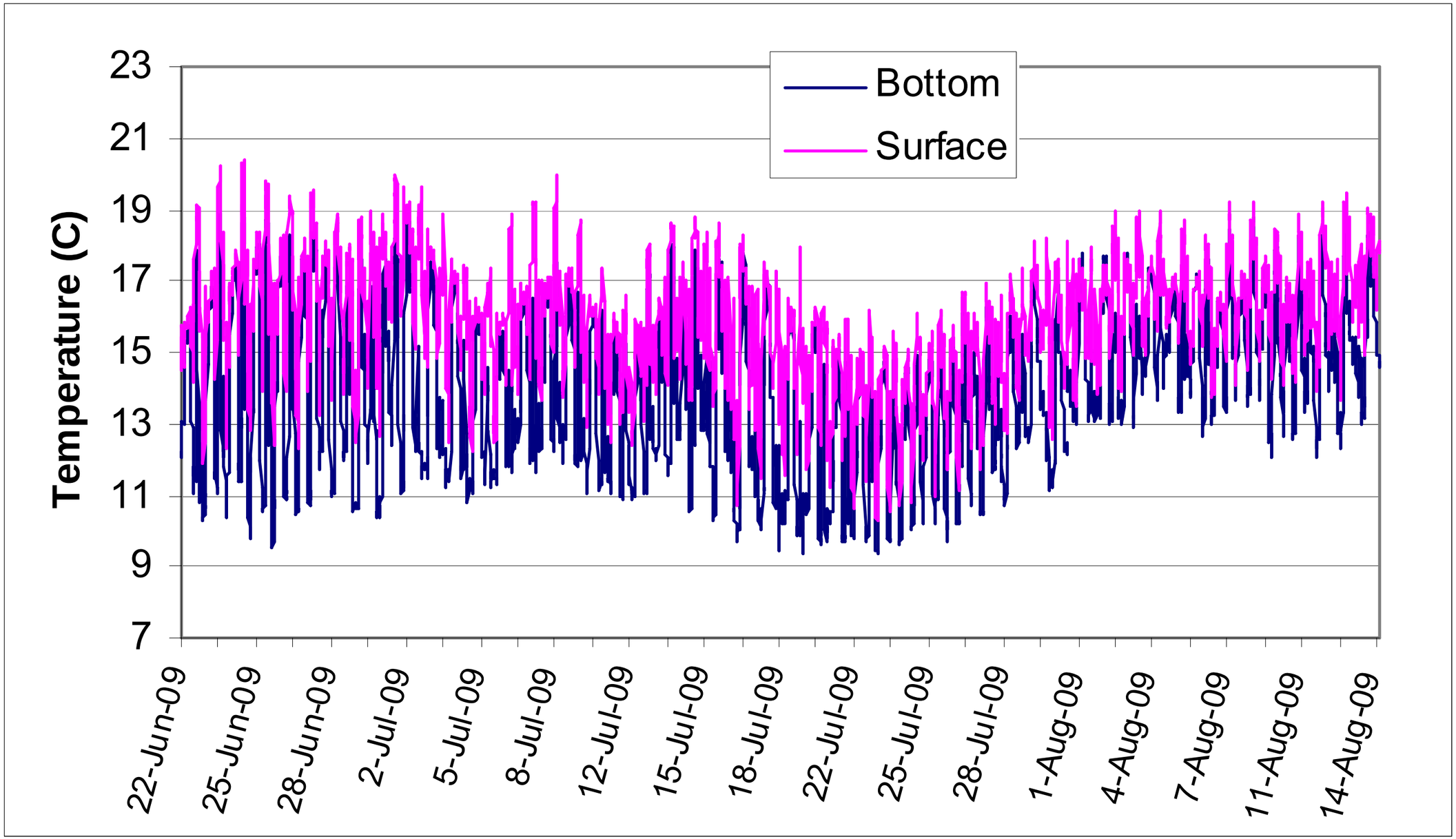


Figure A2b. Water temperature, 6/22/09 to 8/14/09.

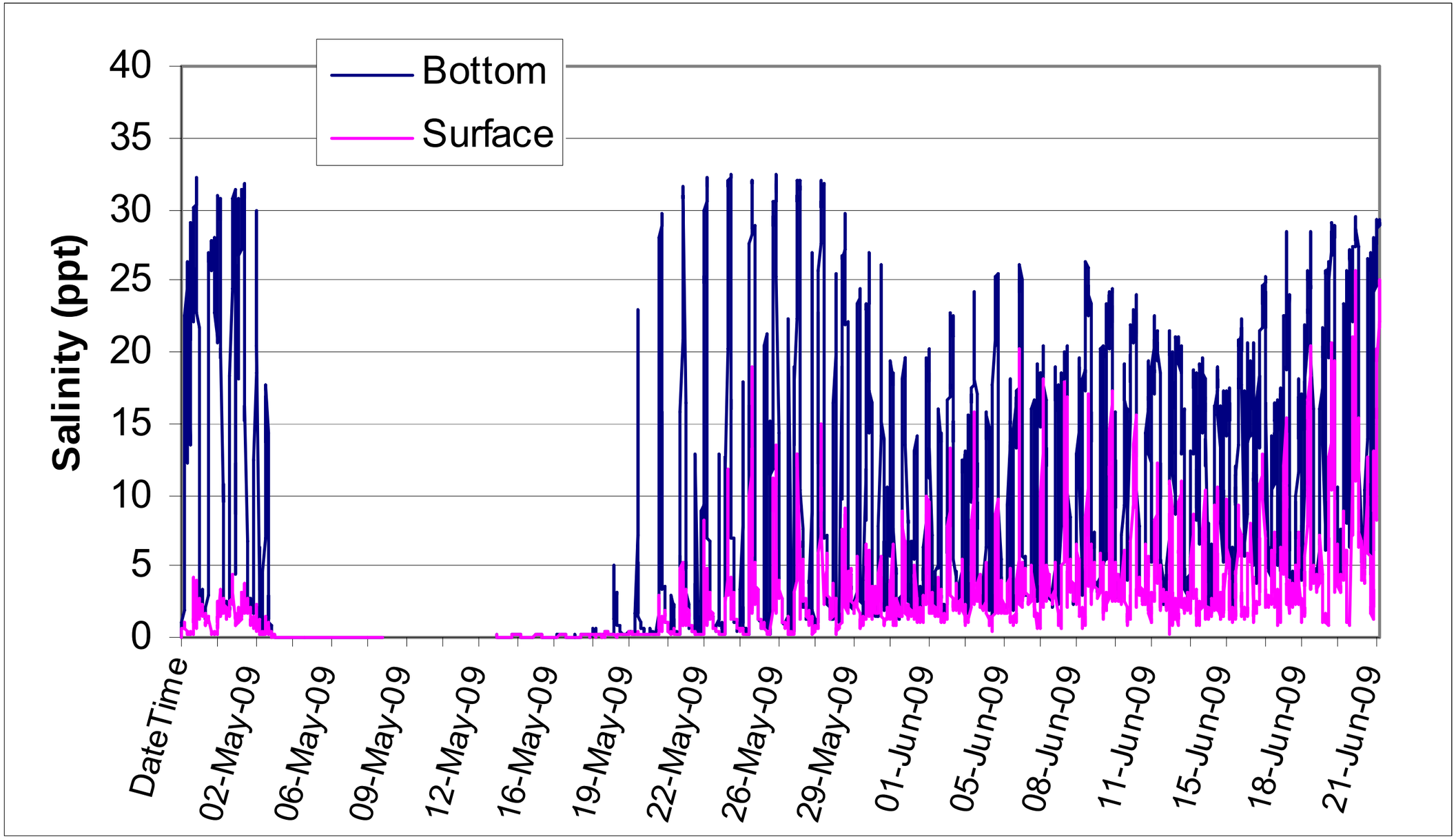


Figure A3a. Salinity, 4/29/09 to 6/22/09. (Missing data is from when the datasonde was pulled after the storm.)

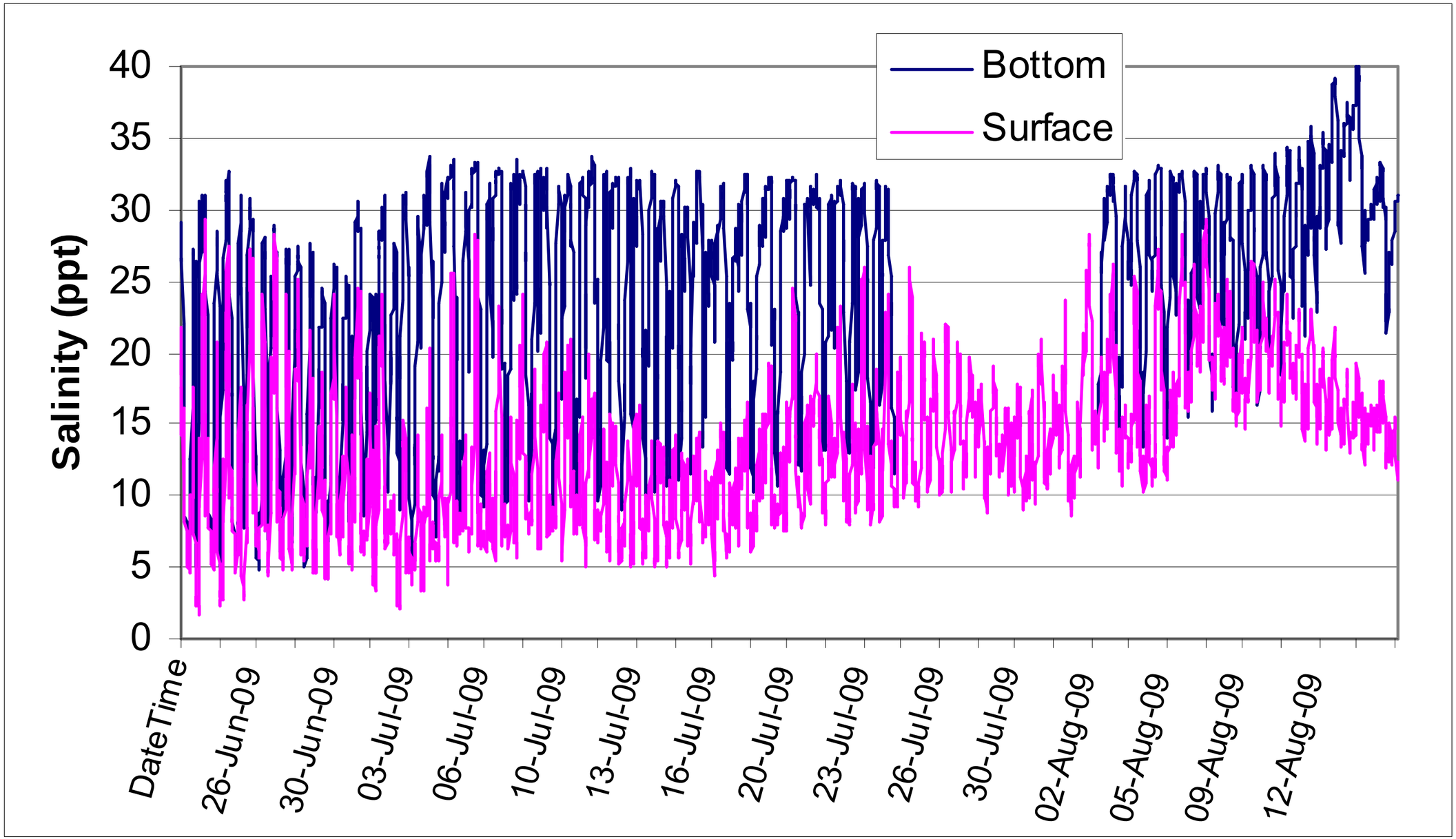


Figure A3b. Salinity, 6/22/09 to 8/14/09. (Missing data was affected by biofouling of the sensor.)

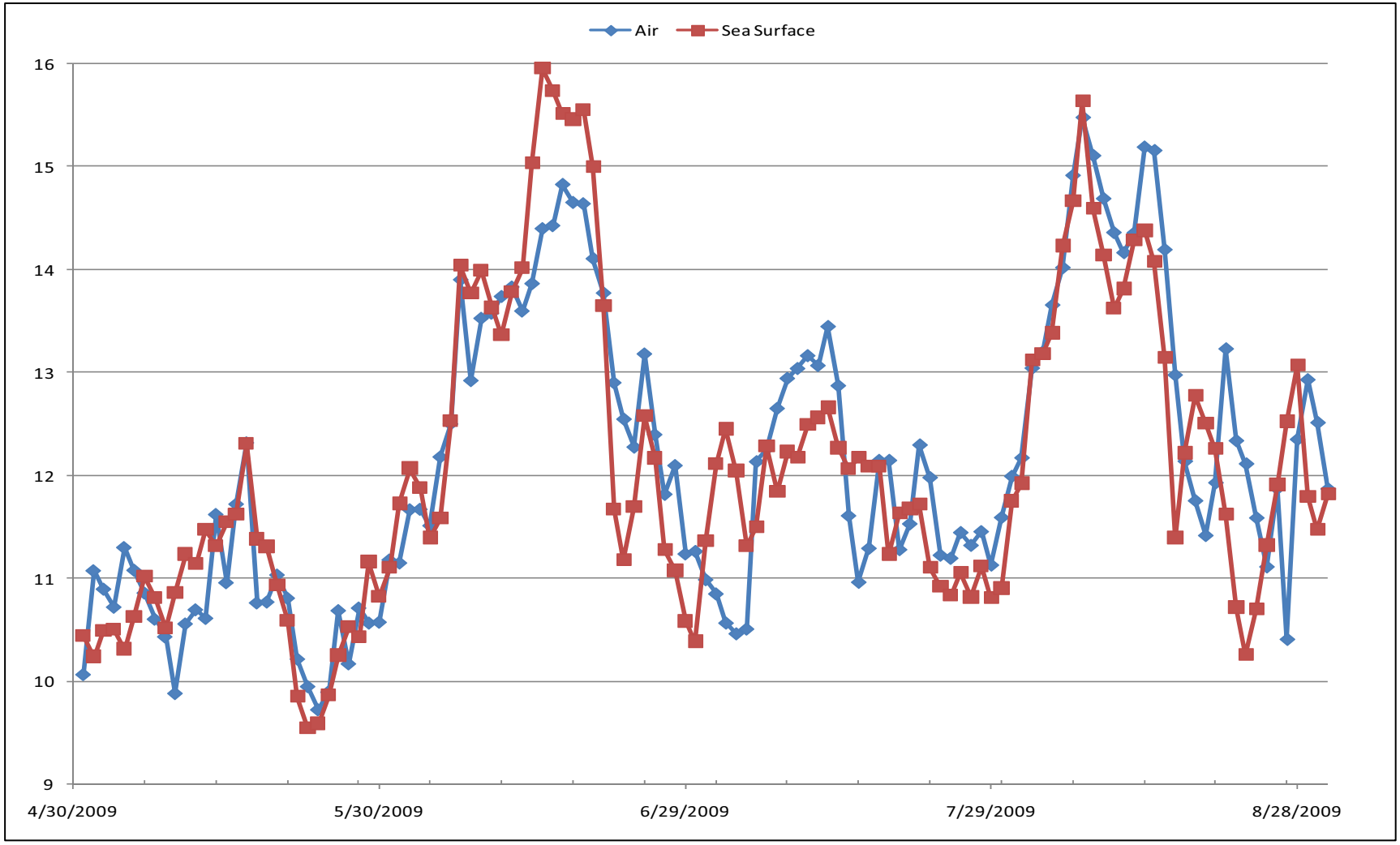


Figure A4. Daily mean air temperatures and sea surface temperatures from May through August 2009, based on data from NOAA buoy station #46022, Eel River 17 NM West-Southwest of Eureka, CA (40°44'58" N, 124 °34'38"W); data buoy collects standard meteorological data, which includes wind direction and speed; wave height and period; sea level pressure; sea surface temperature; and air temperature collected over 1-minute intervals.

