October 2025

Elk River Estuary (Planning Area 1) Restoration Project: Harbor District Development Permit Application Package

PREPARED BY

California Trout
1380 9th Street
Arcata, CA 95521

and

Northern Hydrology & Engineering (NHE)
3101 Concorde Drive, Suite B
McKinleyville, CA 95519

Stillwater Sciences
850 G St.
Arcata, CA 95521

and

GHD
718 3rd Street
Eureka, CA 95501

Attachments

HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT

P.O. BOX 1030
Eureka, California 95502
phone (707) 443-0801
fax (707) 443-0800

PERMIT APPLICATION

Date Filed: 10/20/2025

General Information	For District Use
1.) Name, Address, phone # and email of Developer, Project Sponsor and Legal Owner: California Trout (Arcata, CA office: 1380 9th Street, Arcata, CA 95521) (707) 822-0420	A. Application No. 2025-05 Application Type: Franchise ☐ Permit ☐ Lease ☐
2.) Address of Project and Assessor's block, lot and Parcel Number See Attachment 1 for a list	B. Date Received by Harbor District 10/21/2025
	C. Date Accepted for filing by Commission
3.) Contact person Name, Address, phone # Agent – Andrea Hilton, GHD Andrea.hilton@ghd.com, (707) 267-2262 Applicant - California Trout 1380 9th Street Arcata, CA 95521 Phone: (707) 822-0420 Dmierau@caltrout.org	D. Date of Public Notice
	E. Date of Environmental Compliance
4.) Attach list of names and addresses of all adjoining property owners See Attachment 1	F. Date of Public Notice
	G. Date of Public Hearings
5.) List and describe any other related Project Permits & Other Public Approvals required, including those required by City, Regional, State & Federal Agencies. See Table 4-1 of the Project Description for a complete list.	H. Date of Commission Action Approval: _____ Conditional _____ Disapproval _____
	I. Expiration Date
6.) Existing City/County Zoning Agriculture Exclusive and Agricultural General	Comments
7.) Proposed Site Use (Project Title) Elk River Planning Area 1 Restoration Project	

Describe in detail the proposed project:

The Elk River Planning Area 1 (PA1) Restoration Project is a large-scale ecological restoration effort located in the tidally influenced lower Elk River watershed near Humboldt Bay, California. Within the Harbor District's jurisdiction, the Project Area is approximately 206 acres; the broader Project Area is 857 acres, including areas beyond the Harbor District's jurisdiction. The Project would restore tidal marshes, slough channels, riparian corridors, and floodplain connectivity to improve habitat for threatened and endangered fish species such as Coho and Chinook Salmon, Tidewater Goby, steelhead, and Longfin Smelt. The Project also addresses reduces flooding of agricultural fields and enhances the resilience of the estuarine ecosystem to sea level rise and climate change.

In addition to ecological benefits, the Project includes public access improvements such as new trails, wildlife viewing platforms, and non-motorized boat launches to support recreation, education, and community engagement. The restoration is part of the broader Elk River Watershed Stewardship Program and builds on previous assessments and community collaboration. It integrates habitat enhancement with infrastructure upgrades and sustainable land management practices, making it a model for multi-benefit restoration in coastal California.

Please See Project Description (Attachment 2)

PRE-PROJECT EELGRASS CHECKLIST

Please complete the Eelgrass Pre-project Checklist below. Note that the checklist questions relate to the Area of Potential Effect (APE) associated with your project, which incorporates a surrounding buffer inclusive of the limits of potential construction and/or maintenance-related activities that could affect eelgrass habitat. Provide a copy of the completed questionnaire along with your permit application and a map depicting the proposed project location, potential eelgrass depth range-10 to +4 feet, and benchmark eelgrass distribution in the vicinity of the proposed project. Maps should be of an appropriate scale to clearly depict the preliminary/proposed APE boundary in relation to both existing and potential eelgrass resources as provided in the Humboldt Bay Eelgrass Comprehensive Management Plan and associated webpage (humboldtbay.org/eelgrass-management-plan). Here you'll find information and links including eelgrass information for permit applicants, a baseline eelgrass distribution map, and the Humboldt Bay Eelgrass Comprehensive Management Plan. Contact the Harbor District office with questions (443-0801).

For New Projects:

		YES	NO
a)	Is the project located within 100 feet of previously mapped (known) eelgrass habitat?	X	
b)	Will any construction or new operational traffic occur within the vicinity of existing eelgrass?	X	
c)	Is any portion of the project located in an area with depths ranging from -10 to +4 feet?	X	
d)	Does the project result in new cover, shading or other form of light reduction of open water areas ranging in depth from -10 to +4 feet?		X
e)	Is the project anticipated to affect wind or tidal circulation patterns within the bay? **Changes will be beneficial; located in Swains Slough.**	X	
f)	Could the project affect ambient water temperature or clarity or result in new effluent (including stormwater) discharge point? **Short-term construction phase impacts only.**	X	
g)	Does the project result in any placement of fill, including shoreline armor? **RSP placed in small quantities around upgraded fish friendly tide gates.**	X	
h)	Is the project anticipated to lead to an increase in boat traffic that could affect nearby eelgrass habitat through grounding, prop scarring, wake, or shading impacts? **Project includes non-motorized boat launches for recreation use only, which will not result in wake.**		X

For Maintenance/Repair Projects and Construction Activities:

		YES	NO
i)	Is project construction likely to increase turbidity? To what extent and for what duration? **Short-term construction phase turbidity during the permitted in-water work window.**	X	
j)	Will construction require the use of a barge or other vessel that may temporarily impact the bay floor (e.g. spud poles, anchoring, prop scarring, etc.) within known eelgrass habitat or within depths ranging from -10 to +4 feet? **A barge may be used for construction access on the opposite bank.**	X	
k)	Will construction require the use of turbidity curtains in proximity to eelgrass habitat?		X

l)	Will project construction result in temporary shading from moored/anchored working vessel(s)?		X

If you responded yes to any of the questions above, your project may have the potential to affect eelgrass habitat and you'll need to conduct a preliminary eelgrass survey. Please refer to the District's Eelgrass Management Plan webpage for further guidance and a list of local agency contacts should you have additional questions.

Answer all questions completely on a separate page. If the question does not apply to your project, so indicate by marking N.A. Contact Harbor District Office with questions.

PROJECT DESCRIPTION

8. Site Size

The portion of the Project that is jurisdictional to the Harbor District spans approximately 206 acres along the Elk River and Swain Slough, upstream of U.S. Highway 101.

9. Square Footage

Approximately 37,766,520 square feet.

10. Number of floors of construction

N.A.

11. Amount of off-street parking provided

N.A.

12. Attach plans

Please see Attachment 3

13. Proposed scheduling

Each Project phase will focus on enhancement and restoration actions within a specific river reach along single or multiple property ownerships. Most construction activities will occur within the regulated in-water construction season, typically June 15 through October 15, i.e., during late summer and fall when stream flows are at their annual minimum. If no rain is forecast, construction activities may be extended through October 31 with regulatory agency authorization. Equipment will work from the streambank and within the dewatered channel. Some pre-construction or maintenance activities outside the wetted channel may take place outside the construction season; for example, tree removals may take place prior to the bird nesting season to preclude nesting.

The first phase of construction will focus on Swains Slough and will occur during the 2026 permitted in-water work window.

14. Associated projects

Elk River Watershed Stewardship Program

- The PA1 Project is one phase of this broader watershed-scale effort.
- The program includes sediment remediation and habitat rehabilitation across multiple planning areas further upstream in the watershed, outside of the District's jurisdiction.

Martin Slough and City of Eureka Restoration Projects

- The PA1 Project is designed to connect with recently restored Elk Estuary habitats, including:
    - Martin Slough Restoration
    - City of Eureka's restoration efforts in lower Elk River

15. Anticipated incremental development

There is no indication of planned or proposed housing developments, subdivisions, or urban expansion in the Project vicinity. The focus remains on habitat restoration, floodplain reconnection, and public access improvements consistent with conservation goals.

16. If residential, include the number of units, schedule of unit sizes, range of sale prices or rents, and type of household size expected.

N.A.

17. If commercial, indicate the type, whether neighborhood, city or regionally oriented, square footage of sales area, and loading facilities

N.A.

18. If industrial, indicate type, estimated per shift employment & loading facilities.

N.A.

19. If institutional, indicate the major function, estimated per shift employment, occupancy, loading facilities, and community benefits derived from the project.

N.A.

20. If the project involves a variance, conditional use or recognizing application, state this and indicate clearly why the application is required.

The Elk River PA1 Restoration Project requires a Use Permit for activities within the Coastal Zone, a Special Permit for work in the Streamside Management Area, and a Grading and Floodplain Management Permit from Humboldt County. These applications are necessary due to the Project's location in environmentally sensitive areas and the nature of the proposed restoration activities, which include grading, levee removal, and tidal marsh enhancement.

Are the following items applicable to the project or its effects? Answer yes or no. Discuss all items answered yes.

21. Change in existing features of any bays, tidelands, beaches, lakes or hills, or substantial alteration of ground contours.

Yes. Key impacts include:

- Alteration of Ground Contours: The Project involves extensive grading, excavation, and recontouring of floodplains, marshes, and streambanks. These activities are designed to restore natural hydrologic patterns, improve floodplain connectivity, and enhance habitat complexity.
- Modification of Tidal and Estuarine Features: Restoration actions will remove or modify levees, tide gates, and other infrastructure to reestablish tidal exchange. This will expand the tidal prism and reconnect the Elk River to historic salt and brackish marsh plains, resulting in changes to tidelands and estuarine hydrology.
- Creation of New Topographic Features: The Project will construct eco-levees, tidal channels, intertidal ponds, and hummocks to support diverse wetland vegetation and wildlife habitat. These features will alter the existing landscape to mimic natural estuarine and riparian systems.
- Changes to Bays and Wetlands: Located within the Humboldt Bay watershed, the Project will influence estuarine processes by enhancing sediment deposition, marsh accretion, and habitat connectivity, contributing to long-term resilience against sea level rise.

These changes are intentional and beneficial, aimed at restoring ecological function, improving water quality, and supporting habitat for sensitive and listed species. All alterations will be conducted in compliance with applicable environmental regulations and permit conditions.

22. Change in scenic views or vistas from existing residential areas or public lands or roads.

No, Project components are designed to blend with the natural environment and improve natural visual character of the landscape by enhancing scenic quality.

23. Change in pattern, scale or character of general area of project.

Yes, the Project will transition the landscape from a modified agricultural and flood control system to a restored estuarine and riparian ecosystem. Key changes include:

- Restoration of natural hydrology through levee removal, tidal channel excavation, and floodplain reconnection.
- Conversion of land use from managed pasture to a mosaic of tidal marsh, riparian forest, and wetland habitats.
- Introduction of public access features such as trails and overlooks that support passive recreation and environmental education.
- Enhancement of ecological function and climate resilience across approximately 857 acres.

These changes are consistent with regional watershed restoration goals and are designed to improve habitat quality, water quality, and flood resilience while maintaining compatibility with surrounding land uses.

24. Significant amounts of solid waste or litter.

No, solid waste or litter is not anticipated. The Project aims to mitigate potential littering and illegal dumping through improved public access design and management.

25. Change in dust, ash, smoke, fumes or odors in vicinity.

Yes, temporary dust generation from construction activities may occur however, dust control and air quality BMPs will be implemented.

26. Change in ocean, bay, lake, stream or ground water quality or quantity, or alteration of existing drainage patterns.

Yes, Key changes include:

- Restoration of Natural Drainage Patterns: The Project will remove or modify levees, tide gates, culverts, and ditches to restore natural tidal and fluvial hydrology. This includes recontouring floodplains and daylighting Orton Creek to reconnect it with Swain Slough.
- Improved Water Quality: By restoring tidal exchange and wetland function within stagnant ponds in the tidal marsh plain and off channel areas, the Project will reduce suspended sediment, turbidity, and nutrient loading, and improve dissolved oxygen levels in these locations. These changes will benefit aquatic species and overall ecosystem health.
- Changes in Water Quantity and Flow Regimes: The Project will increase tidal inundation and floodplain connectivity, altering the timing, extent, and duration of surface water flows. These changes are designed to reduce nuisance flooding and enhance habitat availability.
- Groundwater Interactions: Floodplain recontouring and wetland restoration will enhance groundwater recharge and maintain wetland hydrology, particularly through the use of hummocks and eco-levees designed to retain seasonal saturation.

These changes are intentional and beneficial, aligned with regional watershed restoration goals, and will be implemented with appropriate best management practices and regulatory oversight.

27. Substantial change in existing noise or vibration levels in the vicinity.

A. During Construction: Yes, construction of the Project will result in a temporary noise increase associated with the use of construction equipment.

B. During Project Utilization: No, the Project does not involve operational noise or vibration.

28. Site on filled land or on slope of 10% or more.

Yes, the Project site includes filled land (due to historical reclamation and infrastructure).

No, the site is not on a slope of 10% or more; it is a flat, low-lying floodplain and estuarine area.

29. Use of disposal or potentially hazardous materials, such as toxic substances, flammable or explosives.

The Project will include the transport and use of common hazardous materials inherent to the construction process, including petroleum products such as fuel and lubricants for construction equipment and vehicles. These materials are commonly used during construction, are not acutely hazardous, and will be used in relatively small quantities. The established regulatory frameworks, BMPs, and requisite construction protocols provide appropriate risk mitigation and hazard protection, thus the Project will not create a significant hazard to the public or environment from hazardous materials.

30. Substantial change in municipal services demand (police, fire, water, sewage, etc.)

No. The Project improvements will not induce population growth and will not result in the need to increase staffing, create new hazardous conditions, or result in a modification to the road system that would restrict access for emergency services.

31. Substantially increase fossil fuel consumption (electricity, oil, natural gas, etc.).

No. Construction will require the use of fuels, primarily gas, diesel, and motor oil. Inefficient construction-related operations will also be avoided due incorporated avoidance and minimization measures.

32. Relationship to larger project or series of projects

Yes, as outlined in question 14, the PA1 Project is part of the broader Elk River Watershed Stewardship Program, a comprehensive effort focused on sediment remediation and habitat rehabilitation across multiple planning areas. It builds on the Elk River Recovery Assessment (2014–2019), which provided key modeling and restoration priorities. The PA1 Project is also designed to connect with other restoration efforts, including the Martin Slough and City of Eureka Projects in the lower Elk River.

ENVIRONMENTAL SETTING:

33. Describe the project site as it exists before the project including information on topography, soil stability, plants and animals, and any cultural, historical, or scenic aspects. Describe any existing structures on the site and the use of the structures. Attach photographs of the site. Photos will be accepted.

The Elk River Planning Area 1 (PA1) Project site is a low-lying, tidally influenced floodplain located along the Elk River and Swain Slough, upstream of Highway 101 in Humboldt County, California. Historically, the area was a diverse mosaic of tidal marshes, dunes, grasslands, and forests, but has since been heavily modified by diking, draining, and agricultural use. The topography is generally flat, with some artificial fill and levees, and the soils vary from organic silts to clays, with some areas showing signs of instability due to past modifications. Vegetation includes remnant native riparian and marsh species, though much of the site is dominated by invasive plants. Wildlife includes several special-status fish species such as Coho and Chinook Salmon, steelhead, and Longfin Smelt. Existing structures include barns, a milking parlor, a house, tide gates, culverts, and levees, many of which are slated for removal or modification. The site also holds cultural significance, particularly for

the Wiyot Tribe, and includes scenic estuarine landscapes that are vulnerable to sea level rise. Please see the Biological Assessment in Attachment 4 for further evaluation of existing species and habitat conditions.

34. **Describe the surrounding properties, including information on plants and animals and any cultural, historical, or scenic aspects. Indicate the type of land use (residential, commercial, etc.) intensity of land use (one-family, apartment houses, shops, department stores, etc.) and the scale of development (height, frontage, set-back, rear yard, etc.) Attach photographs of the vicinity. Photos accepted.**

    The properties surrounding the Elk River Planning Area 1 (PA1) Project site are a mix of rural residential, agricultural, and conservation lands. The area is characterized by low-density land use, including single-family homes, pasturelands, and undeveloped open space. Many of the adjacent parcels are used for cattle grazing or are part of the Elk River Wildlife Area managed by the California Department of Fish and Wildlife. The surrounding landscape includes riparian corridors, tidal marshes, and forested hillslopes, supporting a variety of native and special-status plant and animal species, including salmonids, waterfowl, and estuarine fish. Cultural and historical aspects are present, particularly in areas owned or stewarded by the Wiyot Tribe, whose ancestral lands include the Project Area. Scenic views of the Elk River, Humboldt Bay, and surrounding wetlands contribute to the area's natural beauty. Structures in the vicinity are generally low-scale, such as barns, sheds, and single-story homes, with minimal commercial development. For further biological context, please see the Biological Assessment in Attachment 4.

Project Area Photos

Image 1. Swains Slough at high tide.

Image 2. Swains Slough channel.

Image 3. Elk River Wildlife Area shown at high tide on November 27, 2023.

Image 4. Lower Elk River watershed looking west toward Humboldt Bay.

---------- Questions 35; and 36 MUST BE ANSWERED! ----------

35. How will the proposed use or activity promote the public health, safety, comfort, and convenience?

Public Health: Project goals do not focus on public health.

Safety: The Project reduces nuisance flooding by improving floodplain connectivity and upgrading drainage infrastructure (e.g., culverts, tide gates). These actions help protect nearby agricultural properties from flood damage, especially during winter storms and king tides.

Comfort and Convenience: The Project includes enhancements to public access, such as new trails, wildlife viewing platforms, and non-motorized boat launches. These features provide recreational opportunities and nature-based experiences for the community, contributing to mental well-being and quality of life.

Climate Resilience: By restoring estuarine and riparian habitats, the Project increases the landscape's resilience to sea level rise and climate change.

36. How is the requested grant, permit, franchise, lease, right, or privilege required by the public convenience and necessity?

The requested permit is required by the public convenience and necessity because it enables a Project that directly addresses critical environmental, safety, and community needs. Specifically:

Flood Risk Reduction: The Project improves floodplain connectivity and upgrades outdated drainage infrastructure, reducing nuisance flooding that affects local roads, homes, and agricultural lands—enhancing public safety and infrastructure resilience.

Water Quality and Ecosystem Health: By restoring wetlands and tidal marshes, the Project supports the recovery of threatened and endangered species, which benefits the broader public interest in environmental stewardship and biodiversity.

Public Access and Recreation: The Project includes new trails, wildlife viewing platforms, and non-motorized boat launches, expanding opportunities for outdoor recreation, education, and nature appreciation—enhancing public comfort and quality of life.

Climate Resilience: Restoration actions increase the estuary's resilience to sea level rise and climate change, protecting both natural resources and human communities in the long term.

In summary, the Project serves a public benefit and requires the necessary permits and approvals to proceed with actions that are essential for ecological restoration, public safety, and community well-being.

---

37. Financial statement:

A. Estimated project cost. The Project cost is TBD but anticipated to be several million dollars or more.

B. How will the project be financed? Project planning, design, and construction is funded by a variety of public agencies, including the California Coastal Conservancy and the National Oceanic and Atmospheric Administration. CalTrout is continually seeking additional funds to support the project.

38. Describe fully directions necessary to arrive at project site.

Access is available via Elk River Road and Pine Hill Road, including access from the CDFW Elk River Wildlife Area. Access via several private parcels can be arranged via CalTrout with advanced notification to landowners.

39. The Applicant agrees to as a condition of the permit being issued, to indemnify and hold harmless the Humboldt Bay, Harbor Recreation and Conservation District from any and all claims, demands, or liabilities for attorneys' fees obtained from or against demands for attorney's fees, costs of suit, and costs of administrative records made against District by any and all third parties as a result of third party environmental actions against District arising out of the subject matter of this application and permit, including, but not limited to, attorney's fees, costs of suit, and costs of administrative records obtained by or awarded to third parties pursuant to the California Code of Civil Procedure Section 1021.5 or any other applicable local, state, or federal laws, whether such attorneys' fees, costs of suit, and costs of administrative records are direct or indirect, or incurred in the compromise, attempted compromise, trial, appeal, or arbitration of claims for attorneys' fees and costs of administrative records in connection with the subject matter of this application and permit

---

NOTE

The District hereby advises the Applicant that, under California Public Resources Code (PRC) Section 21089, the District when a lead agency under the California Environmental Quality Act (CEQA) of 1970, as amended, pertaining to an Environmental Impact Report (EIR) or a Negative Declaration (MND/ND) may charge and collect from the Applicant a reasonable fee in order to recover the estimated costs incurred by the District in preparing an EIR or MND/ND for the project and the procedures necessary for PRC compliance on the Applicants project.

In the event your project contains an analysis of issues pertaining to CEQA, for which District staff is not competent to independently review, or District requires the same in preparation of an EIR or MND/ND for the project, the District may retain a reviewing consultant to evaluate the content of the Administrative-Draft EIR and Final EIR or MND/ND with respect to these issues. The cost of such reviewing consultant services shall be borne by the Applicant.

CERTIFICATION: I hereby certify that the statements furnished above and in the attached exhibits present the information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct

to the best of my knowledge and belief. And I agree to indemnify the District as described in part 39 of this application.

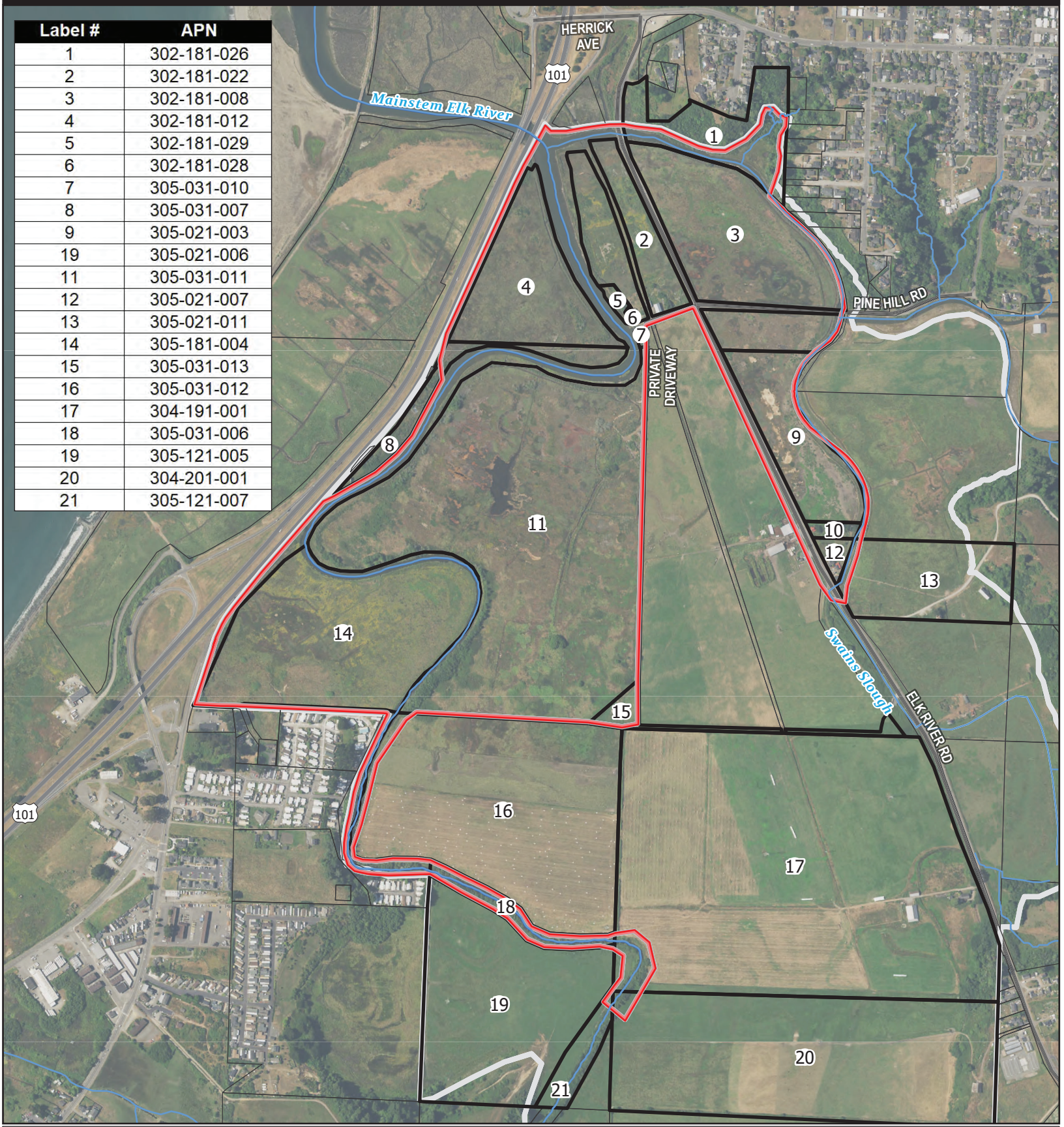
Dated:__  _ _____

For California Trout

Attachment 1

Project Addresses, Parcel Numbers, and CEQA Documentation

Label #	APN
1	302-181-026
2	302-181-022
3	302-181-008
4	302-181-012
5	302-181-029
6	302-181-028
7	305-031-010
8	305-031-007
9	305-021-003
19	305-021-006
11	305-031-011
12	305-021-007
13	305-021-011
14	305-181-004
15	305-031-013
16	305-031-012
17	304-191-001
18	305-031-006
19	305-121-005
20	304-201-001
21	305-121-007



Planning Area 1 Enhancement Actions
HBHRCD Jurisdictional Boundary

N

0 75 150 300 Meters

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

Legend

- PA 1 boundary
- Harbor District jurisdictional boundary (HBHRCD)
- Parcels within Harbor District jurisdictional boundary
- Elk River
- Streams

Northern Hydrology & Engineering

Stillwater Sciences

GHD

Map Sources: California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, USFWS, (c) OpenStreetMap contributors, (c) CARTO, Humboldt County

6/30/2025_mhargin

Table 1: Landowners and Addresses within Harbor District Jurisdiction

APN_12	ACRES	Acres in HBHRCD	Owner	Address
302-181-026-000	11.327708	4.889486	ROBERT D PRIOR	PO BOX 23, EUREKA, CA 95502
302-181-022-000	11.489729	11.487362	RANDALL YOUNGER	WOODCREST, CT, EUREKA, CA, 95503
302-181-008-000	27.331171	27.323532	CALIFORNIA TROUT	1380 9th STREET, ARCATA, CA 95521
302-181-012-000	15.795152	15.791834	STATE OF CALIFORNIA	PO BOX 3700, EUREKA, CA, 95502
302-181-029-000	0.563547	0.563431	RANDALL YOUNGER	WOODCREST, CT, EUREKA, CA, 95503
302-181-028-000	0.13511	0.135082	HUMBOLDT COMMUNITY SERVICES DISTRICT	PO BOX 158, CUTTEN, CA, 95534
305-031-010-000	0.213592	0.213547	STATE OF CALIFORNIA DEPT. OF FISH AND GAME	PO BOX 944209, SACRAMENTO, CA, 94244
305-031-007-000	4.81866	2.562761	ALLPOINTS OUTDOORS INC	3408 JACOBS, AVE, EUREKA, CA, 95501
305-021-003-000	11.844368	11.840921	CALIFORNIA TROUT	1380 9th STREET, ARCATA, CA 95521
305-021-006-000	0.868745	0.868565	DOUGLAS & PATRICIA FRINK	PO BOX 1072, FERNDALE, CA, 95536
305-031-011-000	83.618573	83.600976	STATE OF CALIFORNIA	PO BX 944209, SACRAMENTO, CA, 94244
305-021-007-000	1.098377	1.09815	DOUGLAS & PATRICIA FRINK	PO BOX 1072, FERNDALE, CA, 95536
305-021-011-000	14.246252	0.647288	TRUEMAN VROMAN	2950 E. ST, EUREKA, CA, 95501
305-181-004-000	35.051455	35.040351	WIYOT TRIBE	1000 WIYOT DRIVE, LOLETA, CA 95551
305-031-013-000	2.798377	1.374968	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA, 95502
305-031-012-000	47.989396	1.563372	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA, 95502
304-191-001-000	99.743858	2.185661	CALIFORNIA TROUT	1380 9th STREET, ARCATA, CA 95521
305-031-006-000	3.499008	3.498277	HUMBOLDT REDWOOD COMPANY LLC CO	PO BOX 996, UKIAH, CA, 95482
305-121-005-000	31.772222	0.052017	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA, 95502
304-201-001-000	51.028441	0.640262	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA, 95502
305-121-007-000	3.394895	0.160831	HUMBOLDT REDWOOD COMPANY LLC CO	PO BOX 996, UKIAH, CA, 95482

Table 2: Adjoining Property Owners/Addresses

APN	Owner	Address
305-041-052-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
305-041-030-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
305-041-051-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
305-041-031-000	HUMBOLDT REDWOOD COMPANY LLC CO	PO BOX 996, UKIAH, CA 95482
305-121-006-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
305-121-003-000	SEA VIEW ESTATES LLC	14071 PEYTON DR #1771, CHINO HILLS, CA 91709
302-181-032-000	ROBERT D PRIOR	PO BOX 23, EUREKA, CA 95502
302-111-010-000	JOHN S & KAREN GLADDING	5438 NOE AVE, EUREKA, CA 95503
302-101-023-000	STEPHEN R & DEBRA A JUNGERS	5385 BAYPOINTE CT, EUREKA, CA 95503
302-101-022-000	TIANNA NOUROT	5395 BAY POINTE CT, EUREKA, CA 95503
302-111-013-000	JOHN S & KAREN GLADDING	5438 NOE AVE, EUREKA, CA 95503
302-111-015-000	BRIAN E RONLUND	5436 NOE AVE, EUREKA, CA 95503
302-141-005-000	ALISSA M TDP FERGUSON	3954 SHENANDOAH, ST LOUIS, MO 63110
302-141-032-000	NANCY H KIERI	5472 NOE AVE, EUREKA, CA 95503
302-141-017-000	ANTHONY L & DENISE M FRAGA	151 STEPHENS LN, BAYSIDE, CA 95524
302-141-022-000	SAI ZHANG	PO BOX 594, BAYSIDE, CA 95524
302-141-037-000	ANDREW & LAURA M HOLBERG	5538 NOE AVE, EUREKA, CA 95503
302-141-009-000	JOSEPH C FRANCESCHI	2937 G ST, EUREKA, CA 95501
302-151-019-000	ANDREW & MATTHEW CHAMBERLAIN	PO BOX 90291, LONG BEACH, CA 90809
302-151-018-000	DWIGHT W & SHARON L CLARK	6000 NOE AVE, EUREKA, CA 95503
302-151-013-000	DAVID T & KIRIN C HICKCOX	6060 NOE AVE, EUREKA, CA 95503
302-151-020-000	LOU & ELIZABETH JACOBSON	979 PINE HILL RD, EUREKA, CA 95503
305-111-005-000	JUDITH A MORANDA	5625 HUMBOLDT HILL RD, EUREKA, CA 95503
304-191-002-000	TRUEMAN E VROMAN	2950 E ST #C, EUREKA, CA 95501
305-031-008-000	ALLPOINTS OUTDOORS INC	3408 JACOBS AVE, EUREKA, CA 95501
305-031-009-000	ALLPOINTS OUTDOORS INC	3408 JACOBS AVE, EUREKA, CA 95501
305-031-002-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
305-031-001-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502

304-181-001-000	SHANAHAN FAMILY LLC CO	PO BOX 6514, EUREKA, CA 95502
304-171-001-000	TRUEMAN E VROMAN	2950 E ST #C, EUREKA, CA 95501
304-171-002-000	TRUEMAN E VROMAN	2950 E ST #C, EUREKA, CA 95501
302-101-008-000	RUTH UWSE SCHNELL	PO BOX 5354, EUREKA, CA 95502
304-211-006-000	BLAKE & STEPHANIE ALEXANDRE	8371 LOWER LAKE RD, CRESCENT CITY, CA 95531
304-162-006-000	SHANE & ALISON CALHOUN	5828 ELK RIVER RD, EUREKA, CA 95503
304-181-002-000	TRUEMAN E VROMAN	2950 E ST #C, EUREKA, CA 95501
304-181-005-000	TRUEMAN E VROMAN	2950 E ST #C, EUREKA, CA 95501

Print Form

Notice of Determination

Appendix D

To:

☐ Office of Planning and Research

U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044

Street Address: 1400 Tenth St., Rm 113, Sacramento, CA 95814

☐ County Clerk
County of: _____
Address: _____

From:

Public Agency: NCRWQCB
Address: 5550 Skylane Boulevard, Suite A, Santa Rosa, CA
Contact: Jake Shannon
Phone: (707) 576-2673

Lead Agency (if different from above):
_____
Address: _____
Contact: _____
Phone: _____

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2019100230

Project Title: Elk River Estuary (Planning Area 1) Restoration Project

Project Applicant: California Trout

Project Location (include county): 40.74513, -124.18787, Humboldt County

Project Description:

The Project includes the following restoration elements: remove and/or upgrade drainage infrastructure; reduce or remove levees; breach an abandoned railroad grade; restore tidal sloughs and tidal creek channels and their connectivity to mainstem channels; create backwater features for seasonal waterfowl and winter salmonid rearing habitat (primarily for federally listed Coho Salmon); manage invasive vegetation; expand native plant communities; and recontour portions of the floodplain to guide winter

This is to advise that the North Coast Regional Water Quality Control Board (☒ Lead Agency or ☐ Responsible Agency) has approved the above described project on July 2, 2025 (date) and has made the following determinations regarding the above described project.

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☒ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☐ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☒ were ☐ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☒ was ☐ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☒ were ☐ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at:
https://www.waterboards.ca.gov/water_issues/programs/cwa401/generalorders/2022/srgo-final-peir-cor

Signature (Public Agency): JAKE SHANNON Title: Sr. Environmental Scientist (Spec)

Date: July 2, 2025 Date Received for filing at OPR: _____

Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2011

Attachment 2

Project Description

October 2025

Elk River Estuary (Planning Area 1) Restoration Project: Project Description

PREPARED BY

California Trout
1380 9th Street
Arcata, CA 95521

and

Northern Hydrology & Engineering (NHE)
3101 Concorde Drive, Suite B
McKinleyville, CA 95519

Stillwater Sciences
850 G St.
Arcata, CA 95521

and

GHD
718 3rd Street
Eureka, CA 95501

Suggested citation:

California Trout, Northern Hydrology and Engineering, Stillwater Sciences, and GHD. 2025. Elk River Planning Area 1 Project Description. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; Stillwater Sciences, Arcata, California; and GHD, Eureka, California.