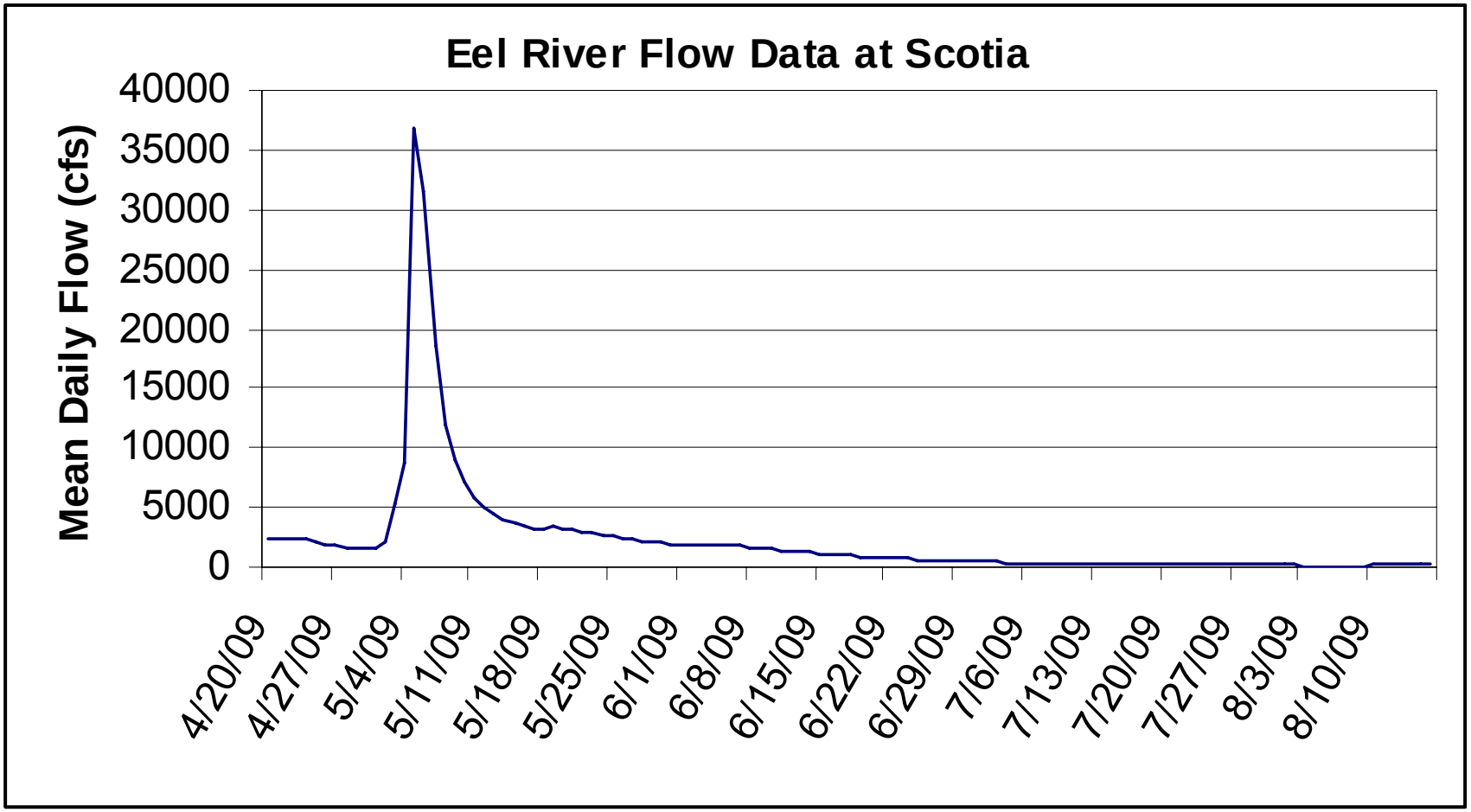


Figure A5. Eel River Discharge at Scotia (http://cdec.water.ca.gov/).

Appendix B.
Photographs

Photo 1. One of three anchors used to hold the datasondes in place.

Photo 2. Attaching the surface datasonde (including protective PVC "stilling well") to buoy.

Photo 3. Deployed datasondes.

APPENDIX F:
Synthesis of Storm Hydrographs in the Eel River Estuary

This appendix provides technical analysis and assumptions made towards development of time series data sets for inferred Eel River Estuary water surface elevations. The data sets were developed to be used as the downstream boundary condition in a MIKE11 hydraulic model of Connick Ranch. Data sets required development because only a small time period of actual measured data was available.

The available water surface elevation data for the Eel River Estuary was recorded from April 29, 2009 through August 12, 2009 by H. T. Harvey & Associates (Eel River Water Quality Datasonde Deployment Summary Memorandum, October 27, 2009). Data was missing from May 8 through May 13.

The Eel River Estuary data covered a time period over which a storm event occurred. Water surfaces within the Eel River at Fernbridge (about 4.5 miles upstream, described below) increased from 8 feet (NAVD88) to nearly 18 feet and back down to 8 feet (May 3 – May 18, 2009). Using water surface elevation data from a tidal gauge downstream (and slightly north) of the Eel River Estuary, and the Fernbridge gauge upstream on the Eel River, an attempt was made to duplicate Estuary data as closely as possible. After development, the algorithm was applied to other time periods of interest.

The nearest tidal gauging station to the Eel River Estuary is located at North Spit (NOAA, Station ID 9418767). North Spit is located about 12.5 miles north of the mouth of the Eel River, at Humboldt Bay. Tidal water surface elevation data is recorded every 6 minutes and was downloaded with a datum of feet NAVD88.

The Estuary data was compared to the North Spit tidal data over the time period from June 26 through July 16, where the tidal cycles appeared very similar. The overall depth of the Estuary data was adjusted by -0.2 feet to match the NAVD88 datum. The tidal data time cycle was adjusted back 6 hours to best match the tidal time cycle of the Estuary. An image of the adjusted data is shown in Figure 1.

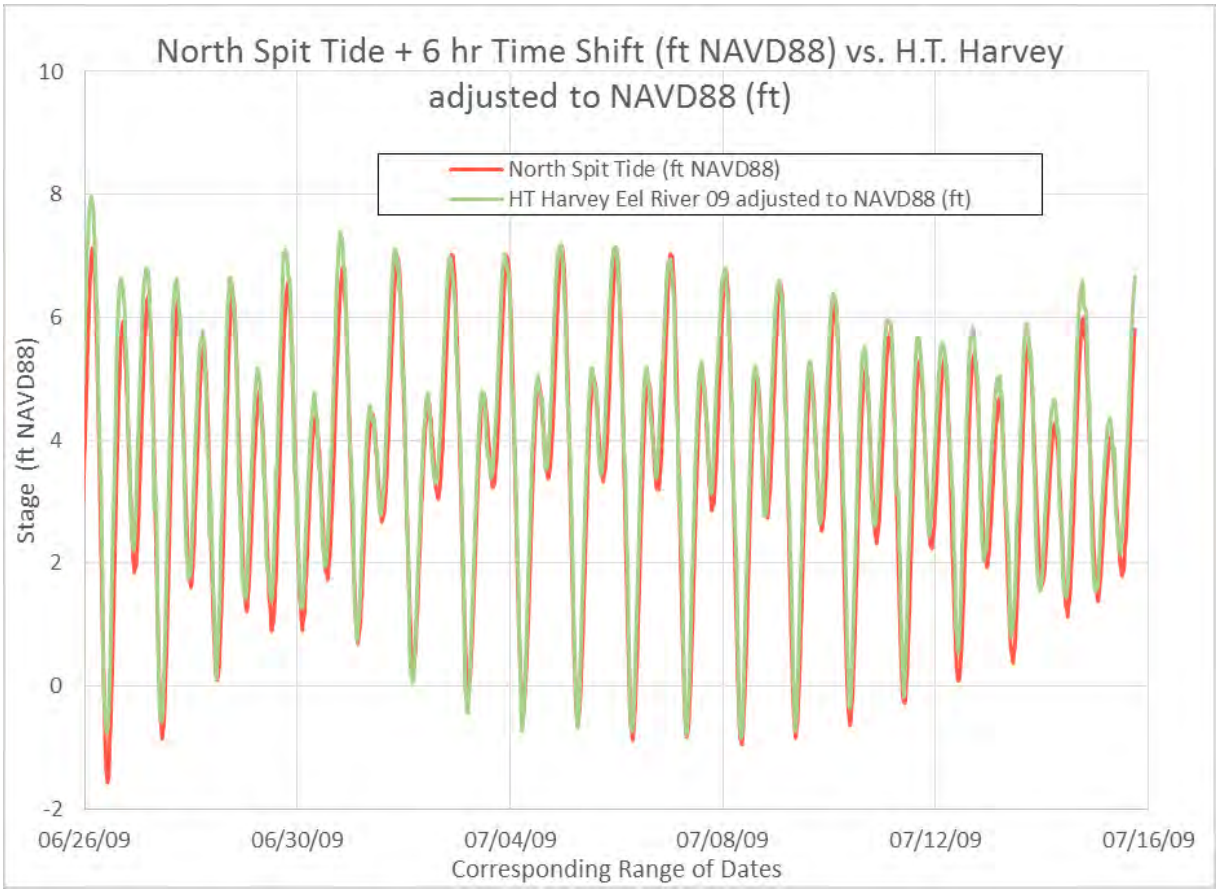


Figure 1. North Spit Tide + 6 hr. Time Shift and Eel River Estuary data adjusted to NAVD88.

USGS maintains a gage on the Eel River at Fernbridge (USGS, Station ID 11479560). Water surface elevation is recorded every 15 minutes. Datum of the gage is 3.64 feet above NGVD29. Data was converted to NAVD88 by adding 6.86 feet to the recorded water surface value (3.22 feet to convert from NGVD to NAVD, and 3.64 account for gage elevation above NGVD).

Estuary data was recorded every 20 minutes, whereas North Spit tide data was recorded every 6 minutes and Fernbridge stage data was recorded every 15 minutes. In order to compare these data sets, they all needed a common denominator. North Spit data and Fernbridge data were converted to a 20 minute time step using HEC-DSSVue software (Hydrologic Engineering Center, USACOE, Version 2.0, February 2010). The three data sets are plotted in Figure 2. The water surface in the Estuary with North Spit subtracted out was also plotted on Figure 2.

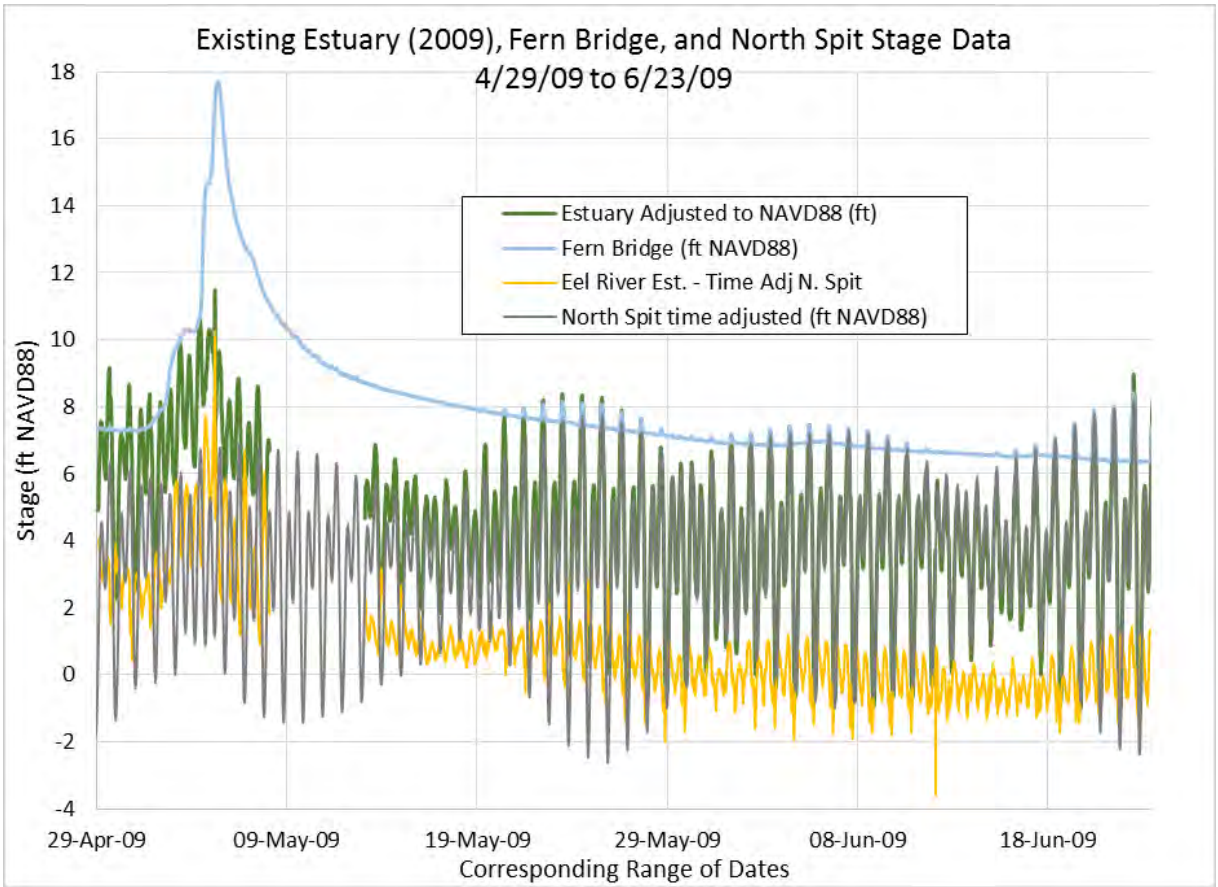


Figure 2. Water Surface Elevations at Estuary, Fernbridge, North Spit, and (Estuary – North Spit).

A correlation was needed to compare the three data sets. Figure 3 is a plot of water surfaces at Fernbridge (blue, above) vs. the Estuary with North Spit subtracted out (yellow, above). Data was plotted as three separate data groupings. The groupings were the time periods April 10 – May 6, 2009; May 6 – May 8, 2009; and May 13 – June 23, 2009.