Cover photo: California Trout, 2020

Table of Contents

1 INTRODUCTION

The Elk River Estuary (Planning Area 1) Restoration Project (Project) is one phase of a watershed-scale effort to restore beneficial uses of water; improve water quality conditions; reduce nuisance flooding; rehabilitate habitat for focal fish species, including Coho Salmon, Chinook Salmon, steelhead, Coastal Cutthroat Trout, Tidewater Goby, and Longfin Smelt; expand riparian habitat; and improve overall ecosystem health in the Elk River. Detailed Project objectives were formulated with the Elk River community as part of the Elk River Watershed Stewardship Program (Stewardship Program)[1] (Table 1-1).

Table 1-1. Elk River Stewardship Program objectives in PA1.

Focus	Objective
Ecological	Maintain existing tidal inundation and expand tidal prism where feasible to restore natural tidal marsh and estuarine functions; and restore seasonal freshwater wetlands, ponds, and aquatic habitats to increase resilience of native fish and wildlife species dependent on these habitats. This restoration action will provide a mosaic of rearing habitats and high-quality feeding habitats for salmonids, and the low-velocity brackish habitats are expected to provide high-value habitat for numerous aquatic species, including Longfin Smelt, in the stream-estuary ecotone.
Ecological	Restore and maintain a natural riverine and riparian corridor along Elk River with natural flood-flow and sediment regimes, seasonal freshwater wetlands, ponds, and aquatic habitats, and buffered protection from agricultural land uses, to increase resiliency of native fish and wildlife species dependent on these habitats.
Land Use	Protect the productivity and long-term sustainability of existing forestry and agricultural operations, protect existing rural residential land uses, and provide access to potable domestic and agricultural water supplies.
Water Quality	Protect and restore water quality from impairment by suspended sediment and turbidity, water temperature, dissolved oxygen, and coliform bacteria (impairment = anthropogenic alteration from natural water quality regimes).
Floodplain	Improve channel/floodplain connectivity during winter flooding, promote natural sedimentation processes, and minimize/avoid stranding of juvenile salmon and steelhead.
Habitat	Restore high quality winter and summer rearing habitat for juvenile salmon and steelhead within tidal creeks and slough channels, in off-channel freshwater ponds, and in the mainstem Elk River.
Nuisance Flooding	Reduce nuisance flooding (e.g., of roadways, residential, and agricultural infrastructure) by restoring channel conveyance capacity, maintaining and improving floodplain flow pathways, and upgrading drainage infrastructure (culverts, tide gates, bridges, etc.).
Vegetation	Restore and maintain healthy and mature vegetation assemblages, including a mosaic of native riparian hardwood and conifer species; manage and prevent/suppress vegetation growth within the channel bed.

The CalTrout-led Project Team, including Northern Hydrology and Engineering, Stillwater Sciences, and GHD, is working to achieve some of these goals and objectives in successive, well-planned phases. The Elk River Recovery Assessment, conducted in 2014-19, assessed severe sediment impairment and consequent nuisance flooding and habitat degradation and conducted detailed hydrodynamic and sediment modeling to evaluate alternative sediment remediation and

[1] California Trout, Stillwater Sciences, Northern Hydrology & Engineering, and GHD. 2022. Elk River Watershed Stewardship Program: Sediment Remediation and Habitat Rehabilitation Recovery Plan. Prepared by California Trout, Arcata, California; Stillwater Sciences, Arcata, California; Northern Hydrology & Engineering, McKinleyville, California; and GHD, Eureka, California, for the North Coast Regional Water Quality Control Board, Santa Rosa, California. https://caltrout.org/wp-content/uploads/2019/05/Elk-River-Stewardship-Recovery-Plan-Public-Draft-July_2022.pdf

habitat rehabilitation approaches. Project Actions were initially derived from the set of recommendations in the Elk River Recovery Assessment. The Stewardship Program, initiated in 2019-22, held extensive meetings with Elk River adjacent landowners, including those whose properties are impacted and who would need to voluntarily participate in restoration efforts, to gain their support for Actions on their properties. These Actions and an associated regulatory compliance strategy were presented in the Elk River Recovery Plan (CalTrout et al. 2022). In the Recovery Plan, the entire Program Area was broken into four Planning Areas, with each Planning Area undergoing planning and engineering design separately.

This Project is within Planning Area 1 (PA1), which includes river adjacent parcels located along Swain Slough and tidally influenced reaches of the Elk River upstream of US Highway 101 (Hwy 101) (Figure 1-1). Landownership within PA1 is summarized in Table 1-2 by Assessor Parcel Number (APN) and shown in Figure 1-2. In PA1, outreach involved eight landowners and was further amplified during a 10% Conceptual Design process funded by the State Coastal Conservancy and the CA Wildlife Conservation Board, in which the Project Team iteratively proposed detailed design elements with landowners, vetted those elements with a Project Advisory Committee (PAC) of resource agency technical representatives, refined project elements, and established full support for each element from landowners and the PAC. That effort culminated in the Elk River Planning Area 1: 10% Design Report (CalTrout et al. 2023).

PA1 encompasses 5.3 miles of channel length, including Elk River and Swain Slough, and spans 857 acres (ac). PA1 is partially located in the coastal zone (Figure 1-2). The northwestern edge of this Planning Area is bordered by Hwy 101. PA1 is generally bounded to the west and east by hillslopes, and Elk River to the south. The Elk River – Swain Slough confluence is at the very downstream end of PA1, just upstream of Hwy 101. PA1 extends up the sinuous Elk River to Showers Road.

This area was once an ecologically rich landscape comprised of dunes and tidal marshes, prairie grasslands, deciduous and coniferous forest, and wetland aquatic habitat. Humboldt Bay is a rare coastal plain on California's north coast, with large expanses of mudflat and coastal wetland habitats sustaining abundant shellfish and crustaceans, estuarine fishes, birds, and salmonids. Historic maps documented Humboldt Bay occupying approximately 25,800 ac, of which 15,300 ac (59.3 percent) were tidal channels and inter-tidal mudflats, and 10,500 ac (40.7 percent) were tidal wetlands (Laird 2007). Today, tidal wetlands occupy just 4 percent of Humboldt Bay (Barnhart 1992). These former tidelands were diked and drained beginning in the 1850s, and 'reclaimed' for agricultural uses by European-American settlers (Barnhart 1992; Figure 1-3), exacerbated by the loss of large areas of seasonal freshwater wetland and riparian habitats (Loudon 2015). This dramatic loss of wetland acreage and function around Humboldt Bay cumulatively degraded one of the most biodiverse coastal water bodies in California (Barnhart 1992) and contributed to the decline in salmonid population abundance (NMFS 2014).

The importance of the estuary to salmonid populations is well established. Estuaries are highly productive ecosystems, providing habitat for a rich assemblage of aquatic and terrestrial species and acting as a critical transition zone between riverine and marine environments. The stream-estuary ecotone is the area extending from the upper limit of tidal influence downstream to where channels become surrounded by mudflats. Habitat restoration and enhancement of the Elk River tidal estuary will benefit salmonids and numerous other native fish and amphibian species by improving their resilience to external stresses and threats through supporting habitat capacity, productivity, and life history diversity. This strategy will increase capacity by restoring access to critical habitats (e.g., restored slough channels and tidal marshes) or by increasing pool frequency and habitat complexity. Additional benefits include an increase in juvenile salmonid growth rates and condition factor by prioritizing habitat areas with more favorable bioenergetics (food and

temperature conditions that increase metabolic scope for growth), which translates into a larger size-class distribution of rearing juveniles. Life history diversity will also increase by providing alternative rearing pathways (e.g., in headwater tributary, mainstem, or estuarine habitats).

Restoration of PA1 is crucial to the ecological function of the Elk River watershed, to the re-establishment of salt marsh, and to the recovery of salmon, steelhead, and other state and federally listed fish and wildlife populations. The lower Elk River is also vulnerable to sea level rise; conversion to salt marsh is occurring in unmaintained pastures, roads in this vicinity currently flood during king tides, and sea level rise will continue to threaten existing land uses (Laird 2007). CalTrout's land acquisitions and restoration work in the estuary are part of a managed retreat strategy allowing local ranchers to move operations to higher ground while creating space to increase the resilience of the estuary ecosystem to climate change.

The Project Team has developed engineering designs to restore natural tidal and fluvial drainage patterns over the entire 857-ac PA1 Project area (Figure 1-4). The Project restoration scope includes the following elements:

1) remove and/or upgrade drainage infrastructure;
2) reduce or remove levees;
3) breach an abandoned railroad grade;
4) restore tidal sloughs and tidal creek channels and their connectivity to mainstem channels;
5) create backwater features for seasonal waterfowl and winter salmonid rearing habitat (primarily for federally listed Coho Salmon);
6) manage invasive vegetation;
7) expand native plant communities; and
8) recontour portions of the floodplain to guide winter flood-flows across the floodplain and back into the slough channel network toward suitable aquatic habitat.

The site will provide a large area of highly productive slough-like habitat; fish will be able to move into tidal channels during higher tides, finding refugia and rearing in slower moving water and feeding on abundant food at the edges of tidal channels or entrained in water leaving the marsh plain. Reconnection of Orton Creek to Swain Slough in a subsequent construction phase will enhance migratory pathways to this Project's restored habitats and provide stream-estuary ecotone habitat for juvenile salmonid winter rearing. A restored marsh will also provide habitat and food resources for other focal species, including Longfin Smelt, Tidewater Goby, and an abundance of marine species. Finally, this Project will also connect other recently restored Elk Estuary habitats, including restoration completed in Martin Slough and the City of Eureka in lower Elk River. The expected benefits to Elk River ecosystems will be substantial, including expansion and enhancement of fish rearing habitat in Swain Slough and increased longevity of salt marsh habitats through increased resilience to sea level rise.

An overview of public access elements is provided in Figure 1-5.

Table 1-2. Summary of participating PA1 landowners.

APN	Landowner Name	Physical Address
302-181-032 302-181-026	Robert D Prior	PO Box 23 Eureka CA 95502
305-181-004	Wiyot Tribe	1000 Wiyot Drive Loleta, California 95551

APN	Landowner Name	Physical Address
302-181-008 305-021-003 304-191-001	California Trout	
302-181-012 305-031-010 305-031-011	California, State of	PO Box 3700 Eureka CA 95502
302-181-022 302-181-029	Randall D Younger	4866 Elk River Rd Eureka CA 95503
302-181-028	Humboldt Community Services Dist.	PO Box 158 Cutten CA 95534
304-092-015 304-211-003 304-221-002 304-221-003 304-221-004	Eugene J & Betty L Senestraro	510 Valley View Rd Eureka CA 95503
304-171-001 304-171-002 304-181-002 304-181-005 304-191-002 305-021-009 305-021-010 305-021-011	Trueman E Vroman	2950 E St Eureka CA 95501
304-181-001 304-201-001 305-031-001 305-031-002 305-031-012 305-031-013 305-041-030 305-041-051 305-121-005 305-121-006	Shanaha n Family LLC Co	PO Box 6514 Eureka CA 95502
304-211-006	Blake & Stephanie Alexandre	8371 Lower Lake Rd Crescent City CA 95531
305-021-006 305-021-007	Douglas & Patricia Frink	5385 Elk River Rd Eureka CA 95503
305-031-006 305-041-031 305-121-007	Humboldt Redwood Company LLC Co	PO Box 996 Ukiah CA 95482
305-031-007 305-031-008 305-031-009	Allpoints Outdoors Inc	3408 Jacobs Ave Eureka CA 95501

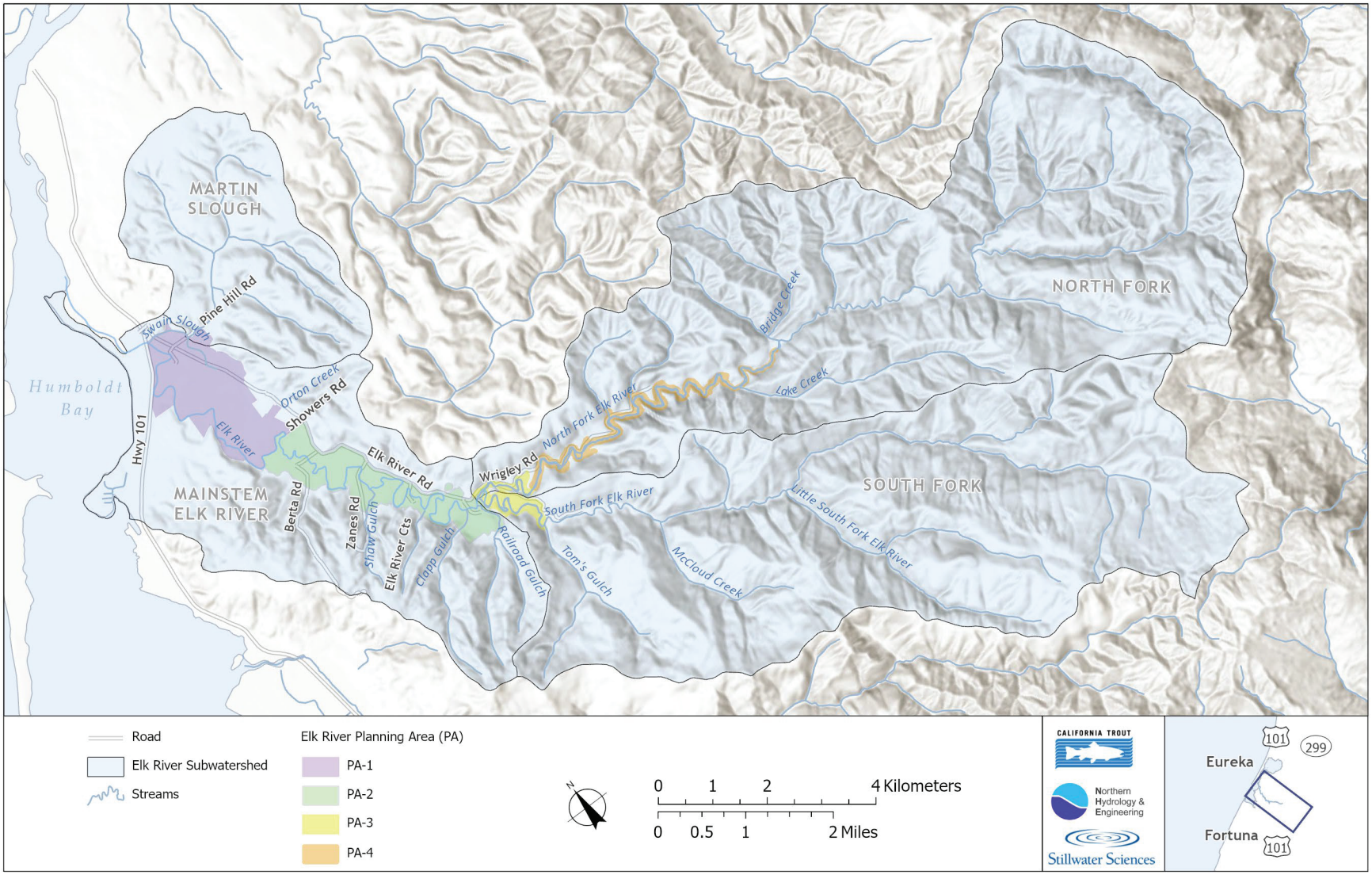


Figure 1-1. Vicinity map of Elk River PA1.

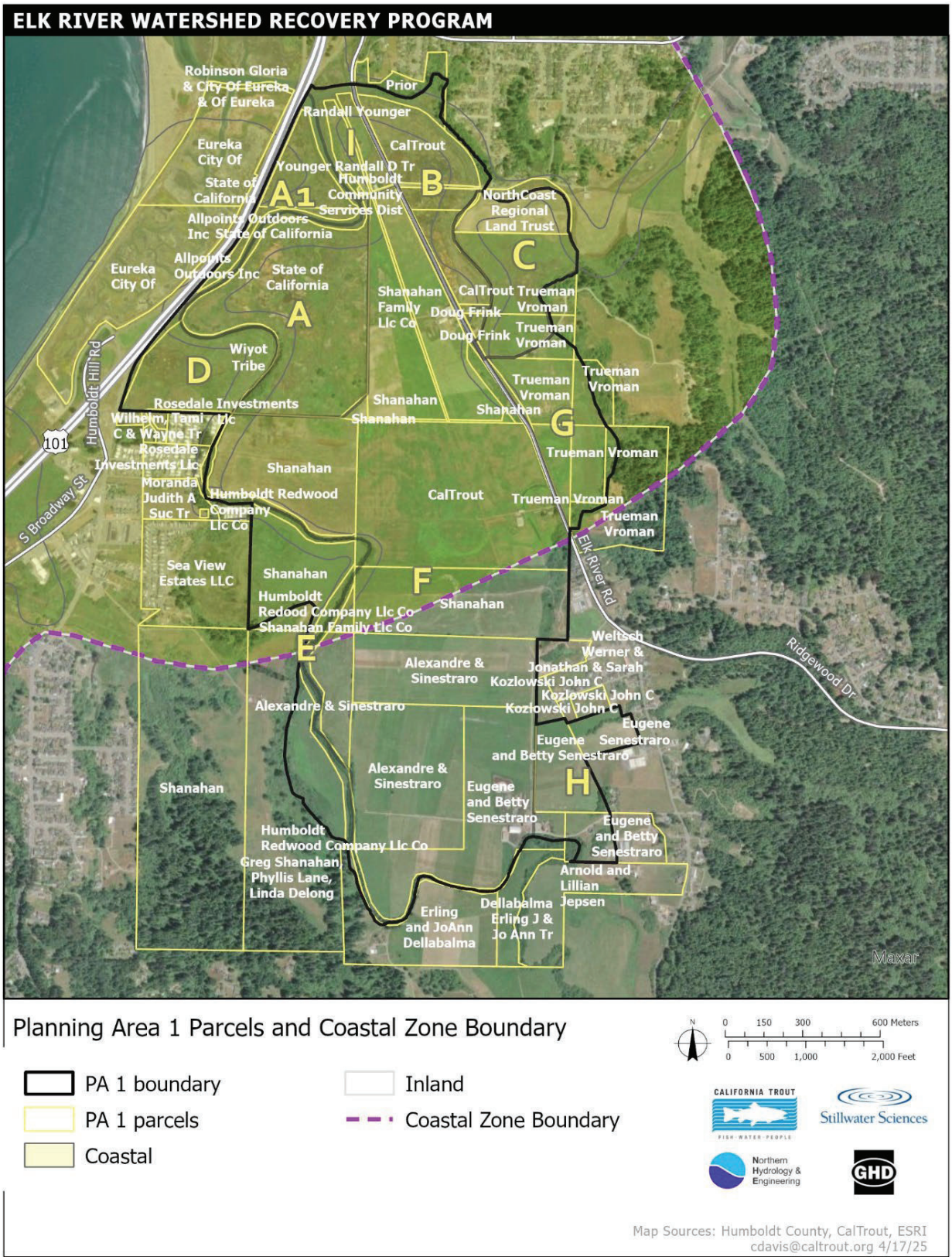


Figure 1-2. PA1 coastal zone boundary and land ownership

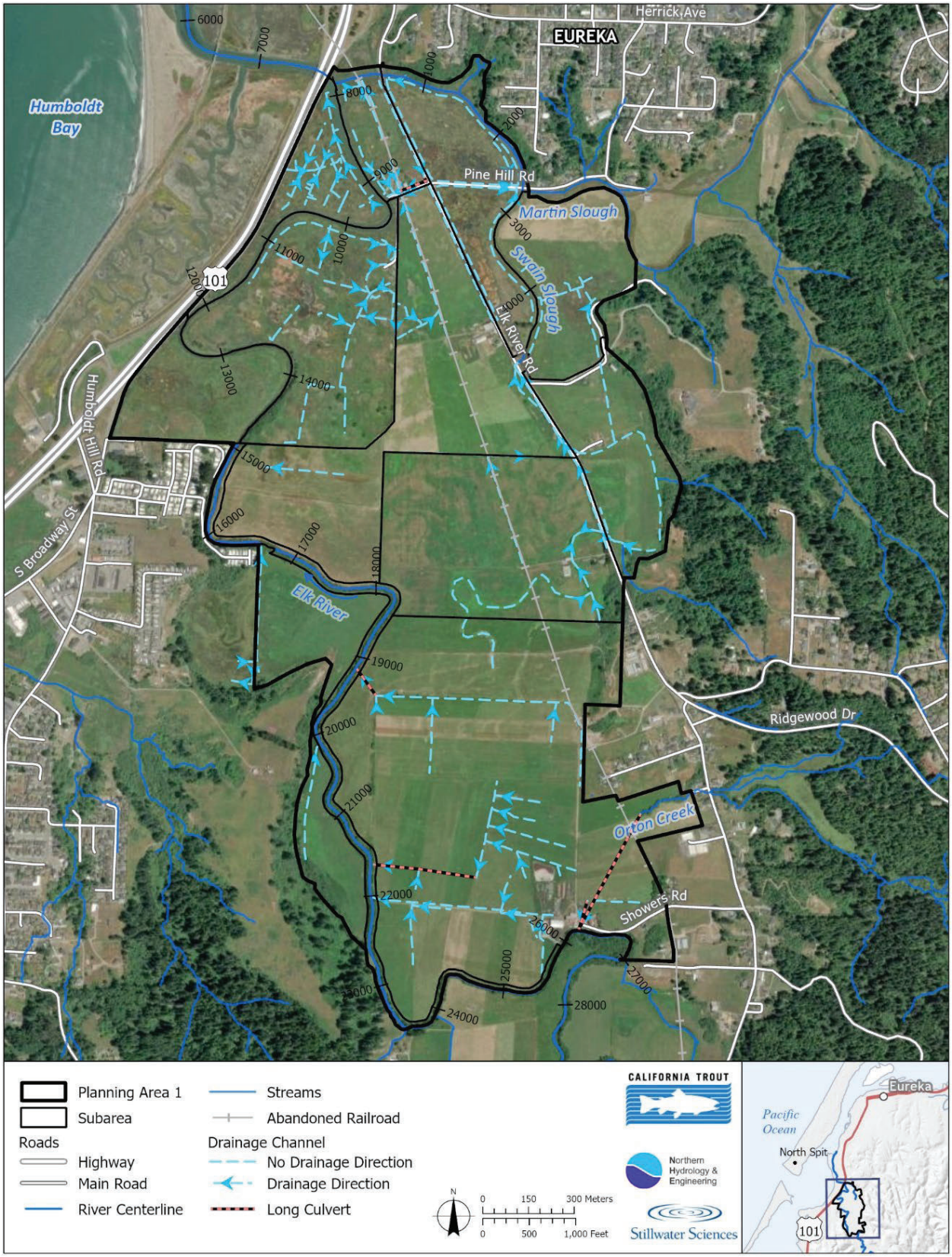


Figure 1-3. Map of Elk River PA1 showing existing drainage. River stationing represents the distance (ft) upstream from the Humboldt Bay confluence.

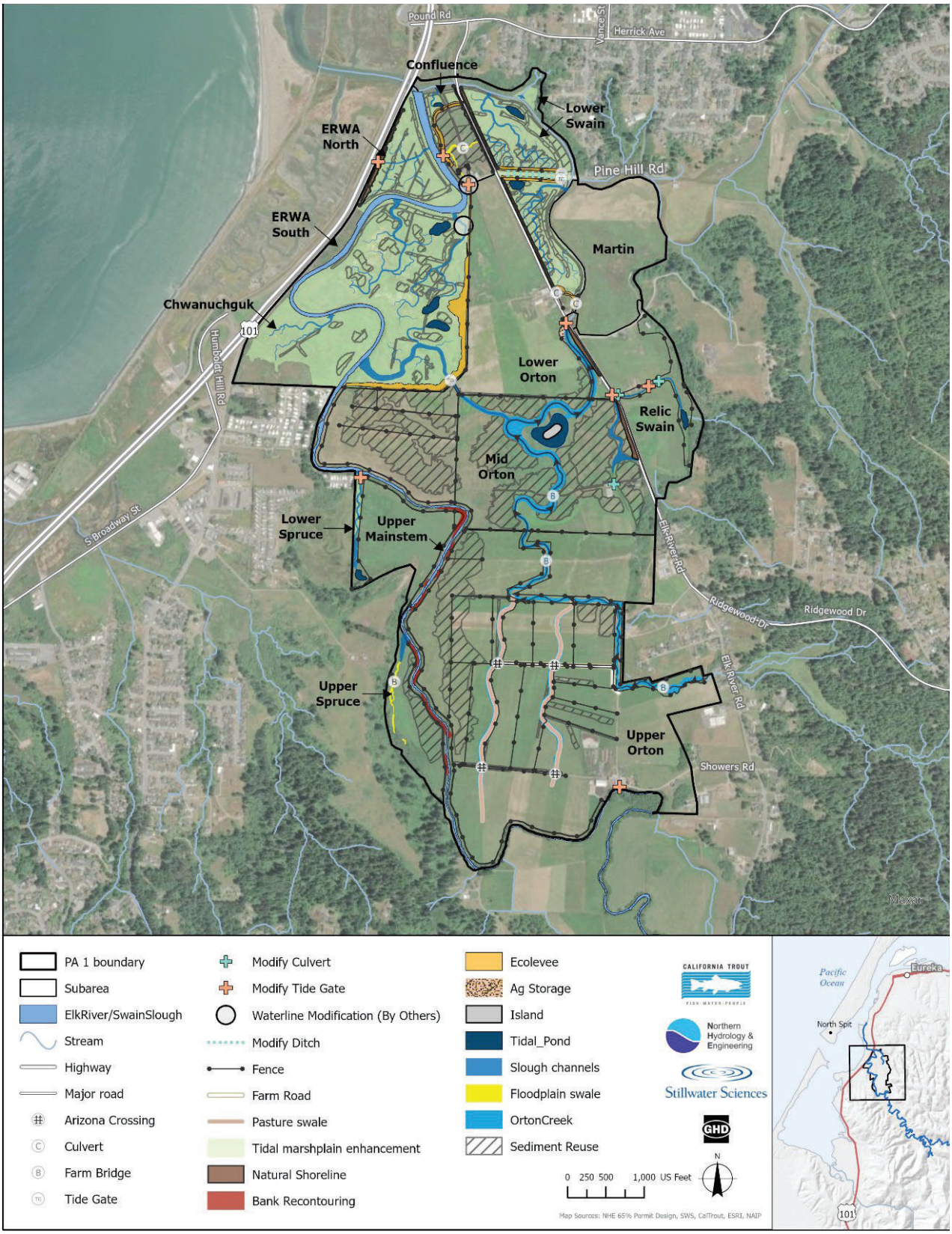


Figure 1-4. Overview of enhancement actions

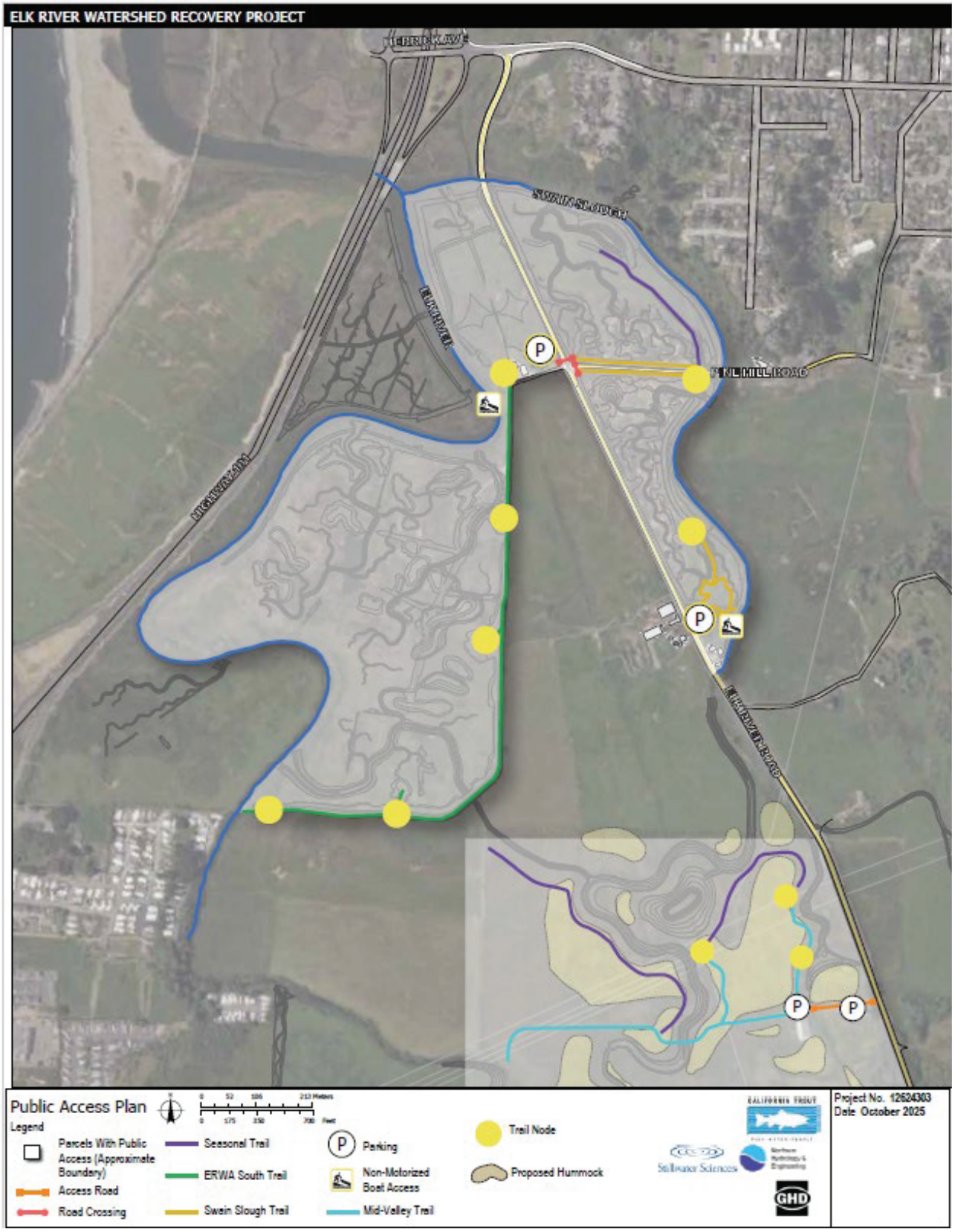


Figure 1-5. Public access overview.

2 PROJECT ELEMENTS

PA1 has eleven distinct subareas (Figure 1-4). Project elements have been described herein for each distinct subarea. Note final Project final restoration and public access elements may adjust slightly in the field at the discretion of the construction management team to accommodate implementation challenges and opportunities, on-the-ground constraints, or other anticipated circumstances that require accommodation.

2.1 Infrastructure Removal and Replacement

The existing drainage system for Elk River in PA1 primarily consists of ditches, culverts, tide gates, and bridges (Figure 1-3). In some locations, roadways influence drainage by acting as a large levee; for example, Elk River Road along Swain Slough, and Hwy 101 at the bottom of the valley. These roadways will not be modified.

An objective of this Project is to re-engineer key pieces of drainage infrastructure to maintain compatibility with the restoration and maintenance of ecological processes, fish and vegetation habitat, and adaptation to sea level rise, while also improving winter flood conveyance and protecting agricultural lands from tidal inundation. Removal of existing infrastructure that inhibits tidal exchange is necessary to restore a full tidal prism to Elk River and Swain Slough and create spatially complex topography (and thus habitat structure), as well as spatially and temporally variable water quality conditions (see discussion of the importance of the stream estuary ecotone in Section 1). Actions will effectively route overbank flow and restore full tidal exchange.

Replacement or modification of infrastructure (Figure 1-4 and Figure 2-1) generally includes:

- Construction of a new earthen eco-levee and augmentation of an existing levee to prevent saltwater inundation to areas maintained for agriculture or freshwater habitat;
- replacement of culverts and installation of fish-friendly tide gates;
- excavation and recontouring of channels and swales to restore a dendritic network of tidal, freshwater, and off-channel features;
- installation of wood structures to create in-stream habitat for aquatic species;
- rehabilitation and expansion of riparian corridors; and
- inclusion of public access features.

A few derelict buildings will be removed, including several barns, a milking parlor, and a house. A description of these buildings is provided in the cultural resources report for PA1 (William Rich and Associates 2023).

New crossings include tide gates, farm and pedestrian bridges, culverts, or low water crossings. Existing crossings may be improved, or temporary crossings installed, to accommodate construction equipment. Rock slope protection (RSP) and/or grade control will be used to prevent scour and erosion associated with the structure hydraulics.

Cattle exclusion fencing will be installed where enhancement sites are adjacent to pastures. Fencing will be added or replaced where natural shorelines are adjacent to roads to limit disturbance.

Cattle troughs will be installed in areas where cattle exclusion fencing prohibits cattle from accessing water in enhancement areas. One water systems (including a new well or new public water line if needed) will be designed to convey water to the new cattle troughs. The water system would not be located in the coastal zone.

Figure 2-1. Infrastructure to be removed. These actions focus on routing overbank flow down valley, removing cross-valley drainage, retrofitting tide gates with fish friendly flap gates, and removing tide gates and levees at tidal march enhancement.

2.2 Vegetation Enhancement and Management

Vegetation enhancement and management activities within PA1 include improvement and expansion of coastal salt marsh, brackish marsh, freshwater wetlands, coastal scrub, and riparian forest communities through revegetation and invasive plant management (Figure 2-2). Final treatment locations may adjust to accommodate site conditions at the time of implementation.

2.2.1 Revegetation Approach

The Project's primary goal for revegetation is to restore native coastal plant communities and their ecosystem function. Revegetation will occur within all restoration grading extents and adjacent enhancement areas, as presented in Figure 2-2. All revegetation activities will follow construction and invasive plant removal efforts. Revegetation activities will serve to increase species richness and terrestrial habitat diversity, improve water quality by enhancing wetland vegetation communities within Elk River's floodplain, and recover sensitive natural communities within PA1.

Planting zones were assigned based on design conditions (elevation, slope, aspect), the existing vegetation zonation (vegetation assemblage gradient from stream bank landward), and environmental factors including hydrology (tidal datums, winter season inundation, hydroperiod, groundwater table), tidal and floodwater salinities,, mapped soil texture and depth, the historical estuarine and riparian condition, and the long-term strategy to control and manage invasive plants in PA1. Dominant species and planting density within each planting zone were driven by the observed vegetation assemblages (Manual of California Vegetation [MCV] alliances/associations [CNPS 2025]) occurring in the PA1 and the larger Eureka Plain (unit that includes Humboldt Bay and the watersheds that drain into it) (NCRWB 2015). Planting palettes were developed to increase species richness and recover habitat biodiversity. Plant selection focused on integrating plants with a varied habit and structure that will be suitable to the specific site conditions within each planting zone (soil type, moisture, depth to water table). Plant assemblages include native species of cultural significance to the Wiyot Tribe, and those that will enhance and restore wildlife habitat quality and support native pollinators throughout the seasons. All species selected are known to successfully establish from seeds, containers, and/or transplants. Furthermore, where applicable, plant selection includes species well-adapted to stressful conditions within estuarine wetlands (i.e., seasonal/tidal inundation, salinity exposure) and coastal uplands (i.e., desiccating upland wind-exposed areas).