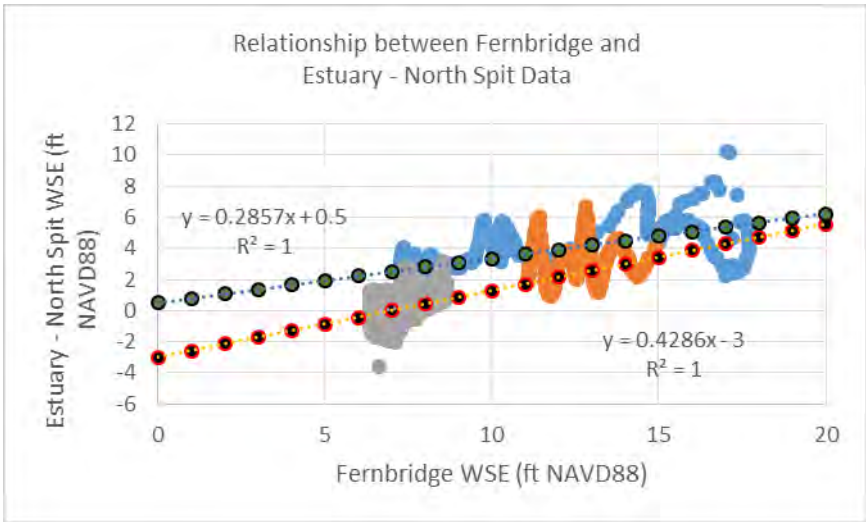


Figure 3. Three data groupings of Fernbridge vs. (Estuary – North Spit) WSE Data.

Two linear relationships between the data were developed. The goal was to mimic the Estuary data, and after testing several relationships, one linear equation best fit the high tides while another best fit the low tides. The relationship developed is as follows:

If (North Spit WSE) ≥ 0.5, {(0.43*(Fernbridge WSE)} - 3)
If (North Spit WSE) < 0.5, {(0.29*(Fernbridge WSE)} + 0.5)
Add the resultant value to (North Spit WSE).

Figure 4 illustrates the relationship described above. The "Test Inferred Estuary Data" shows how closely the inferred data for the Estuary (orange) matches actual Estuary data (green). The "Inferred Estuary Data" fills in the location where Estuary data was missing (thick pink).

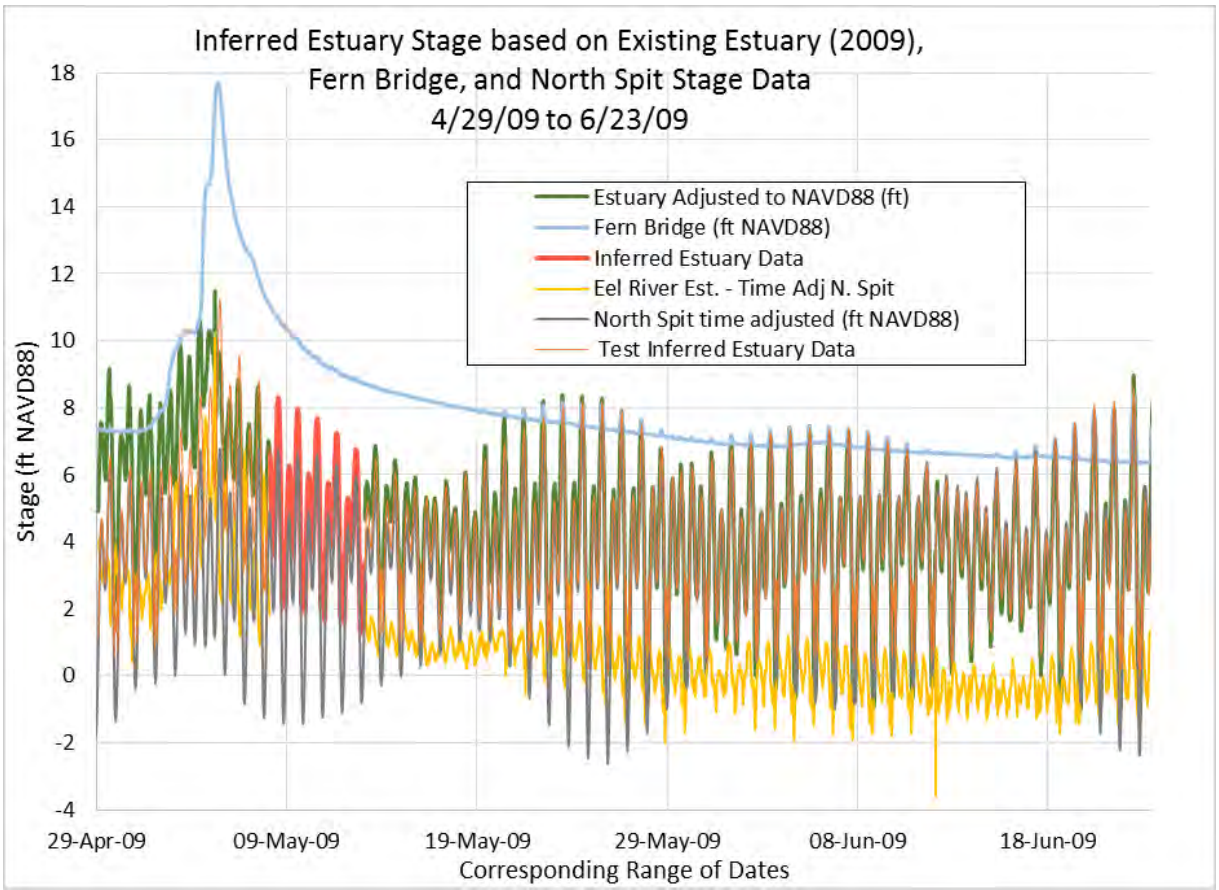


Figure 4. Inferred Estuary Data.

The rising leg of the storm was the most poorly correlated relationship between existing and inferred Estuary data, but in general it was assumed that the relationship over most of the storm period and the post-storm period provided a reasonable fit. The Inferred Estuary relationship was applied to the time period March 11 – May 02, 2012, over a portion of Water Year 2011 (November 2010 – June 2011), and over a portion of Water Year 2002 (November 2001 – February 2002). These three time periods were developed to be used in the project MIKE11 model as the downstream water surface elevation hydrograph (downstream boundary condition).

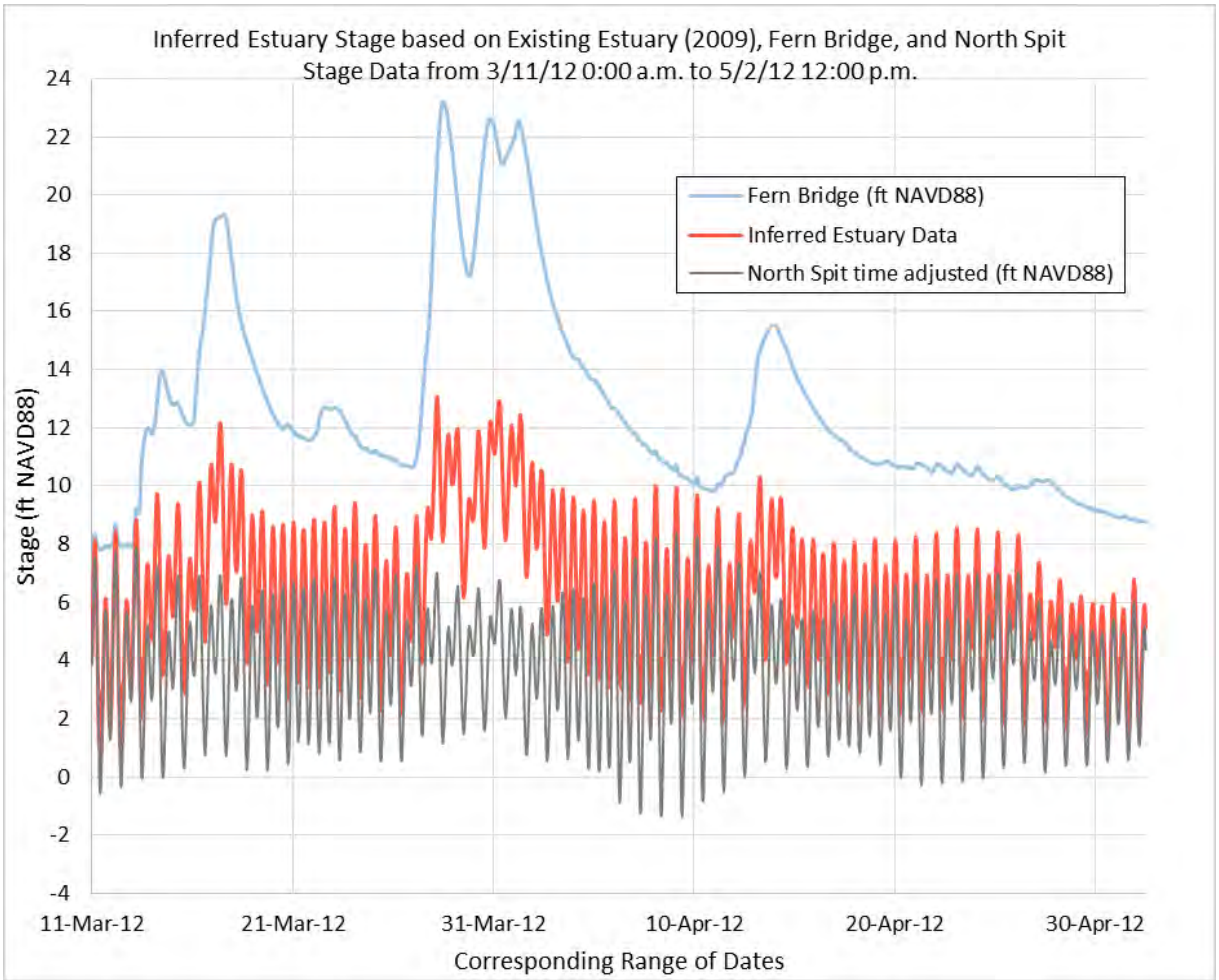


Figure 5. Inferred Estuary Data for Storm Period March 11 – May 02, 2012.

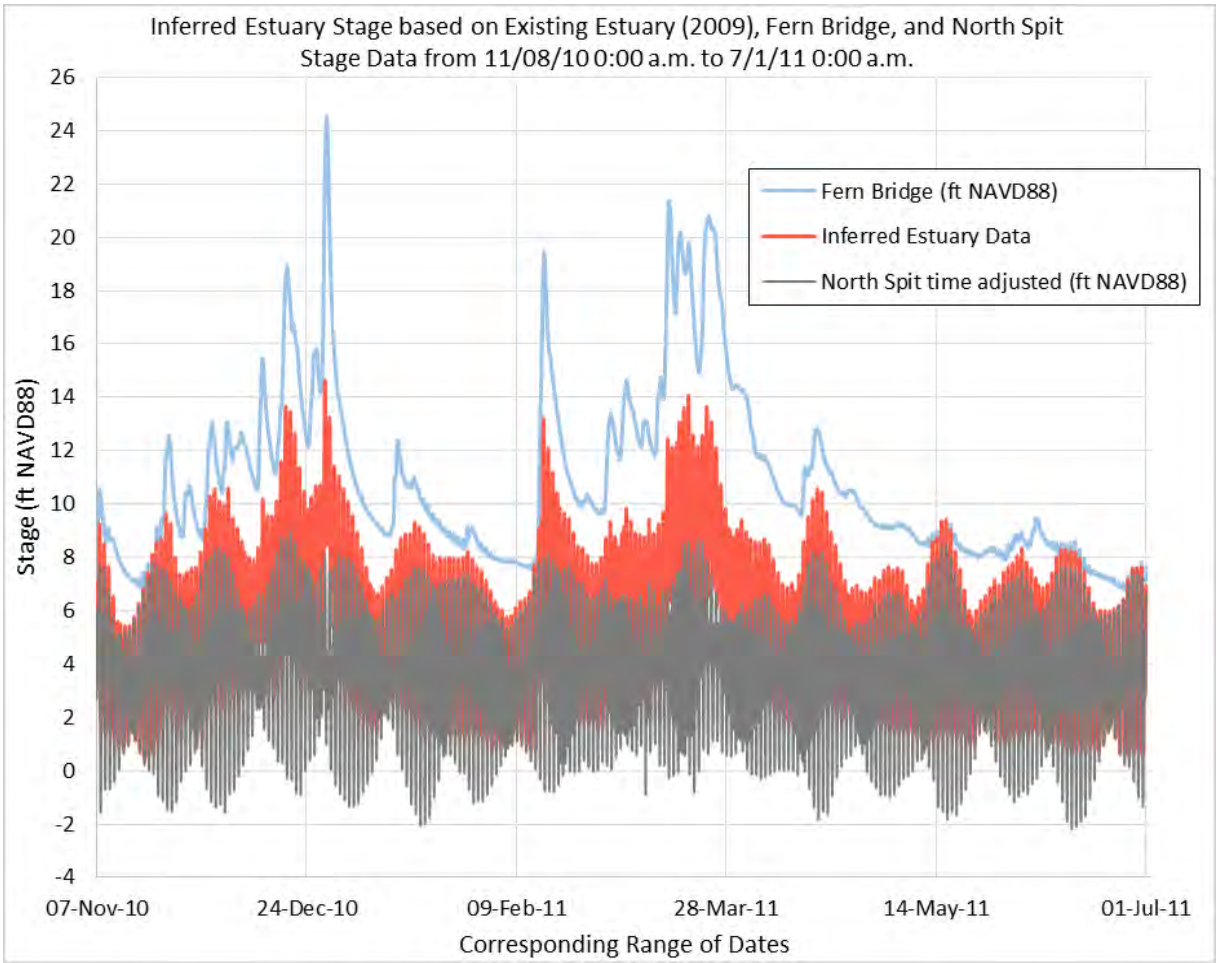


Figure 6. Inferred Estuary Data for Storm Period November 2010 – June 2011.

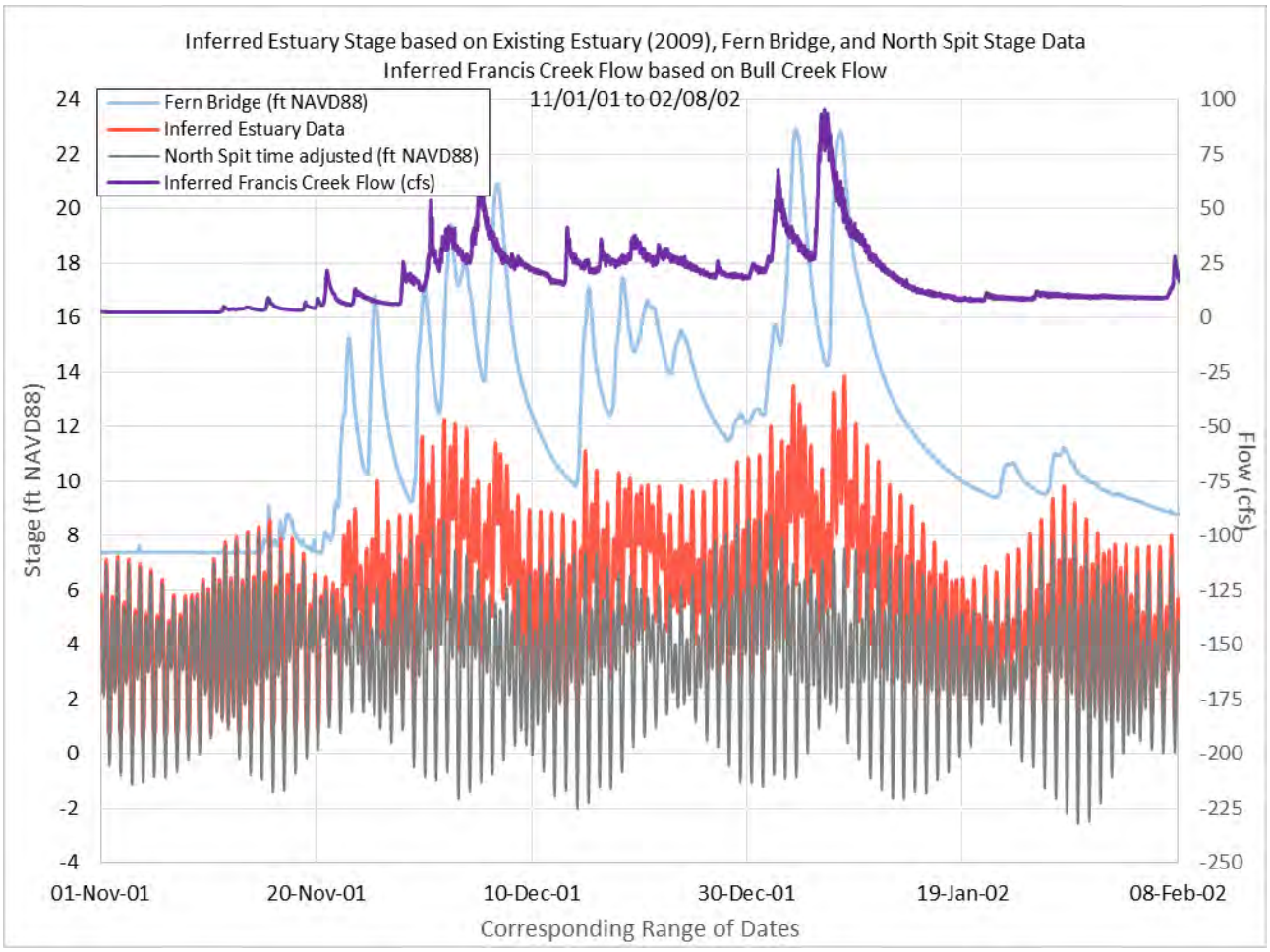


Figure 7. Inferred Estuary stage and Francis Creek flow data for Storm Period November 2001 – February 2002.