Selected planting palettes form known MCV alliances and associations that include sensitive natural community plant assemblages (vegetation community with a state ranking of S1, S2, or S3 [CDFW 2025]). . The 65% Revegetation Design Plans provide planting schedules for each subarea that detail the following for each planting zone: planting palette, plant spacing, planting densities, acreages of planting areas, total plants, seed rate and total seed amount required.

Design enhancements associated with tidal and freshwater marsh recovery will expand suitable habitat for observed special-status plant species in PA1. Special-status plant occurrences will be preserved to the extent possible during construction activities. When occurring within the design grading footprint, all viable special-status plants will be salvaged and translocated to specific elevation grades suitable for the species immediately following construction activities. When possible, special-status plant propagules will be collected, propagated, and out-planted in restored habitats to expand and recover population distribution throughout PA1. The following special-status species are included in revegetation planting palettes to promote establishment and

expansion into newly recovered habitats: *Carex lyngbyei* (Lyngbye's sedge), *Castilleja ambigua* subsp. *humboldtiensis* (Humboldt Bay owl's-clover), and *Angelica lucida* (sea-watch).

Enhancement areas with retained vegetation that are characterized by low native cover, species richness, and/or structural diversity will be interplanted with native species to improve habitat condition. Revegetation in enhancement areas within active agricultural pasture that will remain such post-implementation will be reseeded with land manager-approved pasture seed following Project activities (Figure 2-2). Pasture seed mixes will remain wetland dominant when classified as wetland pasture. All livestock exclusion fencing will be wildlife friendly.

2.2.1 Invasive Plant Management

Controlling invasive plant species will be key to successful restoration within PA1. Invasive plant species are known to have severe or substantial ecological impacts on physical processes, plant and animal communities, and vegetation structure. When present, they often displace native species, reduce native species recruitment, and decrease habitat diversity. Invasive plants within PA1 are defined as species rated by the California Invasive Plant Council (Cal-IPC) as high or moderate, listed as invasive in the *Invasive Weeds of Humboldt County* (Humboldt County Weed Management Area 2010), and/or those species that are known to the region as having invasive tendencies that can be detrimental to the successful establishment of restored native plant communities.

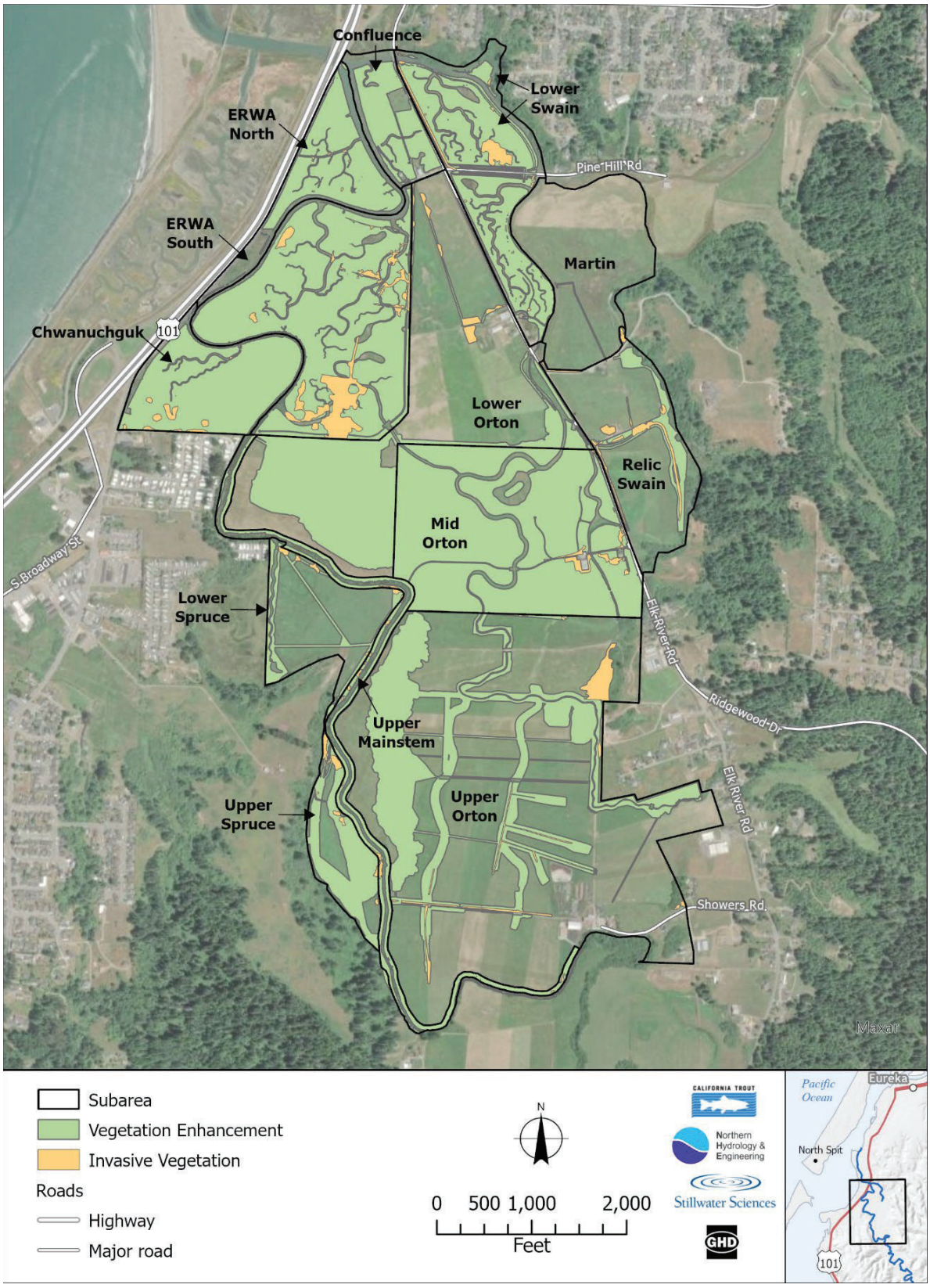


Figure 2-2. Vegetation enhancement actions in PA1, revegetation and invasive plant management areas.

Invasive plants in PA1 live in a range of patterns, from large stands to discrete patches or single individuals within native vegetation communities. Table 2-1 and Figure 2-2 present all invasive plants documented in PA1. Stand-level occurrences characterized by invasive plants can impair stream recovery and riparian ecosystem function and will require significant effort to control and manage. Individual or patch size invasive plant occurrences documented in the enhancement sites of PA1 will also be targeted for removal. Additional invasive plant species may be targeted for control and management in PA1 if they are found to be detrimental to the successful establishment of revegetated areas.

Table 2-1. Target invasive plant list for PA1.

Scientific name	Common name	Cal-IPC rating[1]	Invasive weeds of Humboldt County[2]
Cirsium arvense	Canada thistle	Moderate	Yes
Cirsium vulgare	bull thistle	Moderate	Yes
Conium maculatum	poison hemlock	Moderate	Yes
Cortaderia jubata	purple pampas grass	High	Yes
Cotoneaster spp.	cotoneaster	Moderate	Yes
Cytisus scoparius	Scotch broom	High	Yes
Dipsacus fullonum	wild teasel	Moderate	Yes
Erica lusitanica	heather	Limited	Yes
Foeniculum vulgare	fennel	Moderate	Yes
Genista monspessulana	French broom	High	Yes
Glyceria declinata	**low manna grass**	**Moderate**	**No**
Hedera helix	English ivy	High	Yes
Ilex aquifolium	English holly	Limited	Yes
Phalaris arundinacea	**reed canary grass**	**None[3]**	**Yes[3]**
Rubus armeniacus	**Himalayan blackberry**	**High**	**Yes**
Spartina densiflora	**dense-flowered cordgrass**	**High**	**Yes**
Vinca major	periwinkle	Moderate	Yes

Note: **Bold text** denotes invasive plants with stand-level occurrences within PA1.

[1] Cal-IPC rating (Cal-IPC 2025):
High – these species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.
Moderate – these species have substantial and apparent-but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance.
Limited – these species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness.
None – no rating listed.

[2] Species listed as invasive to Humboldt County, California (Humboldt County Weed Management Area 2010)

[3] Known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities (J.B. Lovelace & Associates 2024).

The *Invasive Plant Management Plan* prepared for the Project details the initial control and management activities for all target invasive plants observed within PA1 (Stillwater Sciences 2025a). Invasive plant control and management will be incorporated as an initial first step to the revegetation process that will focus on treating both stand-level and small invasive plant

occurrences. Invasive plant treatments will occur prior to, or concurrent with, construction activities. Invasive plant management will follow an integrated pest management approach involving the use of multiple management methods in various combinations (specific to the targeted species) to suppress invasive plants within restored areas and encourage the successful establishment and recovery of native riparian, marsh, and grassland communities.

2.3 Tidal Marsh Enhancement

PA1 encompasses eight tidal marsh enhancement sites, five on Elk River and three on Swain Slough. The overarching enhancement approach for all sites is to remove infrastructure that inhibits tidal exchange, restore a full tidal prism, and create spatially complex topography and spatially and temporally complex water quality conditions. These conditions will create a range of habitats supporting a diverse range of species, including focal species (Coho Salmon, Chinook Salmon, steelhead, Coastal Cutthroat Trout, Tidewater Goby, and Longfin Smelt). All sites have ground elevations that are too high for a tidal slough channel network to develop by tidal action alone, and mechanical excavation is required to create a complex network.

Modifying or removing degraded dikes will restore a full tidal prism, reconnecting Elk River to extensive salt and brackish marsh plains during high tides and re-initiating sediment deposition and marsh plain vertical accretion processes (Figure 2-3A and Figure 2-3B). Some earthen dike material will be left in place to avoid disturbance to sensitive plants or create habitat.

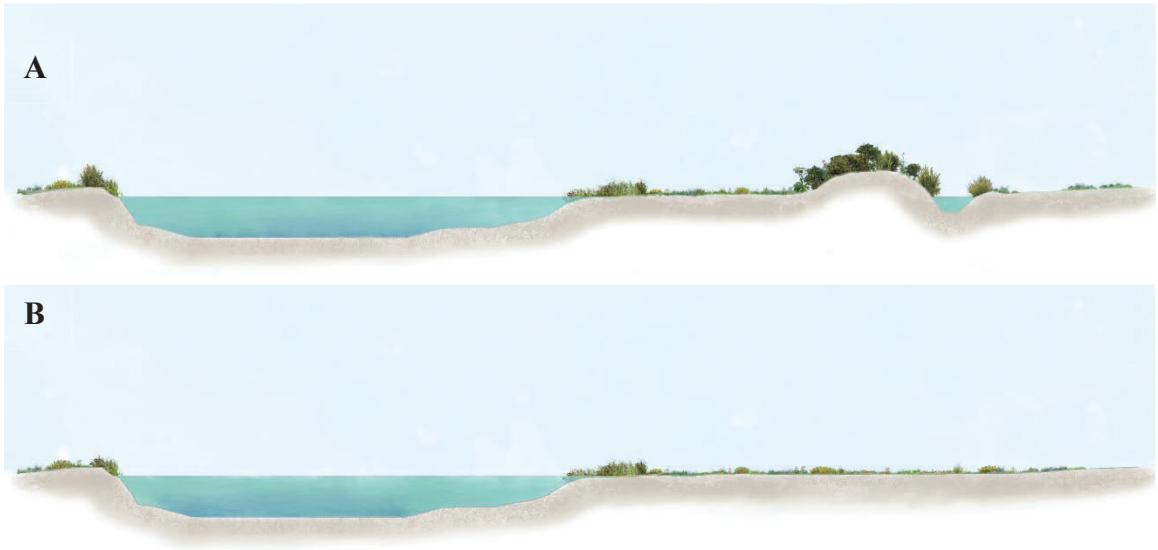


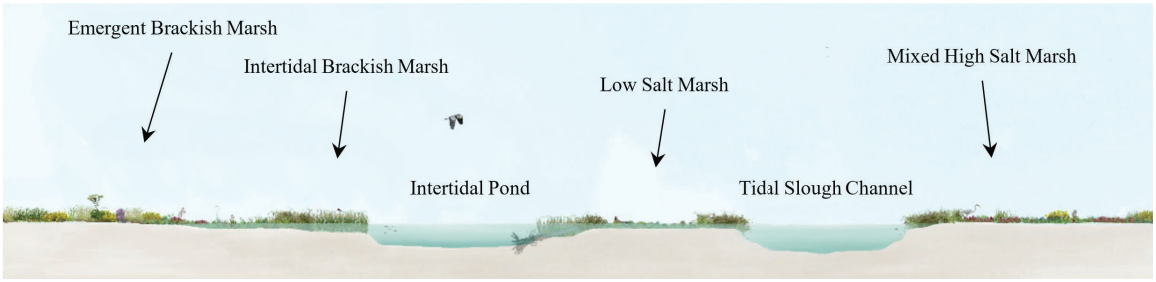
Figure 2-3. Elk River salt and brackish marshes. Existing conditions – with a narrow strip of marsh plain disconnected from larger tidal wetlands by existing levees (A). Proposed conditions resulting from removing and modifying levees to reconnect Elk River to extensive salt and brackish marsh plains during high tides, and from enhancing slough channel networks (B). Example is from ERWA- South in PA1.

Excavating tidal channels will jump-start the development of a natural channel drainage density (Wallace et al. 2005). In combination with the removal or modification of existing levees, a network of variably sized subtidal and intertidal channels and intertidal pools will be constructed. Where feasible, networks will roughly follow the footprint of former tidal channels.

Excavated sediment will be placed as close as is feasible to excavation sites, such as along tidal channel banks, tidal marsh plain, eco-levees, and in hummocks in inter-marsh areas. Hummocks will be used to create or facilitate drainage divides between restored tidal channel networks.

Sediment will be beneficially re-used on-site to enhance tidal marsh habitats, including drainage improvements to enhance floodplain connectivity to the mainstem Elk River, Swains Slough, and the restored Orton Creek channel complex. Off-hauling of sediment will be minimized as much as is feasible. The enhanced topographic relief within the inner marsh areas formed by natural levees and hummocks will enable a greater diversity of marsh vegetation types. Tidal hummocks will occur at elevations just above Mean Higher High Water (MHHW) to spring tide elevations to achieve a diverse tidal marsh complex that will provide forage and resting habitat for shore and water birds and expand high marsh habitat that is suitable for special-status plant recruitment. Tidal hummocks are shown in Section 2.7 – Beneficial Sediment Reuse and incorporated into grading, as shown on attached engineering design sheets. Selected low areas that occur behind formerly leveed areas will be raised to a mature marsh elevation (near MHHW), which will improve the site's resilience to sea-level rise and promote natural recruitment by native salt marsh species.

The creation of an enhanced tidal channel network will alter site hydrology and increase saline and brackish water extents, leading to the continued expansion and creation of estuarine wetlands including intertidal coastal marsh communities. The intent of the low elevation gradient adjacent to the intertidal channels and ponds is to allow the formation of intertidal brackish marsh (based on Elk River's extant Lyngbye's sedge population), emergent low salt marsh, mixed high salt marsh, and brackish marsh, as shown in Figure 2-4 through Figure 2-7. Further along the elevation gradient, tidal influence will decrease, and the formation of native coastal scrub, and riparian shrub and forested communities will be enhanced or created (Figure 2-7). These design features will also serve as an area for potential marsh migration with sea level rise.



Emergent Brackish Marsh	Intertidal Brackish Marsh	Low Salt Marsh	Mixed High Salt Marsh
San Francisco rush	Alkali bulrush	Pickleweed	Pickleweed
Tufted hair grass	Lyngbye's sedge	Dodder	Salt grass
Meadow barley	Common three-square bulrush		Marsh jaumea
Pacific aster	Silver weed cinquefoil		Western marsh rosemary
			Coastal gumplant
			Common arrowgrass
			Humboldt owl's clover

Figure 2-4. Conceptual cross section showing salt marsh enhancement including an enlarged slough channel network, intertidal pools, brackish vegetation along channel edges, and mixed high marsh. Water elevation shown is approximately MHHW. Example is from ERWA-Slough in PA1.

Figure 2-5. Conceptual illustration of mixed high salt marsh located at an elevation near MHHW.

Figure 2-6. Conceptual illustration of emergent brackish marsh located at an elevation above MHHW.

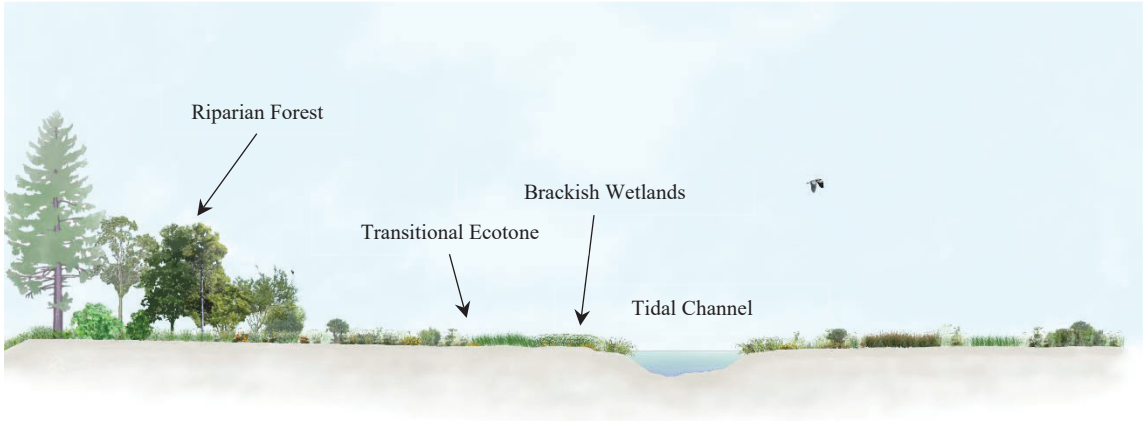


Figure 2-7. Conceptual cross section showing brackish wetlands enhancement including off-channel habitat with tidal channels fringed with brackish marsh vegetation. Brackish wetlands transition through a wetland-to-riparian ecotone, grading to riparian forest and uplands.

2.3.1 Tidal Marsh Revegetation Approach

Design planting zones are informed by the relative elevation above MHHW, groundwater monitoring data, sediment characterization, and water salinity measurements collected within the planning area, as well as, from results of the PA1 *Biological Resource Evaluation* (floristic surveys, vegetation mapping, wildlife assessment) (Stillwater Sciences 2025b). The vegetation design approach within estuarine habitats is to maintain, enhance, and expand sensitive natural communities by retaining native vegetation and interplanting, translocating, and out-planting a diverse selection of native coastal plants. Natural recruitment is anticipated within all recovered tidal marsh areas subject to the MHHW tidal datum. Objectives of the revegetation are to incorporate a diverse coastal plant assemblage along the transitional gradient from tidal marsh to riparian scrub and forest communities. Planting zones include emergent brackish aquatic, high marsh, coastal grassland, coastal and riparian scrub shrubland, and riparian forest planting palettes. Restoration activities will expand special-status plant suitable habitat for species documented in PA1. Four special-status plants occur within the tidal marsh enhancement areas. The Project's special-status plant conservation and recovery strategy will first target avoidance of any extant population during construction. If an individual cannot be avoided, the occurrence will be translocated to a receiving site reflective of its original origin. Seed collection and subsequent propagation of these special-status plants will provide supplemental material for out-planting in recovered habitats.

2.3.2 Elk River Wildlife Area South

This 84.7 ac site occupies the southern parcel of California Department of Fish and Wildlife's (CDFW's) Elk River Wildlife Area (ERWA). The primary objectives of the proposed enhancements are to restore the tidal marsh, slough channel networks, and associated habitats. The design includes a complex tidal channel system with three primary channels connected to the mainstem Elk River, each feeding a dendritic network of smaller intertidal channels and ponds (Figure 1-4). The tidal slough channel entrances will have widened inlets that function as alcoves extending into the tidal marsh.

Some infrastructure will be removed from the site, including:

(1) the levee adjacent to Elk River;
(2) two interior levees;
(3) three tide gates;
(4) ten culverts;
(5) drainage ditches; and
(6) a milk barn structure and artificial fill (Figure 2-1).

One tide gate will be replaced with a side-hinged double-barrel tide gates (Figure 2-1). The Humboldt Community Services District water line is located in the central portion of ERWA South. The water line will need to be modified to replace the tide gate and to accommodate a wider slough channel. The restoration design accommodates access to the water line for emergencies and maintenance.

Following levee removal along the Elk River channel, agricultural fields will be protected by a new earthen eco-levee running along the southern and eastern property boundaries (Figure 1-4). This eco-levee will provide the same level of protection to adjacent agricultural lands as existing conditions but will incorporate design features that accommodate a natural transition from brackish marsh vegetation to riparian ecotone, and then to higher riparian and upland forest vegetation types. The eco-levee will appear as a slightly higher feature on the landscape, reaching an elevation of only 10 ft NAVD. Slopes to the marsh plain are generally 10H:1V slope or flatter,

except localized areas where tide gates are installed and between the water line modifications. Eco-levee slopes will be vegetated by a native plant palette. As one of the few locations in the area not regularly inundated by tides, the eco-levee will be high enough to support a trail for nature study.

New tide gates inlets and outlets will be protected from scour with RSP. RSP may be added to protect the water line where it crosses the slough channel.

2.3.3 Elk River Wildlife Area North

The northern parcel of CDFW's ERWA is 17.3 ac. The existing network of channels at the site are a series of relatively straight ditches and tile drains with a primary channel that extends from a tide gate at Hwy 101 to the Elk River through an existing levee breech. Hwy 101 forms the northwestern boundary and a levee that separates the marsh plain from Elk River on the eastern and southern borders (Figure 1-4). The primary site enhancement will improve connectivity of the existing marsh plain and channel network to the mainstem Elk River by removing eastern levee, removing tile drains, filling remnant linear drainage ditches, and adding a dendritic network of tidal channels from the existing primary channel (Figure 2-1). A living shoreline will grade gently from Hwy 101 to the marsh plain, allowing increased infiltration of road runoff. The native plant community in this area is relatively intact. Removal of the eastern levee will convert upland coastal scrub to estuarine wetland habitat. Construction access will occur via Hwy 101 under an encroachment permit from Caltrans or via a temporary barge or bridge. The door of the existing tide gate at Hwy 101 will be replaced and RSP added in the vicinity of the tide gate. A utility box occurs near Hwy 101. If the box is no longer in use, it will be removed.

2.3.4 Confluence

Abutting the southern parcel of CDFW's ERWA is a 14-ac parcel located on private property. Enhancement actions at this site include levee removal along mainstem Elk River to increase and improve edge habitats along the banks and connected tidal marsh. A setback eco-levee with agricultural exclusion fencing will be constructed on the interior portion of the parcel to an elevation of 10 ft NAVD88. Riparian and coastal scrub communities will be planted on the eco-levee's exterior and interior slopes. A swale will be constructed inland of the eco-levee to reduce the potential for stranding of fish entrained in high flows. High flows enter this site after crossing the adjacent floodplain and flow over Pine Hill Rd. The area interior to the eco-levee will be gently contoured to direct flow to the swale using a combination of scraping and very shallow fill (Figure 1-4). The depth of fill within the floodplain will be less than 1.25 ft, which will allow creation of a gently sloping floodplain and floodplain swales. No wetland conversion will occur from this activity as the final ground surface elevation will retain wetland hydrology from a seasonal high groundwater based on the Project's groundwater monitoring results. In addition to wetland hydrology remaining intact, revegetation by native, hydrophytic coastal marsh and grassland plant assemblages will enhance the existing wetlands that are currently composed of nonnative introduced species. There will be a fish-friendly, side-hinged tide gate at the outlet of the swale to allow fish entrained in flood flows to safely leave the site. RSP will be added to the inlet and outlet of the new tide gate. A gravel road will be constructed at the top of the setback eco levee from the southern portion of the parcel to the tide gate. The road will be used for maintenance of the tide gate. A few areas will not be revegetated or graded. These are areas to be retained for landowner use.

An existing railroad grade running through the middle of the property will be retained and seeded with an upland coastal grassland mix. The railroad grade is raised to ten feet in some areas. The portion of the railroad grade between Swain Slough and the eco levee be retained and planted with riparian vegetation to introduce native cover and wildlife habitat.

Runoff from Elk River Road currently drains into a ditch to the east of the site. The design along Elk River Road will increase infiltration of road runoff by recontouring and directing it along a gentle, vegetated slope.

Construction access will occur via an existing private driveway.

2.3.5 Chwanuchguk

Chwanuchguk is the Wiyot word for "a ridge comes down there." This site encompasses 35 ac and is bounded by Hwy 101 to the west, residential properties to the south, and Elk River to the north and east (Figure 1-4). The primary enhancement at this site is to restore the tidal slough channel network and corresponding tidal marsh habitats through removal of a tide gate and two culverts, enhance existing tidal channels, and construct new tidal channels. Revegetation will support expansion of special-status and culturally-significant plant populations and sensitive natural communities. Subsequent design phases may incorporate additional opportunities and/or constraints identified in coordination with the Wiyot Tribe, who is the landowner. A trail will connect the access point to the Elk River, pending future confirmation from the Wiyot Tribe. Construction access will occur via an existing private driveway from Humboldt Hill Road along the western property boundary.

Existing infrastructure includes an underground HCSD waterline, which bisects the site, and will be avoided by restoration and construction actions (Figure 2-1). The HCSD has an existing easement and restoration design will accommodate access for future HCSD maintenance. Following restoration, all other uses would be tribally directly.

2.4 Off-channel Habitat Enhancement

Off-channel habitat sites occur upstream of tide gates, which are retrofit to allow a muted tidal prism into the enhancement areas. Tidal inundation extends to ponds that also receive freshwater through springs or tributaries. Generally, these areas also have freshwater sources from a tributary or spring. Wherever possible, the Project Team worked with landowners to protect springs with cattle exclusion fencing and reconnect water originating from the springs along valley walls to the Elk River and Swain Slough. Spring-fed channels and wetland complexes will provide seasonal habitat for salmonids and other focal fish species (Figure 2-8 through Figure 2-10).

Figure 2-8. Conceptual illustration of seasonal wetland off-channel from the Elk River.

Figure 2-9. Conceptual illustration of seasonal wetlands dominated by emergent vegetation that flood during high flows.

Figure 2-10. Conceptual illustration of perennial wetland off-channel from the Elk River.

2.4.1 Off-Channel Habitat Revegetation Approach

Design planting zones for off-channel enhancement areas are informed by the hydraulic model results, groundwater monitoring data, sediment characterization, water salinity measurements collected in PA1, and the results from the *Biological Resource Evaluation* (Stillwater Sciences 2025b). The vegetation design approach for off-channel habitat enhancement areas will largely focus on expanding and enhancing freshwater marsh and wetland and mixed riparian forest types. Where intact riparian vegetation is present but of low quality (e.g., thick monoculture of willow, no understory), planned enhancements will include willow thinning and interplanting to increase native plant species richness and habitat structural diversity. Planting palettes include emergent brackish aquatic marsh along intertidal bench features, emergent marsh along channel banks, coastal grassland, coastal scrub, and riparian shrubland and forest types. Special-status plants occur within a range of brackish to freshwater habitats within these enhancement areas. The Project's special-status plant conservation and recovery strategy will first target avoidance of any extant population during construction. If an individual cannot be avoided, the occurrence will be translocated to a receiving site reflective of its original origin. Seed collection and subsequent propagation of these special-status plants will provide supplemental material for out-planting in recovered habitats.

2.4.2 Upper Spruce

This 1.8 ac site is located outside of the coastal zone along the western edge of PA1. Enhancement includes creation of a shallow backwater channel, swales, an alcove feature, complex banks, and inset benches, providing a diversity of habitats (Figure 1-2). Additional infrastructure that will be added to the site includes a modified crossing over the constructed channel and cattle exclusion fencing. Enhancement measures (Figure 1-4) include:

- Alcove expansion;

- minor re-grading of an existing ~1,100-ft drainage ditch to increase sinuosity and enhance channel bed and bank complexity (e.g., inset benches, pools, bank scallops);
- removal of tide gate structure for off-site disposal;
- selective tree thinning and interplanting to improve riparian function in the forest adjacent to the hillslope; and
- rock grade control to prevent upstream incision and lower groundwater levels in the riparian wetland.

2.4.3 Lower Spruce

Lower Spruce is a 2.1-ac site located along the western edge of PA1 (Figure 1-2) and is access via private property owned by Shanahan Family LLC Co. Five main actions are proposed (Figure 1-4):

- Re-grading of an existing ~1,400-ft drainage ditch to increase sinuosity and enhance channel bed and bank complexity (e.g., inset benches, pools, bank scallops);
- creation or deepening of a ~0.63-ac seasonal or perennial brackish pond fed by freshwater springs at the base of nearby hillslopes;
- excavation of an alcove where the design channel meets the mainstem Elk River;
- expansion of tidal marsh and riparian areas; and
- replacement of a tide gate with a larger, fish-friendly tide gate.

Minor floodplain recontouring associated with fill placement on the adjacent pasture will help to direct overbank flows into adjacent habitat areas and minimize fish stranding. The existing TG-601 tide gate and culvert was likely originally installed to support legacy agricultural-related development. The tide gate will be replaced and relocated upstream of the new alcove feature (Figure 2-1). The tide gate will include a side-hinge door and a small, adjustable opening to support fish passage and allow a muted tidal prism through the new gate. This adjustable opening can be modified to facilitate adaptation to sea level rise and/or future changes in upstream constraints.

The constructed pond sill will have grade control to protect the inlet from scour.

PG&E abandoned an existing gas line in 2025. Some sections of the abandoned gas line will need to be removed to achieve targeted design elevations. Physical impacts from cattle (trampling and grazing) will be addressed by constructing exclusion fencing.

2.4.4 Relic Swain

The site includes the historic alignment of Swain Slough, which has been disconnected from Swain Slough by Elk River Road and a tide gate. The channel is currently a freshwater channel. The tide gate (TG-20) through Elk River Road will be retrofitted to replace the top-hinge tide gate with a side hinge tide gate with an adjustable door to allow a muted tidal prism into the relic Swain Slough channel. The tide level will be limited by both the downstream tide gate (TG-100) as well as the tide gate (TG-20). Upstream of the tide gate (TG-20), a perched culvert under the farm road will be replaced. The invert of the new tide gate will be set at the same elevation as the downstream tide gate (TG-20). Accumulated sediment in a portion of the relic slough channel will be excavated and will terminate in a constructed tidal pond. The tidal pond will also receive freshwater from springs and an intermittent tributary (Ridgewood Springs 1). A cattle crossing, upstream of the road crossing, will be upgraded to allow for maximum tidal exchange. Between these crossings, culvert passing under the farm road, discharging into the channel, will be replaced with a tide gate to prevent brackish water from inundating the northern pasture.

Two buildings will be removed. An existing barn that is built adjacent to the hillslope will be demolished and footprint regraded to naturalize the underlying fill with the adjacent landscape. A second structure adjacent to the farm road and channel will be demolished. Artificial fill associated with the building will be removed, while preserving the integrity of the farm road.

Exclusion fencing will be installed to protect the wetlands, valley wall springs, channel bed and banks, tidal pond, and revegetation areas.

2.4.5 Lower Swain

Lower Swain includes three enhancement sites. The two largest sites are located between Elk River Road and Swain Slough. Pine Hill Road separates the sites. The site north of Pine Hill Road is 21 ac and the site south of Pine Hill Road is 16 ac (Figure 1-2). Martin Slough enters Swain Slough just south of the Pine Hill Road bridge. These sites are currently owned by CalTrout. Once restored, the property will be transferred to CDFW's ERWA.

The primary objective at these sites is to restore the tidal marsh and slough channel network, and intertidal ponds, which collectively support dynamic habitats within the estuarine marsh-upland ecotone. A living shoreline will grade gently from Elk River Road to the marsh plain, allowing increased infiltration of road runoff and transitional habitats along the marsh edge. Infrastructure that limits the full tidal prism will be removed, including the levees along Swain Slough and a failing culvert/tide gate (C-24) (Figure 2-1).

An eco-levee is designed on the south end of the project to protect private property. Site drainage (road and property) for the private property currently flows into the south end of Lower Swain area. This drainage will be redirected into Swain Slough via a constructed drainage swale and new tide gate through the eco-levee.

The third enhancement site is located east of Swain Slough. The site is an approximately 0.75-ac marsh that is fed by a small drainage originating in the adjacent wooded hillslopes that provides significant freshwater inputs to the site during the wet season. Construction access to this site will occur by floating equipment across Swain Slough using a small, non-motorized barge. The primary objective of this site is to remove impediments to tidal exchange, create more high quality edge habitats along Swain Slough, and remove the artificial drainage channel. Similar to the other two sites, the levee and tide gate will be removed and ditches will be filled. Fabric will be used to reinforce the ditch fill. An alcove will be created where the tide gate currently exists. Excavated sediment will be used on-site to build hummocks to increase topographic diversity and support more diverse vegetation.

2.5 Mainstem Corridor Enhancement

Sediment remediation is not recommended in PA1. Tidal marshes are natural depositional and aggradation zones, and while the Elk River Recovery Assessment (CalTrout et al. 2019) acknowledges continued water quality impairments resulting from elevated suspended sediment concentrations, the preferred outcome in the tidal estuary is to enable deposition, marsh accretion, and trapping of sediment on restored tidal marsh surfaces, reducing the export of this material to Humboldt Bay. The mainstem of Elk River through the Mainstem River Reach 1 (MSR1[2], Figure 1-3) is expected to adjust over time in response to increased tidal exchange from several estuary restoration projects in the watershed.

[2] MSR1 begins at the downstream end of PA 1 and extends upstream between Station 18,000 and 19,000 as shown on Figure 1-3. The upstream end of MSR1 is the end of tidal influence in PA1.