In addition to the downstream boundary condition stage data, Figure 7 illustrates Inferred Francis Creek Flow data on the secondary axis. Time periods more recent than 2007 had recorded Francis Creek flow data available as an inflow resource to the model, and additional inflows to the model were created based on a flow rate per unit area of Francis Creek and its watershed as compared to the adjacent watershed areas. This analysis is not covered in this tech memo at this time. The storm period from November 2001 – February 2002 was requested to be analyzed through the MIKE model, and therefore flow data for Francis Creek needed to be deduced for this time period. This analysis is described below.

Mattole River near Ettersburg, CA (USGS 11468900) and Bull Creek near Weott, CA (USGS 11476600) flow data was downloaded and compared to the County's available Francis Creek flow data. Data for all three sources ranged from October 2007 through May 2013. In a direct

time series comparison, Mattole River was discarded as its flows were magnitudes greater than those of Bull and Francis Creeks. Bull Creek vs. Francis Creek flows for WY 08 – 13 were compared, then flows for Bull Creek vs. Francis Creek for WY 09, 11 and 12 were isolated because it provided a better correlation. The resulting linear equation was applied to Bull Creek data over the November 2001 – February 2002 time period so as to derive the Francis Creek flow for that time period. The inferred flow data for Francis Creek is shown on Figure 7.

References

Harvey, H.T., Eel River Water Quality Datasonde Deployment Summary Memorandum, October 27, 2009.

NOAA, Tide Gage at North Spit, Station ID 9418767.

USACOE Hydrologic Engineering Center, HEC-DSSVue, Version 2.0, February 2010.

USGS, Flow data for Bull Creek near Weott, CA, Station ID 11476600.

USGS, Flow data for Mattole River near Ettersburg, CA, Station ID 11468900.

USGS, Water Surface Elevation Data for Eel River at Fernbridge, Station ID 11479560.

APPENDIX G:
Design Alternatives for Project Culverts

1.0 Simulated New Project Culverts

Throughout the modeling analysis of alternatives, the new culvert configuration proposed to link the Inner Marsh with outer Cut-Off Slough was kept consistent between all model simulations. This configuration consisted of three (3) 5-foot diameter circular gated culverts to allow one-way flow out of the Inner Marsh and a fourth 5-foot diameter circular culvert equipped with Muted Tidal Regulator (MTR) to allow both full positive (ebb) and managed negative (flood) flow. All invert elevations were set at -3.94 feet NAVD88, which results in approximately 8-feet of overburden above the culverts to maintain the existing levee height. The invert elevation was chosen as described in Section 1.2 below. Modeled culverts are located a short distance west of the existing culverts in order to access the deepest part of the outer Cut-Off Slough Channel.

The cumulative conveyance capacity and invert elevations for the new Inner Marsh/Cut-Off Slough tide gates was settled on after considerable analysis and model iterations that varied the number, dimensions, and invert elevations for multiple culvert configurations in order to maximize and optimize drainage out of the project area. The following sections present modeling results to evaluate optimal culvert conveyance.

1.1 Culvert Conveyance Capacity

A variety of culvert configurations were simulated to evaluate drainage efficiency of the project area. These simulations included altering the number of culverts at the new Inner Marsh/Cut-Off Slough connection as well as modifications to the number and type of flap-gates and culverts at the existing tide gate structure on Cut-Off Slough. Table 1 summarizes the various gated culvert configurations analyzed.

Analysis of gated culvert configurations included simulating a single winter storm event spanning March 30, 2012 through April 6, 2012 an occurring during the Simulation Period 2 (per Section 5.1.2 of report). Simulated water levels within the Inner Marsh for each of conveyance analysis model runs are presented on Figure 1.

A desired objective of this analysis is to identify the most efficient culvert configuration that equals or betters the existing project drainage (_v6 plot on Figure 1). Simulation results indicate that a single (_v7) or three (_v8) 5-foot diameter CMP culvert configuration increases flood levels in the project area, while the four culvert configuration (_v7c) does a good job at matching the maximum existing condition water levels and drainage pattern.

As indicated in Table 1, additional culverts added to either the new or existing tide gate structures did not reduce maximum inundation levels. Although these measures to increase

drainage conveyance may allow slightly more rapid drainage after peak flooding, the benefits are minor and likely not worth the added expense.

TABLE 1: Simulated tidegate configurations

Model Simulation	Existing Tide Gate Structure on Cut-Off Slough	New Inner Marsh/Cut-Off Slough Tide Gate Structure
_v6 (Existing Conditions)	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	No structure
_v7	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	One (1) 5' dia. CMP (muted exchange) Invert el. -3.94'
_v8	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	Two (2) 5' dia. CMP (pos. Q only) One (1) 5' dia. CMP (muted exchange) Invert el. Varies -3.94
_v7c	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	Three (3) 5' dia. CMP (pos. Q only) One (1) 5' dia. CMP (muted exchange) Invert el. -3.94'
_v7d	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	Four (4) 5' dia. CMP (pos. Q only) One (1) 5' dia. CMP (muted exchange) Invert el. -3.94'
_v7e	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94' Six (6) 5' dia. CMP (pos. Q only) Invert el. 3.61'	Three (3) 5' dia. CMP (pos. Q only) One (1) 5' dia. CMP (muted exchange) Invert el. -3.94'
_v7f	Six (6) 5.3'x7.2' wood flap gates; Invert el. -3.94'	Four (4) 5' dia. CMP (pos. Q only) One (1) 5' dia. CMP (muted exchange) Two (2) 5.3'x7.2' wood flap gates; Invert el. -3.94'

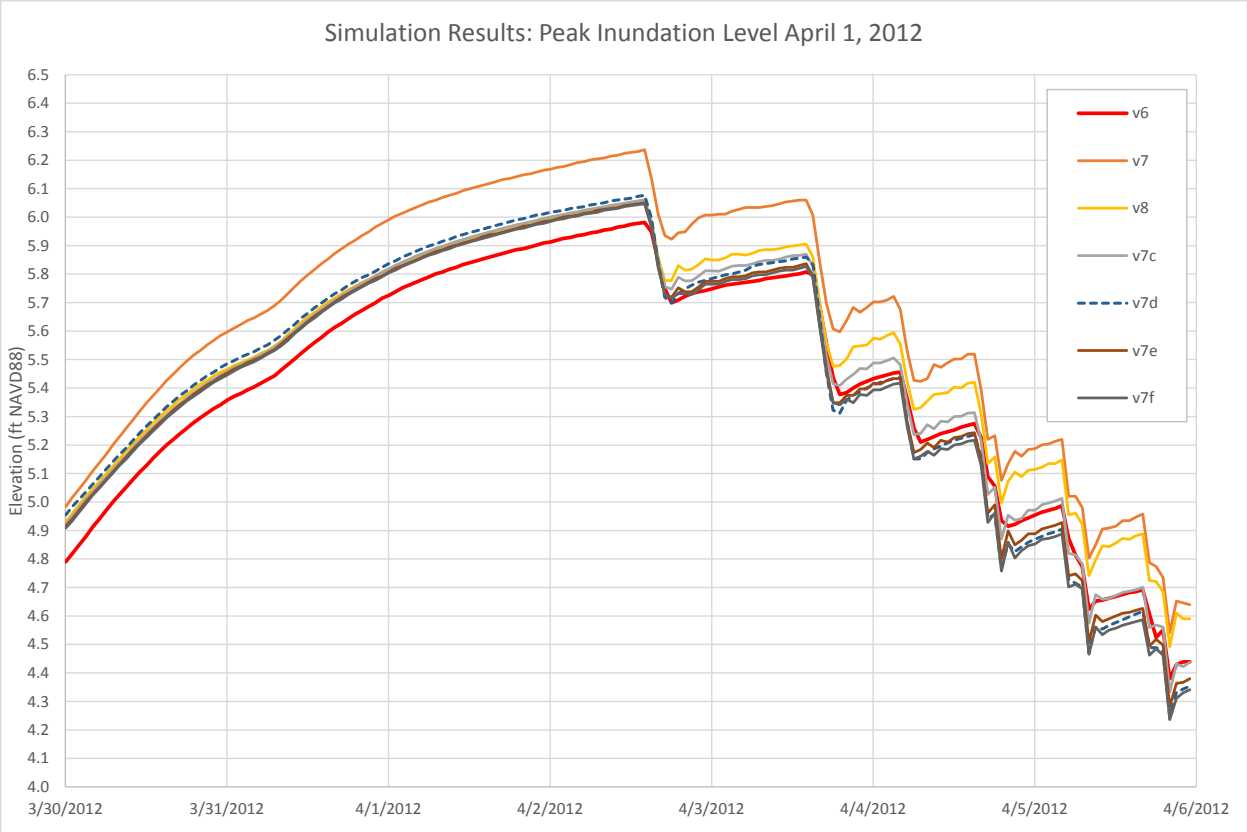


FIGURE 1: Simulation results of various project culvert configurations during storm event between March 30, 2012 and April 6, 2012.

1.2 Culvert Invert Optimization Analysis

In addition to analyzing the optimum conveyance capacity via varying culvert size and combinations, KHE completed and analysis to evaluate the optimum invert elevation of culvert systems. This analysis included simulating varied Inner Marsh/Cut-Off Slough culvert invert elevations for the _v8 simulation summarized in Table 1. Figure 2 is a schematic diagram presenting the five different culvert invert elevations simulated. The resulting simulated culvert discharge rates and Inner Marsh water surface elevations for each simulation are presented on Figure 3.

Simulation results (Figure 3) indicate that the lower the culvert invert elevation, the greater the discharge through the culverts and increased drainage rate of the project area. Thus, a resulting design criteria is to place culverts as low as practical to maximize flow conveyance. However, other variables to consider and evaluate during culvert design include: elevated velocities that create barriers to fish passage; and inverts at grades that match upstream and downstream channel grades.

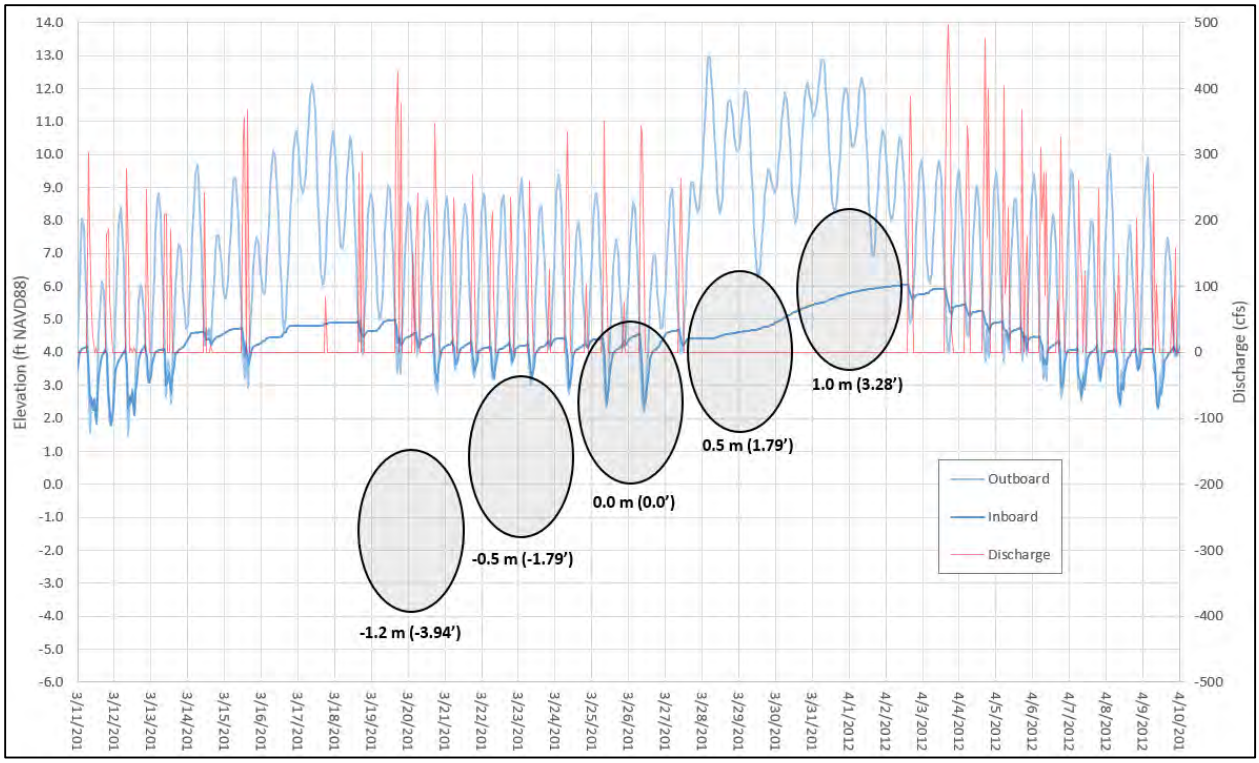


FIGURE 2: Schematic positioning of simulation _v8 culvert invert elevations.

1.4 Muted Tide Regulator Seasonal Operations

The proposed new tide gate structure simulated under all NOP Project alternatives consist of three (3) 5-foot diameter circular side hinged gated culverts to allow one-way flow out of the Inner Marsh and a fourth 5-foot diameter circular culvert equipped with Muted Tidal Regulator to allow both full positive (ebb) and managed negative flow (flood). Muted tidal exchange through the new Inner Marsh MTR would be controlled seasonally. In winter, maximum tidal inflow elevation into the Inner Marsh would be restricted to approximately 2.5-feet, equal to current conditions. Maintaining this level would preserve the existing flood storage capacity of the Inner Marsh. During the dry season, when flooding is not a hazard, the MTR would be adjusted and operated to allow the maximum muted tide levels to rise to an elevation of approximately 5-feet, increasing the depth and area of aquatic habitat.

Figures 4 and 5 present simulation results of flow through the MTR during spring tidal periods under the winter and summer operation periods, respectively. Again, winter operations restrict maximum internal tidal exchange to 2.5-feet in elevation, while summer operations allow tidal exchange up to a maximum elevation of 5-feet. Both ebb and flood flow through the MTR are represented on these Figures.

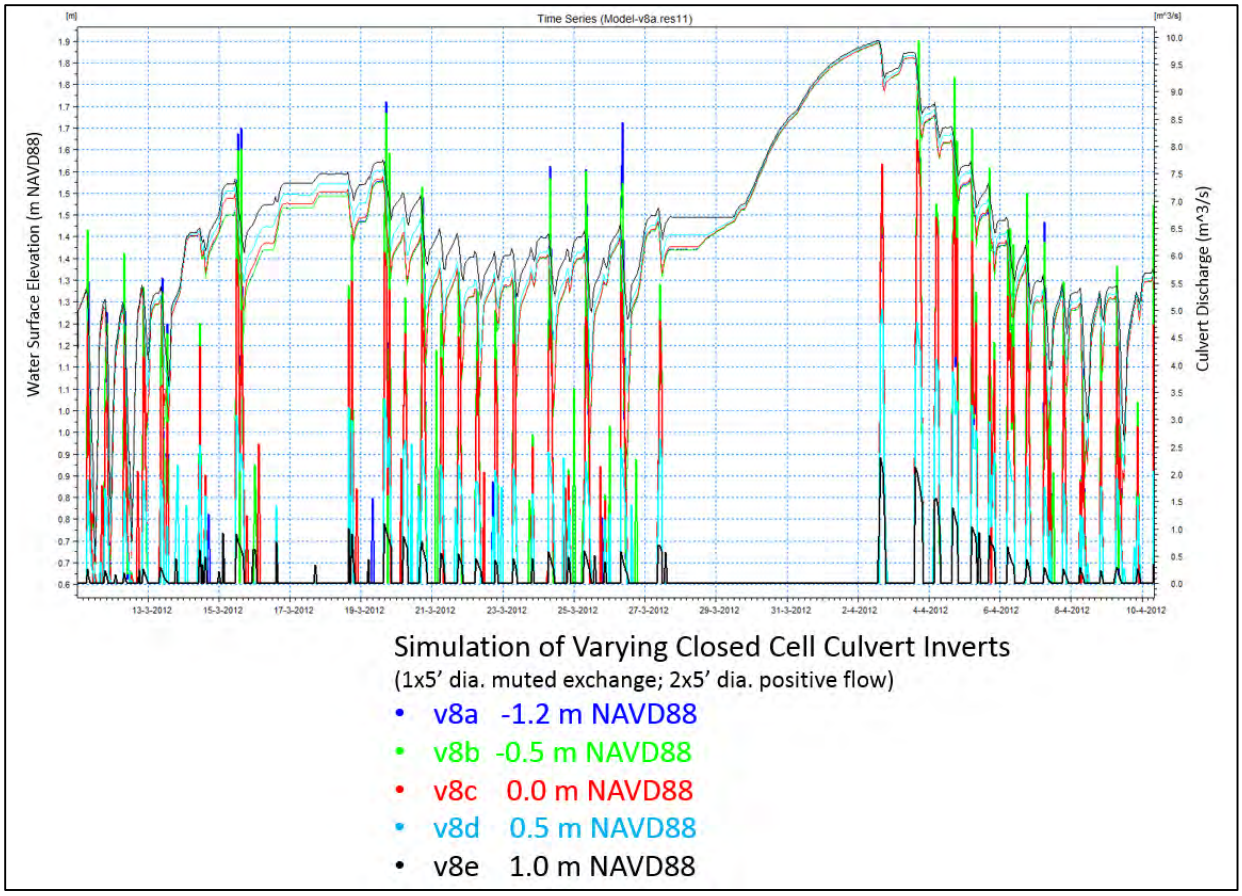


FIGURE 3: Simulated culvet discharge rates and Inner Marsh water surface elevations for the various _v8 culvert invert elevations. Note that plotted hydrographs are color coded to simulated invert elevations listed below graph.

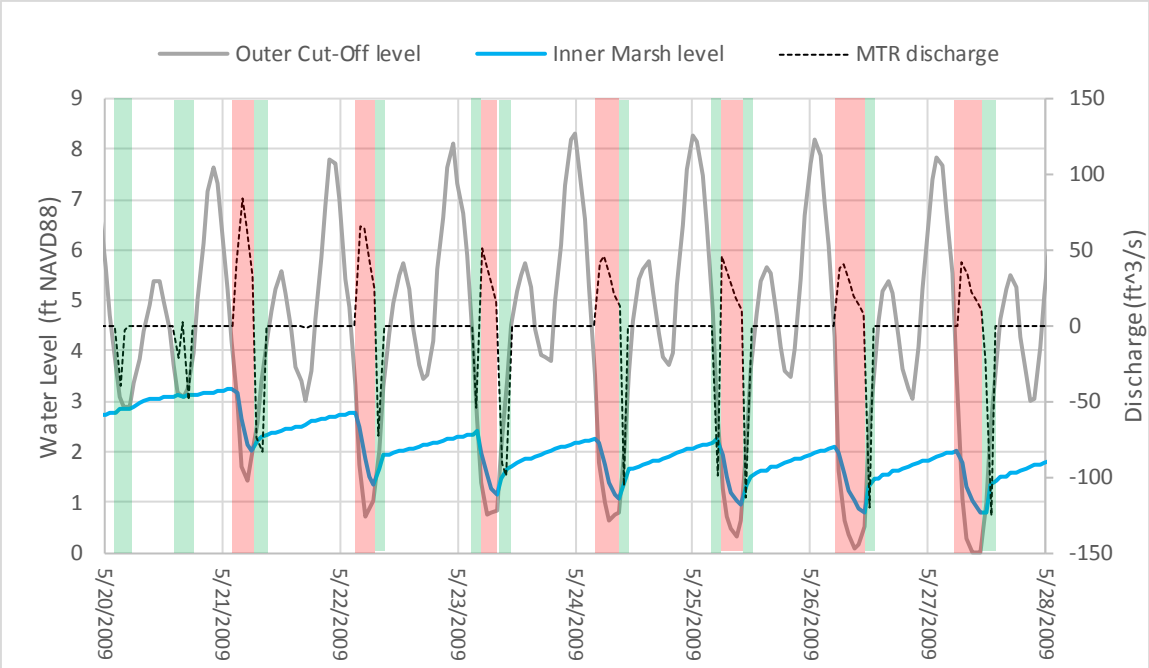


FIGURE 4: Simulated spring tide water levels (upstream and downstream) and discharge through Project MTR under winter operations that restrict Inner Marsh water levels to approximately 2.5-feet NAVD88. Green shading indicates ebb flow through MTR and red shading indicates periods of flood flow through the MTR.

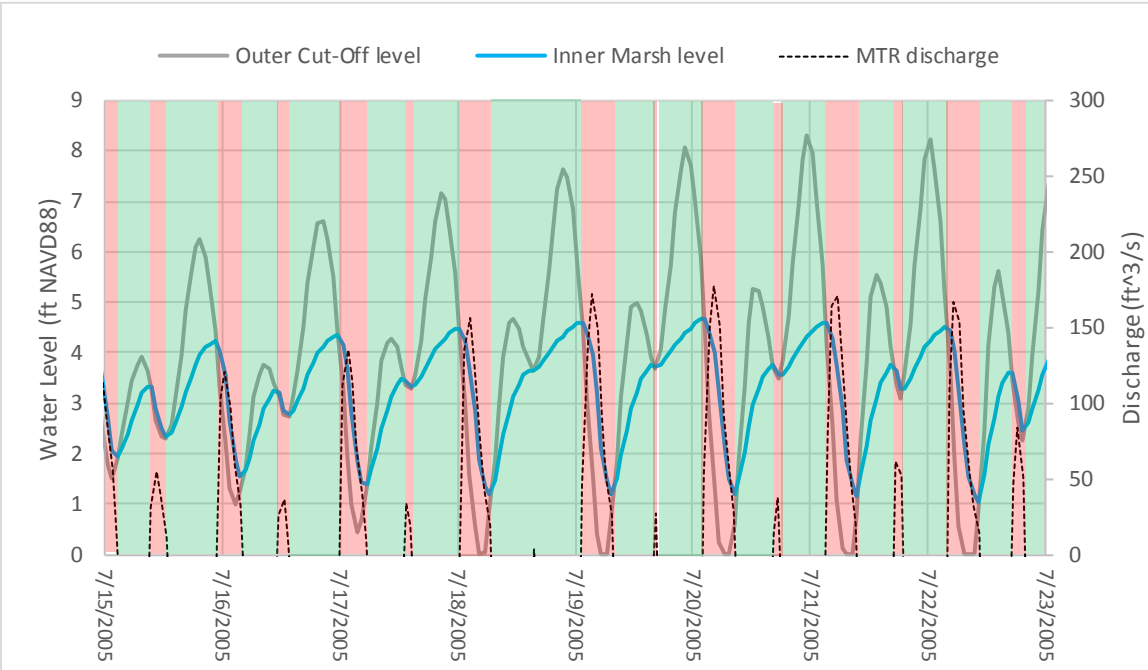


FIGURE 5: Simulated spring tide water levels (upstream and downstream) and discharge through Project MTR under summer operations that restrict Inner Marsh water levels to approximately 5.0-feet NAVD88. Green shading indicates ebb flow through MTR and red shading indicates periods of flood flow through the MTR.

2.0 Simulated Retrofitted Existing Culverts

In order to improve fish passage through the existing tide gate the following improvements are proposed (at a minimum) and were integrated into all project hydrodynamic models. Improvements include replacing one (1) existing flap gate with a new side-hinge gate equipped with a 1-square meter auxiliary fish passage door. It is assumed that side-hinge gates require less force to open, which would increase the gap width and duration gates remain open to convey drainage as well as improve fish passage. Unfortunately, no literature or information providing differences in energy loss through top-hinge vs. side-hinge flap gate culverts was found during this study. Therefore, a conservative modeling approach was taken where the same energy loss coefficient values were used when simulating both top- and side-hinge culverts. Simulated gates through the existing structure consisted of six 5.3-foot wide by 7.2-foot tall gates with invert elevations set at -3.94 feet NAVD88 that match existing conditions. The auxiliary door opening provides unrestricted inflow and outflow through the tide gate structure. In order to ensure the door remains fully submerged at all times, the invert of the auxiliary door invert was simulated at a -3.94-feet NAVD88.

3.0 Recommended Culvert Design

Based on information provided by Leo Kuntz of Nehalem Marine, side hinge culverts and MTR adaptable to the circular culvert size and configuration simulated under this study are available from Nehalem Marine and possibly other venders. The biggest constraint to this design is that during extreme changes in tide, water velocities get very high and gates experience excessive forces and slam shut. This can trigger water hammer pressure surges that are known to damage CMP culverts. Given these constraints, alternative culvert types were investigated.

The best alternative choice may be a set of concrete box culverts equipped with side hinge gates and MRT. These designs are proven and when properly designed, can provide desirable flow velocities for fish passage. According to Mr. Kuntz, concrete box culverts are pretty much "hammer safe" and provide better performance and design-life than conventional circular CMP or other culverts. However, the concrete box culverts are more expensive and would require a cast-in-place construction. Figure 6 provides pictures of the 5'x6' side hinge gates that can be manufactured and installed on the concrete box culverts. These gates can be equipped with seasonably adjustable MTR and auxiliary fish passage doors.

Given the hydraulic analyses completed for this study simulated circular CMP-type culverts, an approach was used to size and design the concrete box structure based on identifying a correct number of appropriately sized culverts that provides an equal amount of flow conveyance as simulated throughout the modeling analysis. Based on a comparison of total flow conveyance through both structures, a concrete box structure consisting of three (3) side-by-side 5'x6' box culverts equipped with side hinge gates provides slightly more conveyance capacity than the circular culvert configuration (see Figure 5). In order to replicate the simulated project

conditions, the concrete box culvert conveyance curve must equal or exceed that developed for the simulated circular CMP tide gate structures. A flow conveyance curve for a single 8'x10' concrete box culvert (a common size also available for this type of tide gate) is also provided on Figure 7 for comparison. However, a multiple culvert design is necessary as one of the culverts needs to be equipped with MTR and a smaller size MTR culvert provides better performance in regulating the winter muted tide levels.

This is an NSRG 5x6 tidegate tidegate installed in Arcata, CA. The NSRG 5x6 is mounted to the concrete.

This NSRG5x6 tidegate is equipped with a auxiliary door which is controlled by an small MTR system.

FIGURE 6: Pictures of 5'x6' Nehalem Marine side hinge culvert gates and auxilliary door.

A conceptual design of the recommended concrete box culverts equipped with side hinge gates and MTR is provided as Figure 8. This design is intended solely to provide a preliminary estimate of likely disturbance during construction. More detailed and in-depth analysis and modeling is recommended to achieve final design. This work should be done in close coordination and collaboration with manufacturer.

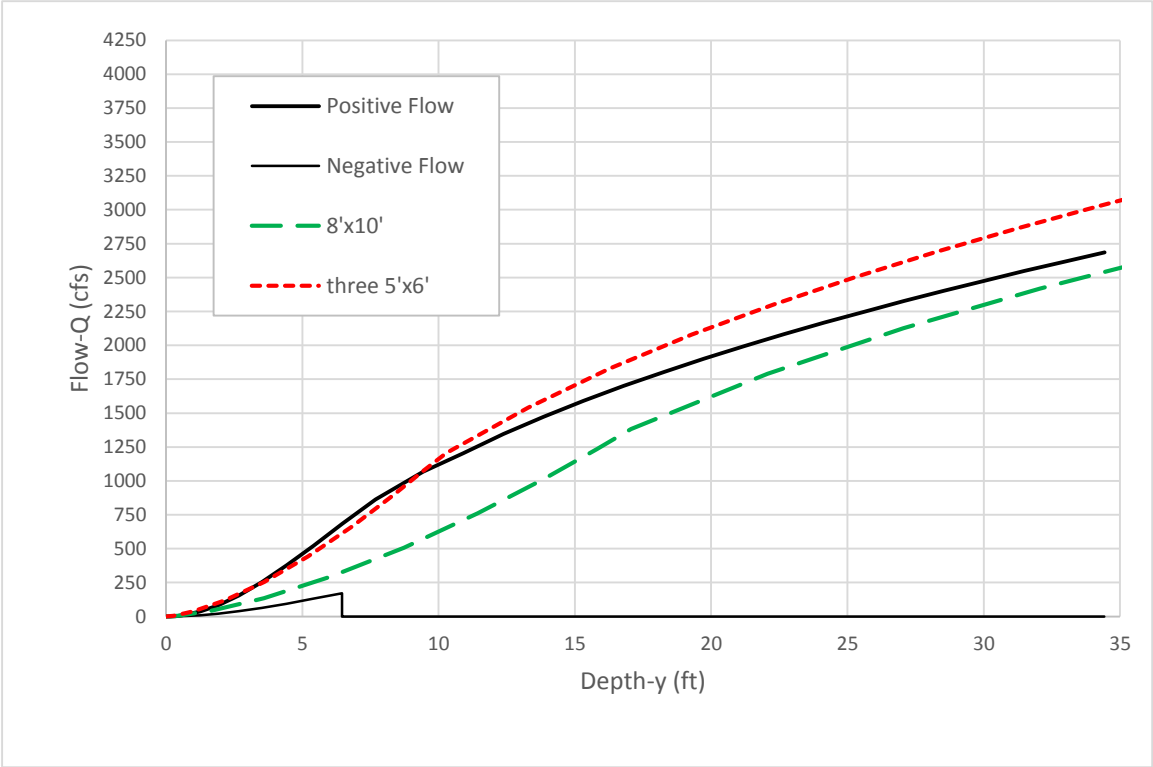


FIGURE 7: Depth-flow convenyance (h-Q) curves for difference culvert configurations. Black lines depict positive and negative h-Q curves for the four (4) 5'-diameter circular culvert system integrated thorughout numerical modeling of project alternatives. The red short dashed line is h-Q curve for total conveyance of three (3) 5'x6' concrete box culverts. Green long-dashed line is h-Q curve for single 8'x10' concrete box culvert.