Actions that directly or indirectly benefit main channel aquatic habitats include the following:

- Removal of earthen dikes confining the channel. This will enable more tidal inundation of salt and brackish marsh plains and flush nutrients and invertebrates back into mainstem channels where they can be consumed by fish.
- Expansion of surrounding tidal marsh habitat connected to the mainstems via enhanced or restored intertidal channels. This will increase the tidal prism in PA1, which will extend the mainstem tidal prism further upstream and increase the length of brackish water mixing zone and increase the duration of inundation of higher tides.
- Removal or thinning of vegetation (mainly coast and arroyo willows) rooted in the bank and overhanging or sloughing into the bed of the channel to provide more functional habitat (Figure 2-11A).
- Adaptive management to address undesirable vegetation regrowth for a period up to five years via subsequent removal in discrete locations.
- Interplanting thinned areas with other species and expanding the riparian corridor to develop a multi-tiered riparian structure (Figure 2-11B).
- Reconnection of freshwater sources from tributaries and ephemeral seeps along the base of hillsides to provide more fresh and brackish water and provide refuge from high turbidity during storms.
- Large wood augmentation and construction of alcove habitats along the mainstem of lower Elk River and Swain Slough to provide deeper pools, more complex escape cover, and velocity refugia. Bank grading will create variable-elevation benches to support a mosaic of low-velocity fish rearing habitats along channel margins that are inundated across a range of flows (Figure 2-11).

Large wood density has been linked to overall salmonid production in streams and correlated with salmonid abundance, distribution, and survival. Because of the shortage and limited overall function of existing wood in PA1, large wood augmentation is an important aquatic habitat restoration action. Wood structures will create low-velocity winter rearing habitat for Coho Salmon and other salmonids, to create complex, low-velocity pool and bank margin habitats in areas currently lacking low velocity refugia. Wood structures will also help maintain alcove inlets via flow deflection and scour and/or backwatering and facilitate juvenile fish access to adjacent low-velocity floodplain habitats.

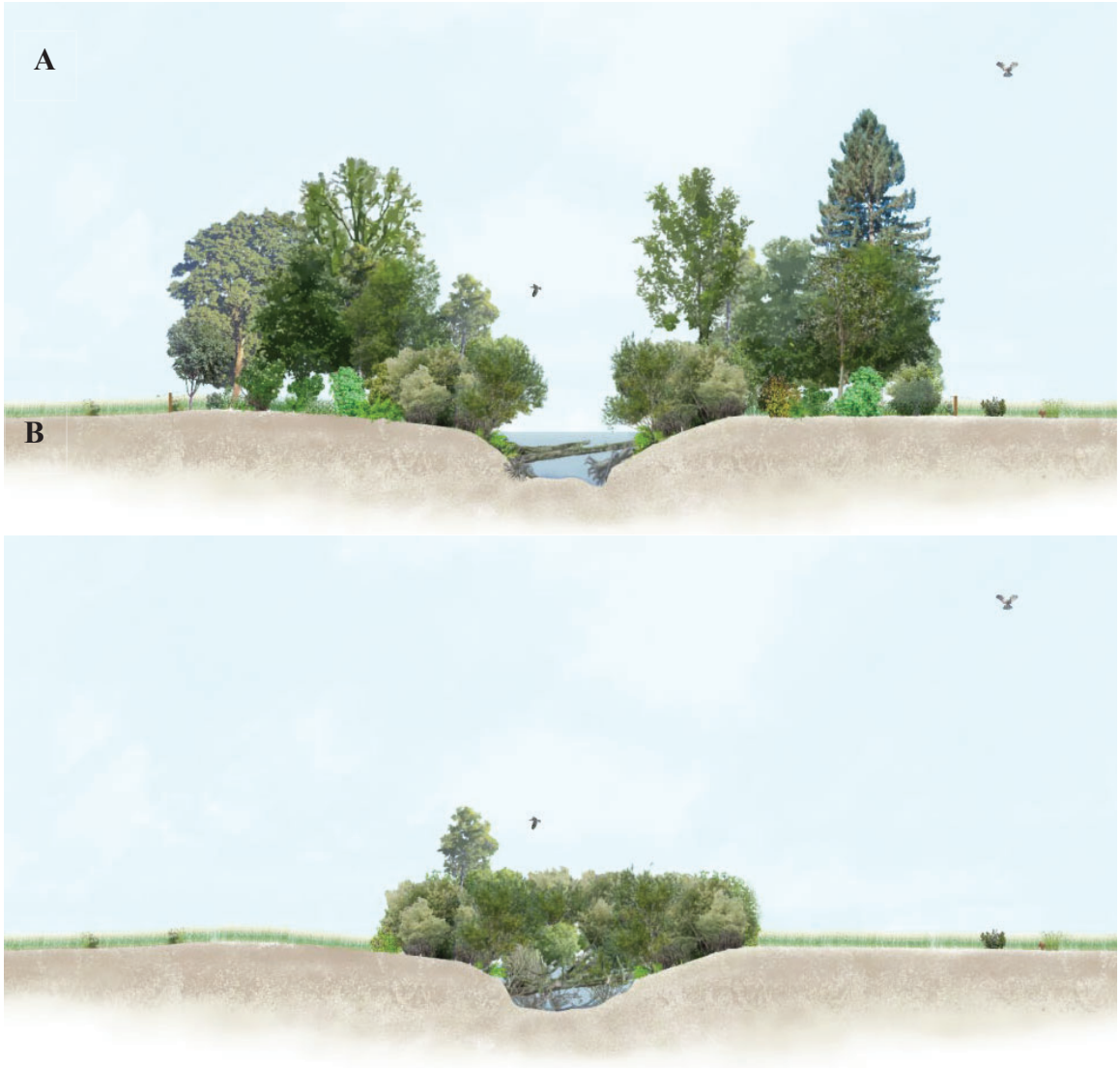


Figure 2-11. Current conditions along sections of Elk River that are dominated by fine stem clonal willow growth that cover the banks (A). Proposed conditions along the Elk River (ER-10 and ER-12) include thinning treatments, interplanting, and expanded width to enhance the riparian corridor in mainstem Elk River (B).

2.5.1 Mainstem Corridor Revegetation Approach

The revegetation strategy for mainstem corridor enhancement sites will diversify the existing homogenous riparian corridor to establish a diverse multi-tiered riparian stand type. This will in turn improve riparian functions beneficial to fish and wildlife. Riparian revegetation will include: (1) interplanting fast-growing riparian trees within riparian vegetation management units (i.e., willow removal and thinning treatment areas), (2) planting a mixed evergreen and deciduous riparian planting palette in an expanded riparian buffer along Elk River, and (3) planting low gradient bank slopes (channel banks and variable-elevation benches) with an emergent marsh planting palette. Design planting zones were informed by the hydraulic model results, sediment characterization, water salinity measurements collected in PA 1, and the results from the *Biological Resource Evaluation* (Stillwater Sciences 2025b). Special-status species and high value trees documented in these enhancement sites will be avoided during construction activities. Invasive plant management will occur in tandem with construction activities.

2.5.2 Upper Mainstem – Elk River

The riparian management and bank treatment unit occupies 4,800 ft of the mainstem Elk River and its riparian corridor (Figure 1-2). Habitat restoration components include thinning of the dense willow vegetation and interplanting within existing vegetation, expansion of the riparian corridor width, and in-channel fish habitat enhancements. An existing farm bridge across the Elk River will be retained and may be upgraded as needed.

In-channel fish habitat enhancements include removal of three culverts (Figure 2-1), and large wood augmentation, installed to mirror the stability of natural wood jams using a combination of burial and wood pins. Bank modifications will occur in conjunction with installation of large wood structures to provide additional low-velocity rearing habitat along the mainstem corridor.

Bank treatments will recreate a mosaic of low-velocity fish rearing habitats along the channel margins that are inundated across a range of stream flows. They will have variable elevations within each grading zones and across a reach, and they will be inundated at biologically meaningful flows, including low winter base flow/spring rearing, winter base rearing, and high flow/top of bank. Large wood will be added where feasible, and patches of high-quality habitat will be roughly ~30 ft long by ~10 ft wide. Bank grading locations were selected to avoid infrastructure and reduce impact on high-value trees and special-status plants that contribute to riparian plant diversity. Graded bank treatments cover approximately 47% of the left bank and 26% of the right bank of the 4,800-ft treatment area.

The entire Upper Mainstem riparian corridor along Elk River will be expanded and protected with cattle exclusion fencing (Figure 2-11). Beyond the graded bank treatments in the riparian management unit, thinning and/or removal of live wood in the Elk River channel will occur in reaches that have high in-channel encroachment of low to midstory shrubs and channel-spanning fallen live wood (Figure 2-12 and Figure 213). Individual trees contributing to overstory canopy will be preserved to the extent possible. The objective for riparian thinning is to reduce the existing small-diameter willow stem accumulation on the channel bed- and revegetate Elk River's upper banks and floodplain with a multi-tiered native riparian community that will promote growth and structure above Elk River's top of bank. Any gaps from thinning in intact riparian areas will be interplanted. Where clumps of willows will be removed, the bank will be recontoured and revegetated. Willow thinning treatments include: (1) the full removal of select individuals contributing to high fine stem accumulation within the lower channel bed and bank and (2) pruning and removal of fallen live channel-spanning willows rooted on the upper bank. The latter will involve a pruning cut at the base of selected incompletely-felled tree trunks and the subsequent removal of the trunk and its resprouted branch stems to considerably reduce stem density on the channel bed. Epicormic growth of treated willows will occur along the top of bank and will no longer contribute to fine stem accumulation on the channel bed. These willow thinning treatments include an additional 14% on the left bank (12% for full removal and 2% pruning) and 17% on the right bank (6% for full removal and 11% pruning). All thinned areas will be revegetated with a diverse riparian forest plant palette to promote fast recovery, stream cover, and expanded wildlife habitat. Subsequent vegetation management treatments may be warranted during the riparian plant establishment period to support the riparian plant community transition towards greater species and structural diversity.

Figure 2-12. Example of high-density fine stem clonal willow growth in the channel.

Figure 2-13. Existing conditions showing incompletely-felled live willows resprouting along channel bed that are targeted for removal.

2.6 Floodplain Corridor

The lower valley and tidal estuary of Elk River is dominated by large areas of floodplain that transition down-valley to tidal marsh plains. Floodplains have been heavily altered by drainage infrastructure designed primarily to serve ranching and dairy operations rather than accommodating fish rearing habitat or migration patterns. Reconnecting and maintaining stream and tidal inundation onto floodplains and marsh plains is a central objective to restore more natural patterns of inundation and flow direction. Near the upstream end of PA1, floodplain modification through the strategic placement of thin layers of sediment (~0.5 - 1.0 ft fill depths) will gently recontour existing floodplain and pasture surface (Figure 2-14; see Section 2.7. This will create flood-flow pathways that are broad, shallow swales that are inundated frequently during moderate and larger winter floods (approximately 1.25-year return interval) but provide pasture for grazing during the low-flow season. This improved flood-flow routing will reduce the risk of stranding of juvenile salmonids during winter by conveying flow (and any entrained salmonids) toward high-quality winter rearing habitat in the daylighted Orton Creek, which connects further down the valley in the ERWA and in Swain Slough. Marsh plains along the stream-estuary ecotone will be connected to mainstem channels through removal of earthen dikes

along the mainstem Elk River and Swain Slough and replacement of old top-hinged tide gates with fish friendly side-hinged tide gates.

2.6.1 Floodplain Corridor Revegetation Approach

The revegetation of the floodplain connectivity enhancement areas will occur after invasive plant management and recontouring activities. The planting zones occur in active agricultural pasture and will be reseeded with a land manager-approved grass seed mix. The seed mix will have recommendations to include native livestock forage grasses and forbs to promote more native cover and pollinator habitat within the Elk River floodplain. The newly expanded riparian corridor along Orton Creek will be revegetated with a mixed evergreen and deciduous riparian forest palettes as described in more detail in Section 2.6.3.

2.6.2 Upper Orton - Floodplain Swales

Overbank flows from the Elk River spread across the broad floodplain and are intercepted by a series of ditches and culverts that run perpendicular to the valley. This dysfunctional drainage infrastructure likely causes juvenile fish stranding during winter high flow events. Floodplain enhancements will reestablish down-valley floodplain swales to restore natural drainage patterns and reduce stranding risk. These floodplain swales direct overbank flows into the restored Orton Creek channel. Infrastructure changes include removal of at least five culverts (Figure 2-1), realignment of fences to accommodate changes to agricultural operations, and backfilling or modification of ditches to drain toward the new floodplain (Figure 2-14). A PG&E gas line bisects the property and will be avoided (Figure 2-1). As the floodplain swale features will continue to be used for cattle grazing, revegetation will include a landowner-approved livestock forage seed mix in combination with some native palustrine emergent vegetation plantings similar in species assemblage to other seasonally flooded swales in the Elk River valley bottom.

Figure 2-14. Floodplain channel through agricultural grasslands during flood flows in the Elk River. The low flow channel, set within a broad shallow floodplain channel, provides deeper flow paths with cover for fish to pass through agricultural grasslands to reach higher quality habitats as high water recedes. During dry periods, the floodplain channel is grazed.

2.6.3 Orton Creek

Reconnecting freshwater flows from tributaries to a restored tidal slough network will allow juvenile salmonids and other species access to more habitat at a broader range of salinities. The daylighted and enhanced channel network will support an extended riparian corridor on the Elk River floodplain beneficial to fish and wildlife (Figure 2-15). The creation of these recovered waterways and adjacent riparian corridors will improve species and habitat diversity in areas currently occupied by agriculture land use.

Revegetation within riparian hummocks will provide diverse vegetation structure to support wildlife resting, breeding, and foraging habitats and supply nesting materials.

Figure 2-15. Conceptual cross section. Orton Creek restoration will include daylighting Orton Creek riparian creation and enhancement, and improving channel complexity with wood, alcoves, inset benches, and exclusion fencing.

Orton Creek is the second largest freshwater tributary in PA1 after Martin Slough. Orton Creek currently enters a culvert near the old railroad grade and is routed subsurface through a 2.5-ft diameter culvert for approximately 1,400 ft to Elk River (Figure 1-2). Orton Creek will be daylighted and reconnected to Swain Slough. Reconnection of Orton Creek to Swain Slough includes replacement of the existing tide gate door at Elk River Rd to enable fish passage and a muted tidal prism to extend through Lower and Mid Orton subareas. Rock slope protection will be added in the vicinity of the upgraded tide gate.

The channel will have a meandering complex channel morphology (riffle, pools) with inset benches, alcoves, and wood structures to create high quality fish habitat within the restored channel. Within the fluvial sections of the channel, gravel will be imported to reestablish a natural stream bed and prevent incision.

The tidal pond in Mid Orton will be approximately 3.2 ac with a 0.2-ac island. The design included a minimum width of 10 meters, retaining 3-ft perennial depth around island, and including varied pond shoreline gradients that include both steep and gradual slopes to allow for access to deep water as well as habitat that will promote emergent marsh habitat establishment to provide forage and cover. The island within the pond revegetated with native coastal grassland

habitat and pond shorelines will be planted with emergent brackish marsh species. This island is intended to create habitat for ground nesting birds that nest near water and marsh edges (e.g., Canada geese and northern harrier) that provides security from predators. Crest elevation is designed to remain dry during the breeding season (~ March to April).

Riparian hummocks can be incorporated into grading in areas shown in Figure 2-17 (see Section 2.7 – Beneficial Sediment Reuse) . The hummocks will increase the topographic diversity within Mid Orton and provide suitable elevations for establishing the coastal grassland, riparian and coastal scrub and riparian forest communities in this area.

The existing Orton Creek culvert will be removed up to the connection with a second culvert (C-210, Figure 2-1. Culvert C-210 shares the same outlet as the Orton Creek culvert (C-210, Figure 2-1). Culvert C-210 will be retained, and a flap gate will be added to the Culvert C-210 outlet to prevent Elk River from backwatering through the culvert into the Culvert C-210 drainage ditch.

Daylighting Orton Creek and establishing a new alignment through the valley bottom requires modification of drainage ditches, crossings, and access/farm roads throughout the valley. New crossings will be installed (a minimum of 1 per parcel) to maintain access across Orton Creek. Drainage ditches that currently run perpendicular to the valley will be filled or graded to drain toward Orton Creek (Figure 1-4). Crossings will be modified along existing farm roads.

The design alignment intersects and occupies a portion of an unpaved agricultural access road in Upper Orton. This road will be realigned to provide access to realigned pastures. A crossing will be installed to provide access for flash grazing. Additional crossings may be required for PG&E access to power poles in Upper Orton. Cross-valley drainage ditches and culverts that follow existing farm roads will be removed.

The design alignment intersects the former Elk River Road alignment in Lower Orton Creek. This road is currently used as an agricultural storage area. A portion of the road will be removed and the storage area will be reconfigured closer to Elk River Road.

The new Orton Creek alignment crosses the PG&E gas line at the same location as an existing drainage ditch. Orton Creek crosses an existing gas line. The crossing occurs at the same location as an existing drainage ditch. The bottom elevation of the Orton Creek channel will be higher than the current ditch, thus will be more protective than existing conditions. Additional protective measures against erosion (e.g., grade control) will be implemented.

Targeted fill occurs along selected sections of the creek to ensure the hydraulic function of the Orton Creek channel.

All sections of Orton Creek will have livestock exclusion fencing. Cattle watering troughs may be installed to encourage cattle not to seek water within the new Orton Creek channel.

A protected vegetative corridor on Orton Creek will transition from riparian forest and shrublands within Upper Orton to a mosaic of brackish marsh, coastal grassland, and riparian habitats in Lower and Mid Orton subareas. The creek and riparian corridor will be fenced with a minimum width of 90 ft where active pasture remains adjacent. The area that will be fenced is located outside of the coastal zone. The corridor includes a meandering channel with a low flow channel that has a ~6- to 10-ft bottom width.