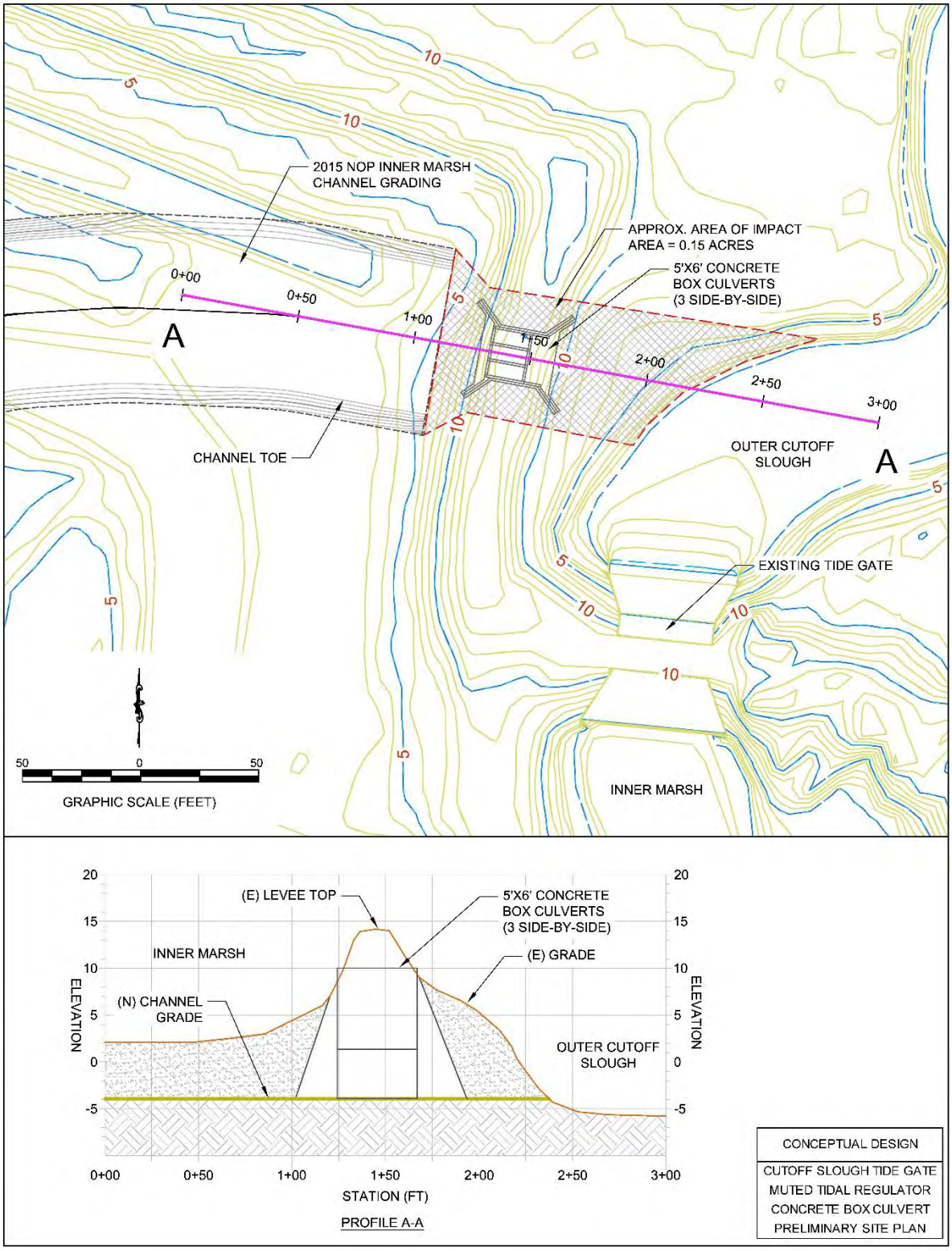


FIGURE 8: Conceptual Design for new project culverts.

APPENDIX H:
Fluvial Sediment Yield Analysis

This section presents the results of a study to quantify the amount of fluvial sediment yield off of the Wildcat Mountains to the project area.

1.0 Sources of Information

There are three sources of independent information used to estimate sediment yields from the local creeks draining the Wildcat Mountains, including:

- Sediment yield rates estimated by the U.S. Department of Agriculture - Soil Conservation Service (SCS) and reported in their 1993 Local Implementation Plan report (USDA SCS, 1993);
- A long-term (1967-2006) sediment yield rate developed by KHE (KHE, 2012) from comparison of digital elevation models (DEMs); and
- Total suspended sediment monitoring and yield estimates for Francis Creek completed by Humboldt County from 2007 through 2014 (Fenton, 2007, 2008, 2009, 2010, 2011, 2012, 2013, and 2014).

For consistency in data presentation and discussion through this section of the report, most sediment yield rates are normalized to unit area values (e.g., cubic yards per acre per year [CY/acre-yr]) to provide a more consistent and meaningful comparison between rates from different watersheds or periods.

1.1 SCS 1993 Sediment Yield Estimates

The 1993 SCS study included estimating the erosion rates and sediment yield to the base of the Wildcat Mountains from all local creeks. Their study included: review of aerial photographs and soil/geology/topographic maps; field inventories/interviews; and implementation of the Universal Soil Loss Equation (USLE). They also made a couple of annual field measurements of sediment debris fans on Russ Creek in 1989 and 1990 (Russ 1989 and Russ 1990 entries on Table 1) to estimate yield on Russ Creek[16]. A summary of the SCS sediment yield rates is presented in Table 1, and indicates annual yields range from 1.24- to 3.81-cubic yards (CY) per acre for all watersheds. Although data suggest that unit area sediment yield rates are lowest in the Russ Creek watershed and highest in Smith Creek, all values are quite similar and the differences likely fall well within the margin of error used to generate the estimates.

[16] The 1993 SCS report states the following. "*In 1989 and 1990, surveys were made of a five acre plot of pasture where sediment from the diverted Russ Creek drainage had been allowed to settle to raise the elevation of the fields. Results of the surveys show that 2.1 acres-feet of fined-grained material was deposited over a 4.6-acre area (equivalent to an average thickness of 5.4-inches) during the 1989 wet season, and 1.6 acre-feet of sediment was deposited over a 4.8-acre area (equivalent to an average thickness of 4.0 inches) during the 1990 wet season.*"

TABLE 1: Estimates of sediment yield to base of Wildcats (SCS, 1993)

Watershed	Drainage area (acres)	Sed Yield (tons/yr)	Annual Sed Yield (t/ac-yr)	Sed Yield (CY/yr)	Annual Sed Yield (CY/ac-yr)
Russ	2,080	3,790	1.82	3,297	1.59
Smith	160	700	4.38	609	3.81
Reas	1,210	2,690	2.22	2,340	1.93
Francis	1,990	5,480	2.75	4,768	2.40
Williams	3,660	9,960	2.72	8,665	2.37
Coffee	350	1,050	3.00	914	2.61
Russ 1989	2,080	3,894	1.87	3,388	1.63
Russ 1990	2,080	2,967	1.43	2,581	1.24

1.2 KHE Historic Sedimentation Analysis

As part of the design process for the Salt River Ecosystem Restoration Project, KHE assessed spatial patterns of historic sediment deposition by comparing topographic surveys from 1967 and 2006 along the Salt River and tributary corridor on the Eel River coastal plain. The approach assumes that a change in elevation between the two topographic surveys indicates the approximate depth of sediment erosion or deposition at a given location.

The 1967 U.S. Army Corps of Engineers (USACE) topographic and bathymetric survey of the Eel River Delta and channel were digitized and georeferenced by KHE to provide the source data for the 1967 digital elevation model (DEM) of the topographic surface. Electronic copies of the 1967 USACE maps were obtained from the Humboldt County Planning Department in 2005. A DEM of the 2006 topographic surface of the Salt River floodplain and adjacent areas was generated from the 2006 topographic survey contracted by the USACE as part of the Salt River Ecosystem Restoration Project. Channel bathymetry representative of 2006 conditions was prepared from channel cross-sectional profiles completed through the entire Salt River project reach in 2005.

Changes in elevation between the 1967 and 2006 surveys were assessed by comparing the DEM surfaces in GIS. Extracting the difference between the two topographic surveys reveals spatial patterns of sedimentation along the stream corridor (Figure 1). Comparison of the DEMs yielded an estimate of approximately 3.4 million cubic yards of sediment deposition along the Salt River and tributary corridors between the confluence with Reas and Williams Creeks during the period 1967-2006 (KHE, 2012). Sediment accumulation subtotals by selected sub-areas are presented in Table 2. Assuming that sediment deposited upstream of Reas Creek is derived from the Francis Creek and Williams Creek watersheds, and that the contributing drainage areas for these watersheds are 1,990- and 3,660-acres, respectively[17], average annual sediment contributions

[17] Watershed areas were defined at the base of the Wildcat Hills by the SCS in 1993 as listed in Table 1

from tributary areas are estimated at 15.44 CY/acre per year (17.75 tons per acre) during the1967-2006 period. This rate is notably higher than those estimated and presented by the SCS in 1993 (Table 1).

One reason for the difference between the SCS and KHE rates is that the KHE sedimentation rates were derived from comparison of topographic and hydrographic maps for the Salt River corridor downstream of Williams Creek. The associated sediment accumulation volumes in this mapped area likely reflect partial contributions from the upper Salt River watershed (e.g., Coffee Creek and other unnamed tributaries) as well as occasional flooding and associated sediment contributions from the Eel River. Thus, the KHE sediment loads likely reflect a maximum annual sediment accumulation rate to the Salt River project area, including sources beyond contributions solely from Francis and Williams Creeks. Reasons for the differences in SCS and KHE rates are discussed further below.

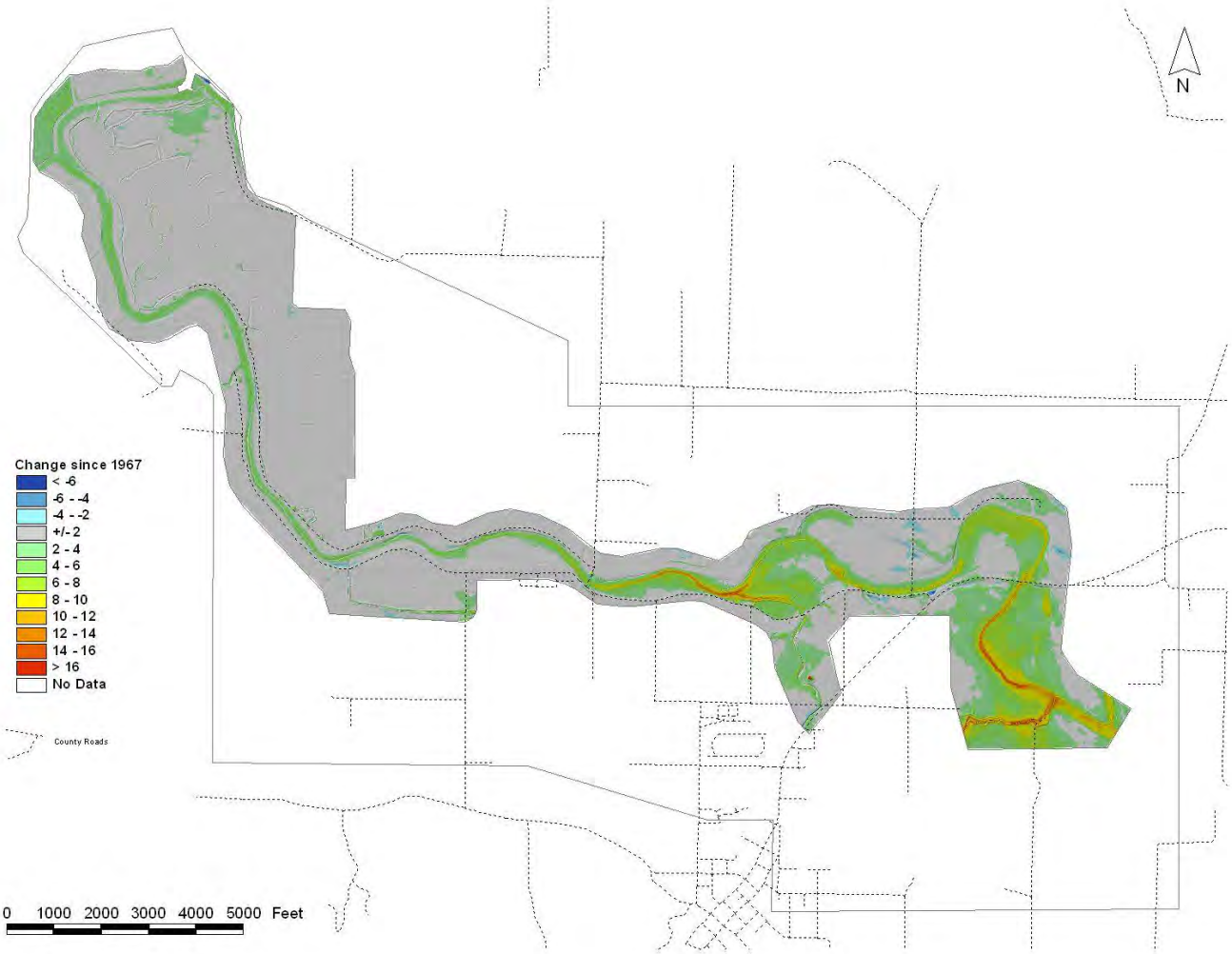


FIGURE 1: Spatial patterns of sedimentation between 1967 and 2006. Positive values indicate sediment deposition and negative values indicate sediment erosion. Analysis is limited to overlapping areas of the two survey extents.

TABLE 2: Sediment deposition estimated within selected sub-areas between Reas and Williams Creeks.

Sub-Area	1967-2006 Sed Yield (tons)	Annual Sed Yield (t/ac-yr)	1967-2006 Sed Yield (CY)	Annual Sed Yield (CY/ac-yr)
Reas Creek to Dillon Rd	180,808	4,636	157,224	4,031
Dillon Rd to Francis Cr.	271,677	6,966	236,241	6,057
Lower Francis Cr. and Salt R. below Fulmor Rd	1,038,286	26,623	902,857	23,150
Fulmor Rd to Hwy 211	607,014	15,564	527,838	13,534
Lower Williams Cr. and Salt River above Hwy 211	1,814,003	46,513	1,577,394	40,446
Total	3,911,788	17.75	3,401,554	15.44

1.3 County Suspended Sediment Monitoring

The Humboldt County Materials Testing Lab, led by Clark Fenton, has maintained a flow and suspended sediment[18] monitoring and Turbidity Threshold Sampling (TTS) Station on Francis Creek in Ferndale between 2007 and the time this report was written (see annual reports by Fenton, 2007-2015). The annual total suspended sediment yields measured during this period are summarized in Table 3. Annual sediment yield rates range from 0.51- to 29.62-CY/ac-year. Our initial impression for the variability in annual yields is that sediment yields are positively correlated to water year-type, where wetter years are associated with higher sediment yields. To investigate this relationship, KHE obtained Eel River annual flow totals at Scotia for water years 1911 through 2014 (see Figure 2). Plotting mean annual flow rates on the Eel River versus annual sediment yields on Francis Creek for the 2007-2015 period reveals a positive correlation between value pairs, with an R^2 correlation coefficient of 0.75 (see Figure 3).

[18] The County's sediment monitoring work only represents suspended sediment concentration and excludes bed-load contributions. No data was available to quantify the bed-load component of total sediment load delivered by Francis Creek. Therefore, total sediment loads quantified and described here would likely be greater than the total suspended sediment volumes presented.

TABLE 3: Total annual suspended sediment yields/rates on Francis Creek, 2007 through 2014.

	Drainage area (acres)	Sed Yield (tons)	Annual Sed Yield (t/ac-yr)	Sed Yield (CY)	Annual Sed Yield (CY/ac-yr)
2007	2,050	11,875	5.79	10,349	5.05
2008	2,050	20,870	10.18	18,187	8.87
2009	2,050	6,289	3.07	5,480	2.67
2010	2,050	19,490	9.51	16,985	8.29
2011	2,050	35,171	17.16	30,650	14.95
2012	2,050	32,930	16.07	28,696	14.00
2013	2,050	69,676	33.99	60,720	29.62
2014	2,050	1,210	0.59	1,054	0.51

2.0 Sediment Yield Estimates

KHE applied the correlation equation generated in Figure 3, to the long-term annual Eel River flow record at Scotia (Figure 2) to generate a long-term record of estimated unit area sediment yields from the Francis Creek data. Multiplying these normalized values by the Russ Creek watershed area (2,080 acres), yields a long-term estimate of sediment yields from Russ Creek into the southern project area (Figure 2). The estimated annual sediment yields from Russ Creek over this period ranged from 167- to 127,600 CY (0.08- to 61.35 CY/acre). A probability analysis was completed on the long-term (1911-2014) Russ Creek sediment yield estimates. The results of this probability analysis are summarized in Table 4 and indicate a long-term median sediment yield from Russ Creek of 17,943 CY of total suspended sediment or 8.63 CY/acre. Sediment yield values for other selected exceedance probabilities are provided in Table 4.

An interesting outcome of this analysis is that it resolves the apparent discrepancy in sediment yield estimates generated under each of the independent methods described above. For example, averaging the estimated Russ Creek sediment yields generated by correlation to Eel River flow for the 1967-2006 periods produces a unit sediment yield of 13.58 CY/ac-yr, which is very close to the same 1967-2006 average yield value of 15.44 CY/ac-yr resulting from the KHE analysis described above. Similarly, the very low yield values generated by the SCS in 1993 are well within the range of unit sediment yield values measured by the County and estimated through the flow correlation. We suspect the SCS biased their representative annual average estimate by basing their estimate on a pair of sediment yield values estimated from empirical data collected in 1989 and 1990, both very dry year-types. Estimated SCS sediment yield rates for these years are 1.63- and 1.24-CY/ac-yr, respectively. Each of these years were quite dry and the sediment yield estimates based on Eel River flow correlation result in relatively low unit area sediment yields of 7.73- and 2.53 CY/ac-yr for 1989 and 1990.

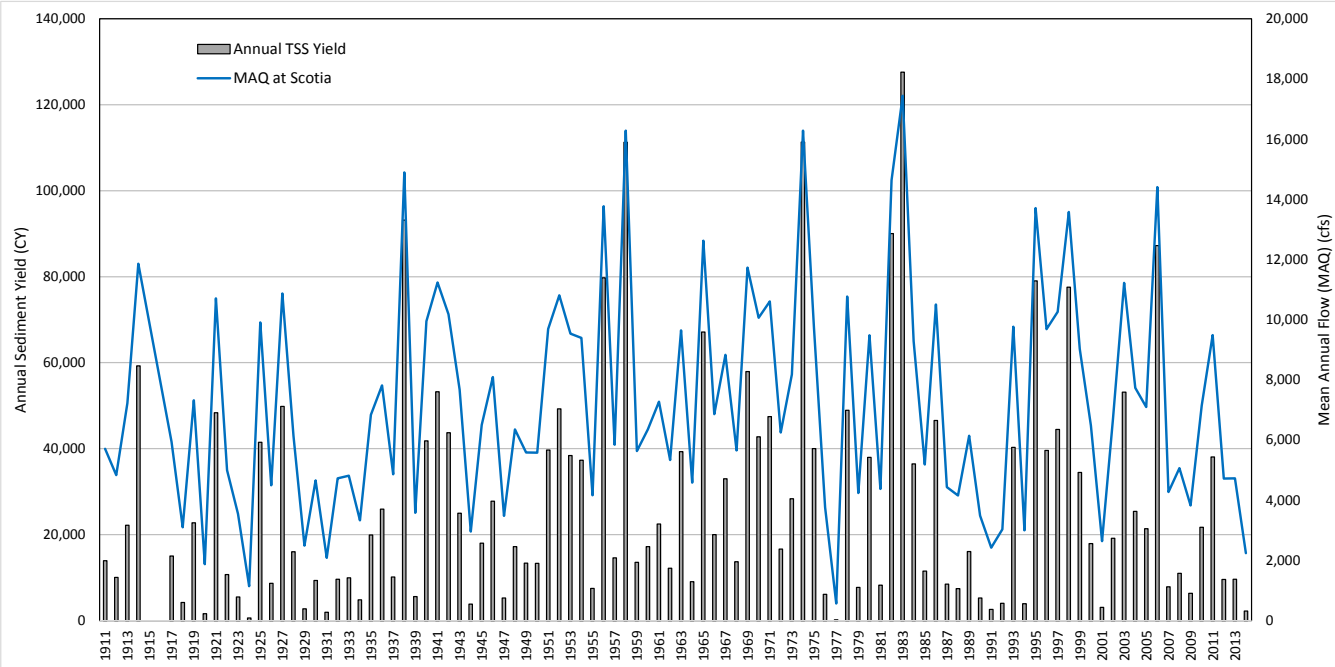


FIGURE 2: Plot of mean annual flow (MAQ) on Eel River at Scotia versus annual sediment yields for Francis Creek gauge, 2007-2014. Note positive correlation between flow and sediment yield.

Water Year	MAQ Scotia (cfs)	Annual Sed Yield (CY/ac-yr)
2007	4270	5.0
2008	5067	8.9
2009	3824	2.7
2010	7145	8.3
2011	9490	15.0
2012	10,530	14.0
2013	10,551	29.6
2014	3,835	0.5

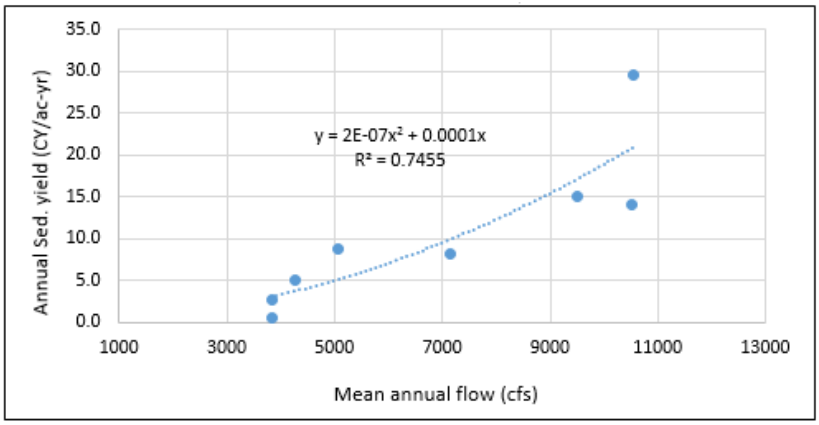


FIGURE 3: Plot of mean annual flow (MAQ) on Eel River at Scotia versus annual sediment yields for Francis Creek gauge, 2007-2014. Note positive correlation between flow and sediment yield.

TABLE 4: Long-term (1911-2014) sediment yield probabilities for Russ Creek.

Probability of Exceedance	Annual Sed Yield (CY/ac-yr)	Russ Cr. Sed Yield (CY)
99%	0.09	181
90%	1.90	3,959
80%	3.59	7,462
50%	8.63	17,943
20%	21.78	45,303
10%	31.14	64,768
1%	61.11	127,115

3.0 References

Fenton, C., 2014, Francis Creek Annual Suspended Sediment Yield, Turbidity Threshold Sampling Summary Report, Hydrologic Year 2014, Site FRC-1099 Van Ness Avenue, Ferndale, CA. A collaborative project between: National Marine Fisheries Service, Humboldt County, California Coastal Conservancy, Humboldt County RCD, and North Coast RWQCB, July 15, 23p.

Fenton, C., 2013, Francis Creek Annual Suspended Sediment Yield, Turbidity Threshold Sampling Summary Report, Hydrologic Year 2011, Site FRC-1099 Van Ness Avenue, Ferndale, CA. A collaborative project between: National Marine Fisheries Service, Humboldt County, California Coastal Conservancy, Humboldt County RCD, and North Coast RWQCB.

Fenton, C., 2012, Francis Creek Annual Suspended Sediment Yield, Turbidity Threshold Sampling Summary Report, Hydrologic Year 2011, Site FRC-1099 Van Ness Avenue, Ferndale, CA. A collaborative project between: National Marine Fisheries Service, Humboldt County, California Coastal Conservancy, Humboldt County RCD, and North Coast RWQCB.

Fenton, C., 2011, Francis Creek Annual Suspended Sediment Yield, Turbidity Threshold Sampling Summary Report, Hydrologic Year 2011, Site FRC-1099 Van Ness Avenue, Ferndale, CA. A collaborative project between: National Marine Fisheries Service, Humboldt County, California Coastal Conservancy, Humboldt County RCD, and North Coast RWQCB.

Fenton, C., 2010, Francis Creek suspended sediment yield, turbidity threshold sampling summary report, Hydrologic year 2010, Site FRC-1099 Van Ness Avenue, Ferndale, CA.

Prepared for: the Salt River Ecosystem Restoration Project, in collaboration with NMFS, Humboldt County, Coastal Conservancy, Humboldt RCD and North Coast RWQCB, 18p.

Fenton, C., 2009, Francis Creek suspended sediment yield, turbidity threshold sampling summary report, Hydrologic year 2009, Site FRC-1099 Van Ness Avenue, Ferndale, CA. Prepared for: the Salt River Ecosystem Restoration Project, in collaboration with NMFS, Humboldt County, Coastal Conservancy, Humboldt RCD and North Coast RWQCB, 14p.

Fenton, C., 2008, Francis Creek suspended sediment yield, turbidity threshold sampling, Hydrologic year 2008, Site FRC-1099 Van Ness Avenue, Ferndale, CA. Prepared for: the Salt River Ecosystem Restoration Project, in collaboration with NMFS, Humboldt County, Coastal Conservancy, Humboldt RCD and North Coast RWQCB, 13p.

Fenton, C., 2007, Francis Creek suspended sediment yield, turbidity threshold sampling, 1-23-07 to 5-31-07, Site FRC-1099 Van Ness Avenue, Ferndale, CA. Prepared for: the Salt River Ecosystem Restoration Project, in collaboration with NMFS, Humboldt County, Coastal Conservancy, Humboldt RCD and North Coast RWQCB, 15p.

Harvey, H.T., Eel River Water Quality Datasonde Deployment Summary Memorandum, October 27, 2009.

Kamman Hydrology & Engineering, Inc. (KHE), 2012, Basis of Design Report, Volume I, Salt River Ecosystem Restoration Project, Riverside Ranch Tidal Marsh Restoration and Preliminary Salt River Channel Design. Prepare for: Humboldt County RCD, May, 236p.

NOAA, Tide Gage at North Spit, Station ID 9418767.

U.S. Department of Agriculture, Soil Conservation Service (USDA SCS), 1993, Salt River Local Implementation Plan, Humboldt County, California. Prepared for: Eel River Resource Conservation District, prepared in cooperation with: California Coastal Conservancy, Humboldt State University, Oscar Larson and Associates, and Questa Engineering Corporation, March.

USACOE Hydrologic Engineering Center, HEC-DSSVue, Version 2.0, February 2010.

USGS, Flow data for Bull Creek near Weott, CA, Station ID 11476600.

USGS, Flow data for Mattole River near Ettersburg, CA, Station ID 11468900.

USGS, Water Surface Elevation Data for Eel River at Fernbridge, Station ID 11479560.

APPENDIX I:
Equilibrium Channel Dimensions for 2015 NOP Alternative

1.0 Introduction

This appendix presents an analysis completed by KHE to predict equilibrium channel geometries for the 2015 NOP Equilibrium alternative. The outcome of this analysis resulted in an estimation of channel top width, thalweg depth and channel bottom width for five (5) reaches within the proposed channel alignments of the 2015 NOP channel design. Results of this analysis were used to generate a digital terrain model (DTM) that grades the equilibrium channels into an existing conditions terrain model as described in Appendix C. The DTM with channel grading was subsequently used to generate modeling geometry files for hydraulic analyses with a MIKE11, 1-D modeling platform.

2.0 Equilibrium Channel Sizing Methods

The analysis utilized existing empirically-based hydraulic geometry relationships for mature salt marsh channels derived for the San Francisco Bay area, Humboldt Bay area, and Ocean Ranch Unit (ORU) of the Eel River Wildlife Area (NHE, 2011). These relationships are presented in Figures 1 and 2. Increases in tidal prism create greater flow rates and energy through associated tidal channels. This increase in energy erodes and maintains channel geometry to a state of equilibrium with the associated tidal prism volumes. As indicated by the data and trends presented in Figures 1 and 2, increases in tidal prism yield progressively larger channels. For the purposes of this analysis, potential diurnal tidal prism[19] is used as the dependent variable controlling channel geometry.

In order to estimate potential diurnal prism volumes, KHE performed an analysis to determine tidal datums (MLLW – MHHW) within the muted tidal region of the EREP project area. The calculated tidal datums for the Eel River Estuary gauge (see Appendix D) were used in conjunction with measured water levels recorded at the inner tide gate for the tidal period between June 23, 2005 and 10/20/2005. Exceedance probability plots were developed for each dataset for this period (Figure 3). Eel River Estuary tidal datums were used to estimate exceedance probabilities for each individual tidal datum. These probabilities were then used to extract corresponding inner marsh tidal datum water level elevations. Table 1 present these data for the Eel River Estuary and the Inner Marsh.

Once inner marsh tidal datums were developed, potential diurnal tidal prisms were estimated for five (5) separate sub regions within the project area that were subject to varying magnitudes of tidal prism. Figure 4 presents these sub regions. These estimates were used to develop five (5) separate channel geometries, for each regions, using the hydraulic geometry relationships.

[19] Potential diurnal tidal prism is defined as the volume of water in a marsh system between Mean Higher High Water (MHHW) and Mean Lower Low Water (MLLW) tidal datums.

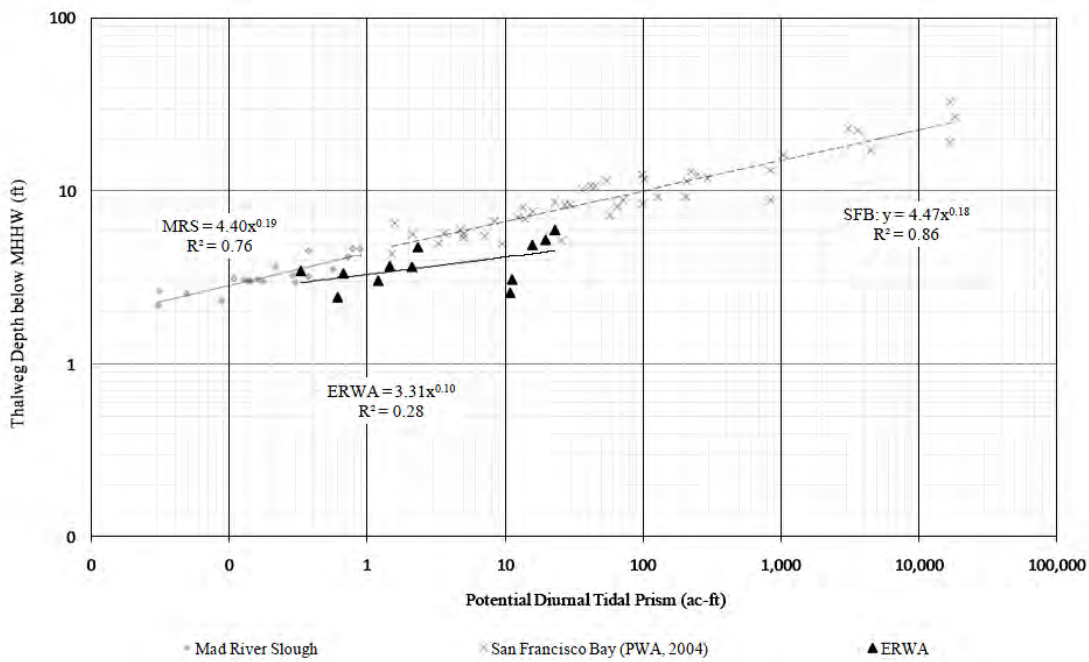


FIGURE 1: Relationship between channel thalweg depth and potential diurnal tidal prism at ORU and Humboldt and San Francisco Bays (Source: NHE, 2011)

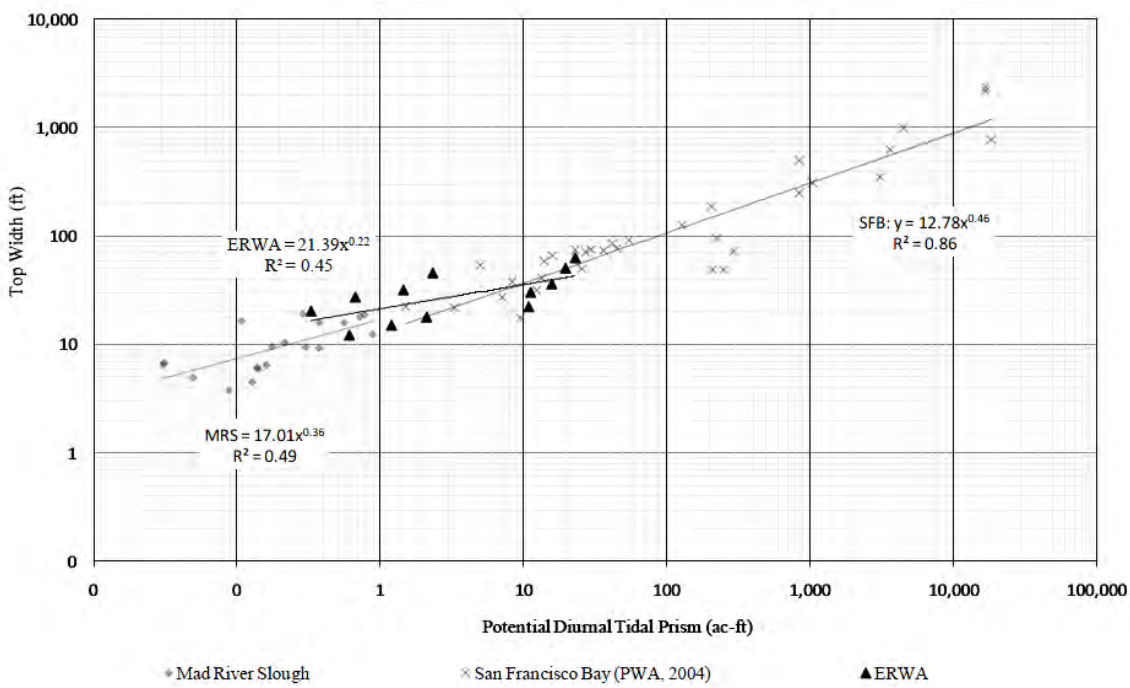


FIGURE 2: Relationship between channel top width and potential diurnal tidal prism at ORU and Humboldt and San Francisco Bays (Source: NHE, 2011)

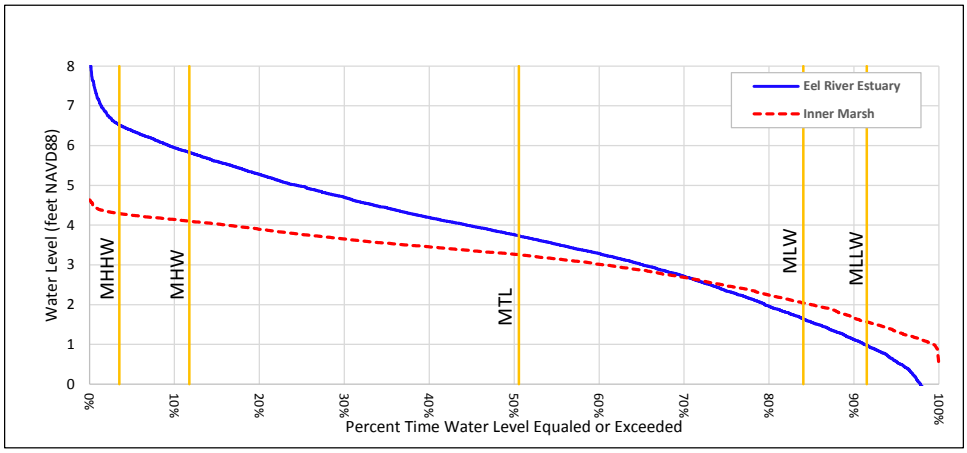
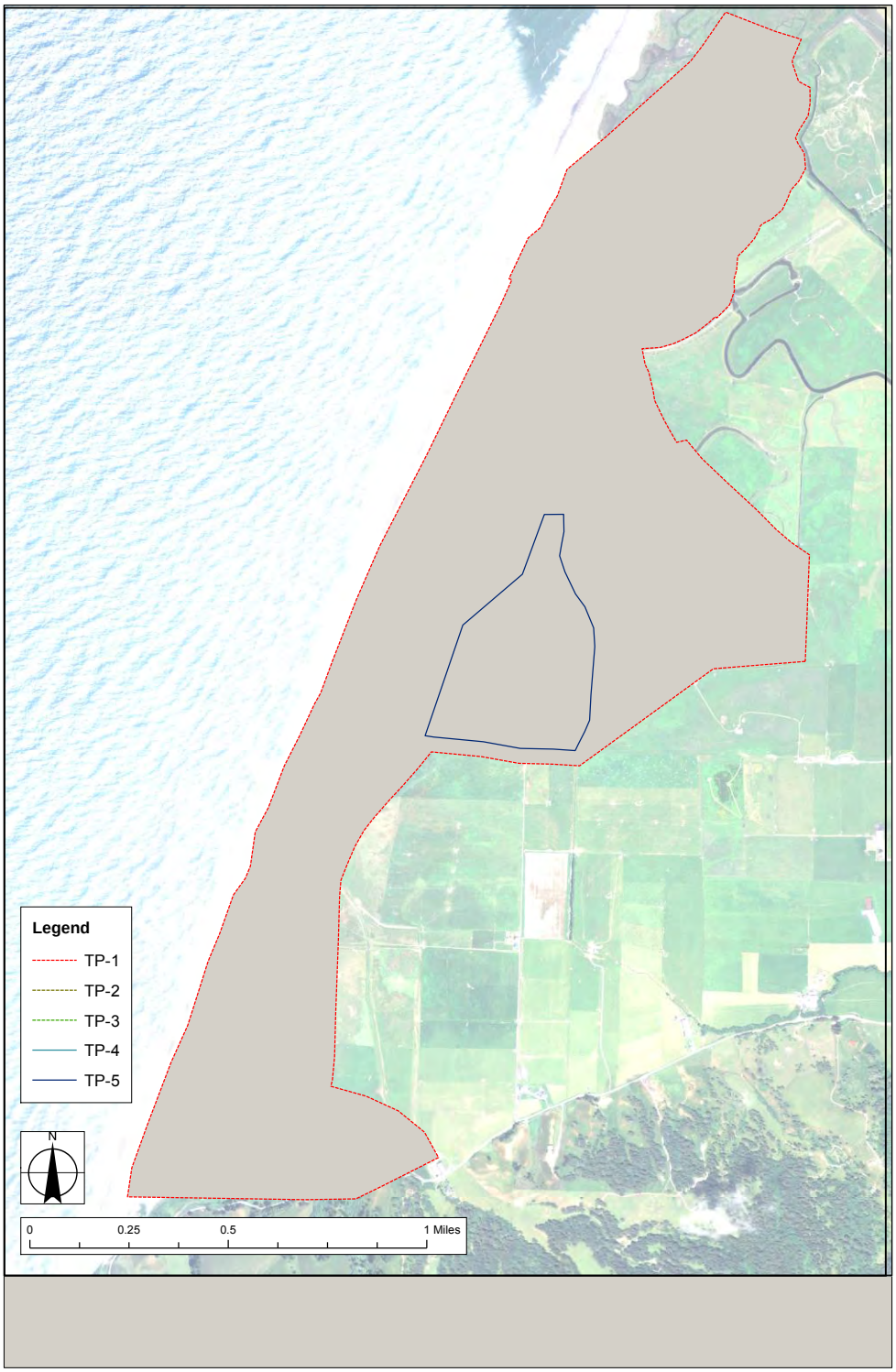


FIGURE 3: Exceedance probability plots of water levels measured at the Eel River Estuary gauge for period June 24, 2005 through Oct. 20, 2005 versus estuary tidal datums.

TABLE 1: Tidal Datums and corresponding exceedance probabilities for the Eel River Estuary measured water levels during tidal epoch (June 24, 2005 through Oct. 20, 2005)

Tidal Datum	Eel R. Estuary Computed Tidal Datum Elevations (ft, NAVD88)	Inner Marsh Computed Tidal Datum Elevations (ft, NAVD88)	Percent Time WL Equaled or Exceeded (2005 Record)
MHHW	6.52	4.29	3.50%
MHW	5.83	4.10	11.75%
MTL	3.73	3.26	50.55%
MLW	1.64	2.04	84.05%
MLLW	0.98	1.57	91.50%

Three digital terrain models (DTM) were used to estimate tidal prisms for each region. DTMs include (1) Existing Conditions DTM, (2) 2015 NOP Narrow and (3) 2015 NOP Wide. Five channel geometries were developed for each tidal prism region for each of the three DTMs based on each tidal prism estimate (Figure 5 and Table 2). The channel geometries used for the 2015 NOP Equilibrium alternative channel design are presented in Table 2. These geometries were integrated into the numerical model used to evaluate this alternative.


Legend
TP-1
TP-2
TP-3
TP-4
TP-5
N
0
0.25
0.5
1 Miles

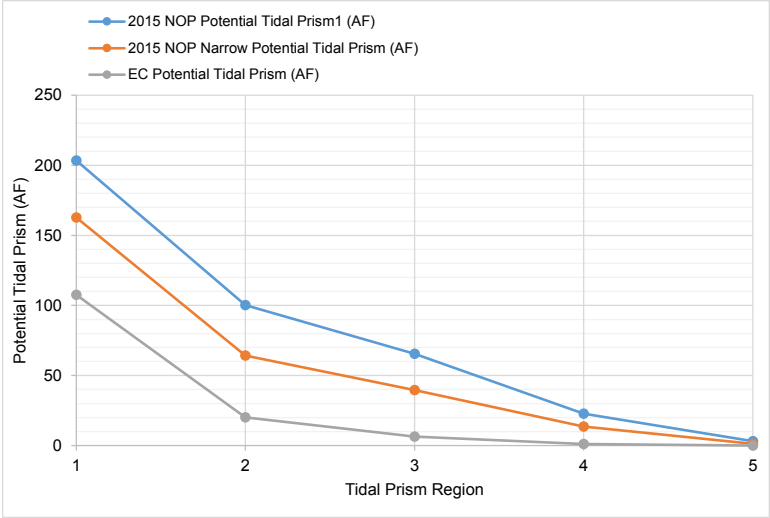


FIGURE 5: Tidal prism estimates for each of the five sub regions and three DTMs

TABLE 2: Tidal Prism and channel geometry results for each sub region and each DTM

2015 NOP			
Tidal Prism Region	Potential Tidal Prism1 (AF)	Thalweg Depth below MHHW (feet)	Channel Top Width (feet)
1	203	5.6	69
2	100	5.2	59
3	65	5.0	54
4	23	4.5	43
5	3	3.7	28
2015 NOP Narrow			
Tidal Prism Region	Potential Tidal Prism (AF)	Thalweg Depth below MHHW (feet)	Channel Top Width (feet)
1	163	5.5	66
2	64	5.0	53
3	40	4.8	48
4	14	4.3	38
5	1	3.4	23
EC			
Tidal Prism Region	Potential Tidal Prism (AF)	Thalweg Depth below MHHW (feet)	Channel Top Width (feet)
1	107	5.3	60
2	20	4.5	41
3	6	4.0	32
4	1	3.4	22
5	0	0.0	0

TABLE 3: Channel Geometries used for the 2015 NOP Equilibrium Channel alternative

Tidal Prism Region	Thalweg Depth below MHHW (feet)	Channel Top Width (feet)	BED ELEVATION	SIDE SLOPES	CHANNEL BW
1	5.51	70	-1.22	3:1	38.84
2	5.01	60	-0.72	3:1	31.67
3	4.78	55	-0.49	3:1	27.95
4	4.30	45	0.00	3:1	20.69
5	3.41	35	0.88	3:1	15.71

3.0 References

Northern Hydrology and Engineering, 2011, Ocean Ranch Unit, Eel River Wildlife Area, Tidal Geometry Analysis. Prepared for: California Department of Fish and Game Northern and Marine Regions, February, 31p.

www.ghd.com