An intermittent tributary, informally called Ridgewood Springs 2, enters the project site via a culvert at the southwest corner of the Relic Swain Slough subarea and under Elk River Road into

Mid Orton subarea. The area will be transferred to CDFW ownership and managed by the agency. This tributary will be rerouted out of the roadside ditch and meandered through portions of Mid Orton, then it will return to the roadside ditch to go under the PG&E substation to avoid conflicting with the gas line.

The newly expanded riparian corridor will be revegetated with a mixed evergreen and deciduous riparian forest palettes. Figure 2-15 provides an example of the desired future condition at these locations. Mid Orton is a large enhancement area that will be revegetated to form a mosaic of habitats consisting of aquatic brackish marsh, emergent fresh and brackish marshes, coastal grassland, riparian and coastal scrub and riparian forest communities. Planting zones are informed by the hydraulic model results, groundwater monitoring data, sediment characterization, water salinity measurements collected in PA1, and the results from the *Biological Resource Evaluation* (Stillwater Sciences 2025b). Where ground elevations remain saturated and may limit woody riparian establishment, construction of raised hummocks will provide opportunities for habitat complexity within the floodplain. These riparian hummocks will be revegetated with native tree and shrub species to form a diverse structure beneficial to wildlife.

2.7 Beneficial Sediment Reuse

Sediment is an important resource in PA1 and is necessary to support restoration. Sediment will be reused in tidal marshes and riparian wetlands to increase topographic complexity, which supports more diverse aquatic and terrestrial habitats. Sediment will be repurposed to build eco-levees, enabling the restoration of full tidal prism on lands that are adjacent to agricultural fields, as well as natural shorelines, which provide transitional habitats and gentle gradients to roads. Sediment reuse is designed to minimize the conversion of wetlands to uplands by limiting the depth of placed material to depths that retain hydrologic connection to groundwater and protect from wetland loss. Wetland areas receiving sediment will be revegetated with a range of plant communities suitable to the conditions present. Sediment reuse in wetlands will assist in the establishment of wetland habitat diversity more congruent to historic conditions on the floodplain. For instance, a slightly raised ground surface will allow for the formation of forest and shrubland wetlands in areas currently subject to long-duration inundation periods that inhibit the formation of these wetland communities. Sediment placement is site-specific, with consideration of soil depths and suitable soil types required for successful revegetation to achieve ecological objectives. Tidal and riparian hummock features are designed to promote habitat complexity with variable structure and diverse vegetation. Tidal hummocks will occur at elevations just above MHHW to spring tide elevations with low gradient side slopes to achieve a diverse tidal marsh complex that will provide forage and resting habitat for shore and water birds and expand high marsh habitat that is suitable for special-status plant recruitment. Revegetation within riparian hummocks will provide a diverse vegetation structure to support wildlife resting, breeding, and foraging habitats and supply nesting materials. Where possible, sediment will be reused within the same subarea as the source material. A temporary crossing over Elk River, or an upgrade of an existing farm bridge on Upper Spruce/Mainstem may be needed to transport sediment to Mid Orton area.

There are a range of sediment types that are available for reuse in PA1 (Table 2-2). Materials are categorized into five material types based on their reuse potential. Type 1 materials are the most versatile and are suitable for re-use across all project elements as this material supports a wide range of vegetation types across different hydrologic regimes. This is the only material identified as suitable for surfacing agricultural fields and surfacing revegetation areas above spring tide (Figure 2-16). Within subareas ERWA South, ERWA North, Swain Slough West, and Confluence, this material type will be reused on features above spring tide such as the natural shoreline and eco-levee to support revegetation. Within the Orton subareas, priority areas for

Type 1 material are in floodplains within agricultural areas that will be used to recontour floodplains with the objective of directing overbank flows (and thus fish) into the higher quality habitats across PA1.

Type 2a materials have similar reuses and ecological objectives as Type 1 but may not be suitable for reuse as the surface layer in agricultural fields due to the higher clay content (Figure 2-16). Type 2b and Type 3 are clays and are generally placed subsurface and capped with Type 1 or Type 2a materials. Type 3 materials are suitable for ceramics and could be used by community ceramics groups.

Current estimates of volumes from each material type indicate that all material can be reused on site to support ecological objectives. However, substantial deviations of volumes of materials quantities may occur due to subsurface variation in material types. If excessive quantities of Type 2b or Type 3 are encountered during construction, stockpiling or off-haul may be required.

Type 4 material is expected to be generated in limited areas where control of invasive vegetation requires excavating the soil and burying or solarizing in an upland area. Burial of this material is expected to occur predominately within filled ditches across PA1. Burial may also occur in the tidal marsh areas beneath tidal hummocks.

Sediment reuse sites may deviate in location and extent with PA1 depending on the quantity of each material type. Volumes for each material type were estimated from 20 test pits across PA1. However, the variation observed within each pit indicates significant variability in the subsurface materials. Thus, the example sediment reuse extents (Figure 2-17) are expected to vary in size depending on the actual quantity of each material types excavated.

Table 2-2: Soil reuse categories.

Type	Reuse Description	Soil Types (USCS)
1	Surfacing in agricultural fields and revegetation areas above spring tide elevation	Organic silts (ML/OL – contains organics, topsoil), Silts (ML - coarser grain size distribution, low plasticity), Peat (PT), Silty sands (SM)
2a	General project fills (eco levees, trail prisms, etc.), revegetation of all restoration areas. May not be suitable for use in agricultural fields.	Clayey sands (SC), Clayey silts (ML - finer grain size distribution, low plasticity), and ML/CL
2b	General project fills (eco levees, trail prisms, etc.), estuarine marsh fill below spring tide, and basal material in revegetation areas that will be elevated. In revegetation areas above spring tide assume a surface treatment with organic material would be needed.	Clays and silty clays (CL – low plasticity)
3*	Fill in estuarine areas below spring tides, ditch fill, subsurface material in revegetation areas that will be capped with Type 1 or 2 material.	Clays (CL – medium plasticity, CH – high plasticity)
4	Burial with a depth of 2 ft of clean cover (Type 1, 2a, 2b, or 3) in the tidal area and a minimum of 2-6 ft in freshwater areas depending on species.	Soil with seed bank material, active root biomass, including rhizomes.

* Soil in this category is suitable for clay ceramics and can be stockpiled for the clay users community to access.

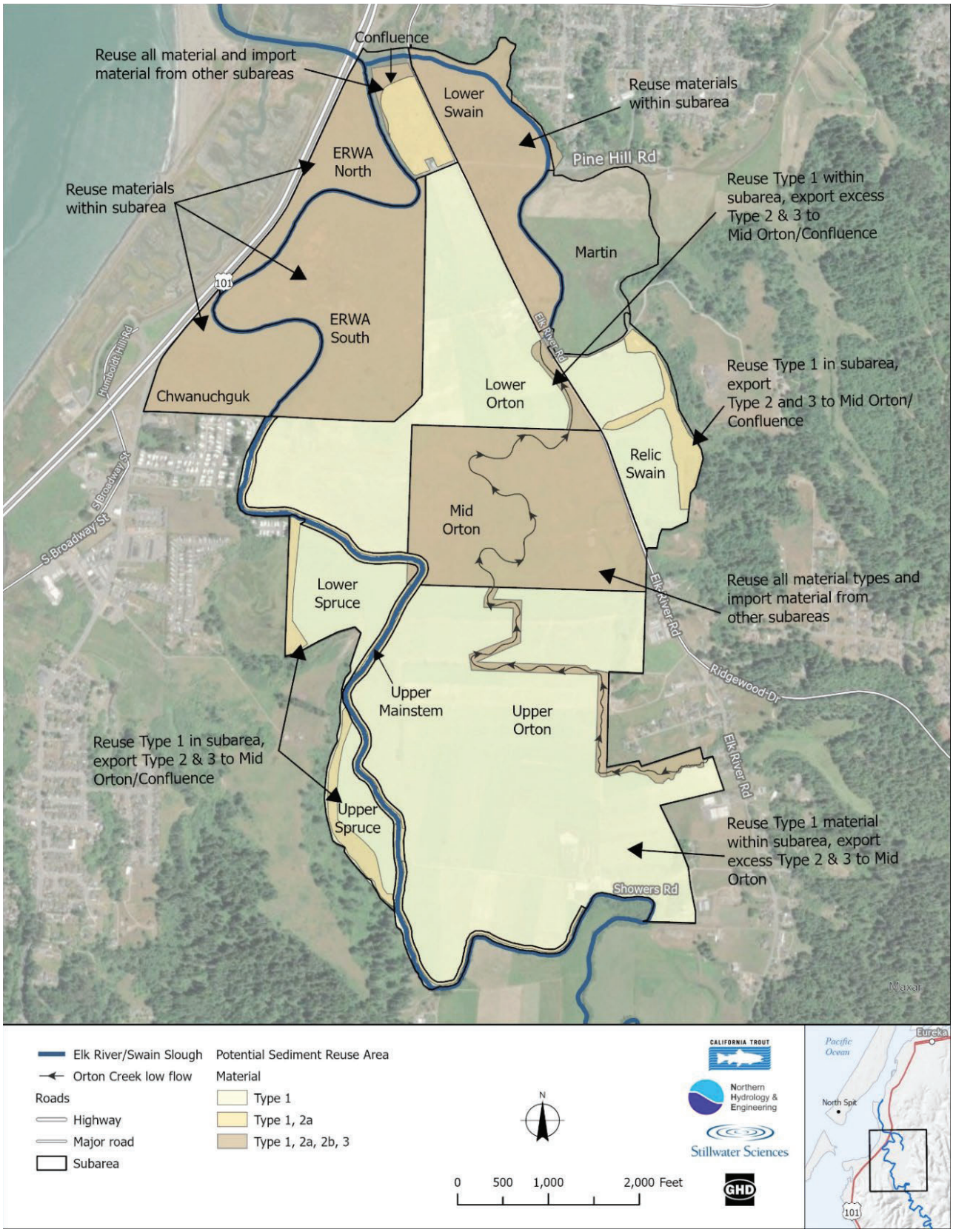


Figure 2-16. Potential sediment reuse areas categorized by material type.

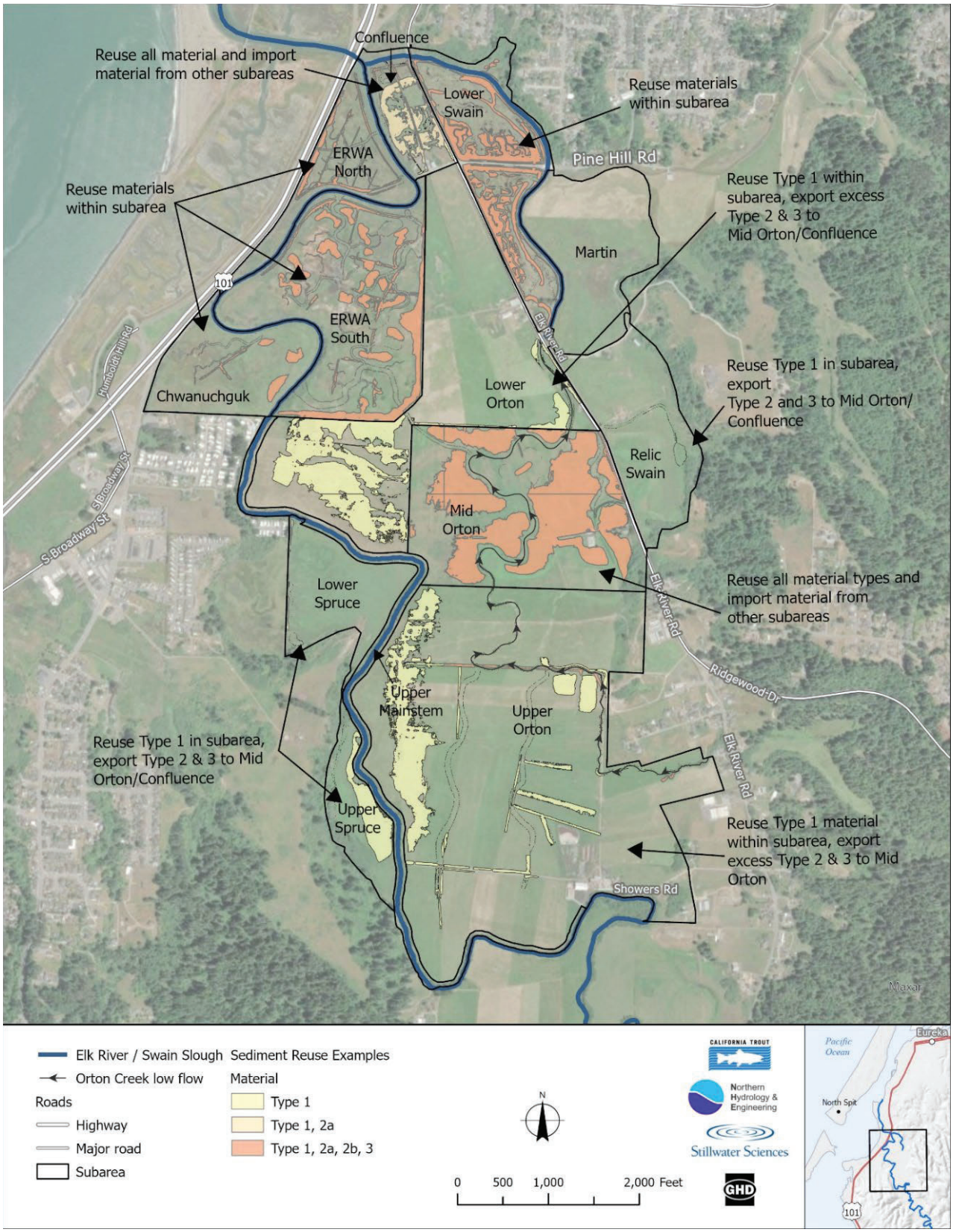


Figure 2-17. Sediment reuse (65% designs).

2.7.1 Beneficial Sediment Revegetation Approach

The sediment reuse enhancement areas are designed to support revegetation of both estuarine marsh and riparian habitats. Native plant salvage will occur in low marsh areas that will receive sediment to reach mature marsh elevations (near the MHHW tidal datum). Salvaged native salt marsh plants will be redistributed onto the resurfaced tidal marsh plain to promote faster recovery. Passive recolonization by salt marsh plants is anticipated within tidal marsh plains below MHHW and no additional planting is planned at these locations. Revegetation of tidal and riparian hummocks will include planting palettes associated with brackish marsh, coastal grassland, and riparian forest planting zones. Natural shoreline and eco-levee features will be revegetated with planting palettes associated with the estuarine marsh-upland ecotone. Sediment reuse areas that occur in active agricultural pasture will be reseeded with a land manager-approved grass seed mix.

2.8 Public Access Enhancements

Public access enhancements (Figure 1-5 and Attachment 1) will support nature study, post-construction performance and regulatory monitoring, and CDFW's operation and maintenance within the ERWA. Formalized public use via access facilities will limit nuisance use, including litter, illegal hunting, and illegal dumping, which may otherwise be detrimental to sensitive habitats and species. Key elements are shown in Figure 1-5 and Attachment and include:

- In-kind replacement of unpaved trails in CDFW's ERWA, a small overlook structure;
- enhanced parking in existing parking areas at APN 305-031-011, and 305-021-006;
- pedestrian crossing facilities across Elk River Road and Pine Hill Road;
- new unpaved trails and/or boardwalks and small overlook structures at APNs 302-181-008 and 305-021-003 (CDFW's expanded ERWA parcels);
- new unpaved trails and related public access features at APN 304-191-001;
- non-motorized boat launches in Swains Slough and the mainstem Elk River (one each);
- interpretive and wayfinding signage;
- wildlife viewing platforms and overlooks; and
- in-kind replacement of site security features, including gates and fencing.

Public access trail systems will be located atop new or existing berms (eco-levees or living shorelines) that skirt the newly restored tidal marsh areas or on boardwalks. Trails and boardwalks will provide elevated and designated areas for site visitors to enjoy passive recreation and wildlife viewing. Trails will extend as far along the length of select berms as feasible while minimizing disruptions to restored areas and will be surfaced with compacted aggregate. Widths will vary from 4 ft to approximately 10 ft wide, pending trail location and type. The trail on APN 305-032-011 will be approximately 4 ft wide and some trails on APN 304-191-001 will be approximately 10 feet wide. Seasonal trails will be marked with trail wayfinding markers but will not be developed or graded. Where trails are located on the crest of eco-levees, a compacted sediment core will be required to adequately support the trail. Sediment source options for the compacted trail core will be excavated onsite soils if adequate. Otherwise, soils will be imported to achieve compaction requirements.

To provide additional access and nature viewing opportunities, additional out-and-back spur trails and elevated viewing platforms will be located at select high points between tidal channels, including on APN 302-181-008 near Pine Hill Road and APN 305-021-003 and -006. Primary and secondary trail nodes will be located at various locations along the trails to provide additional

access opportunities. Primary nodes, often associated with a trailhead, will typically include bike parking, wayfinding signage, and bench seating. Secondary nodes will include interpretive signage. A crosswalk across Elk River Road, between Pine Hill Road and the private driveway, will be installed to increase visitor safety. The crosswalk will include rapid rectangular flashing beacons.

Three trailheads with parking will be enhanced. As space allows, trailheads will provide vehicle and bike parking, signage, picnic tables, and benches. A non-motorized boat launch will also be installed on APN 305-031-011 to support access to the mainstem Elk River.

Multiple parking areas will be enhanced. The existing parking area at the entry to APN 305-031-011 will not be expanded; however, the compacted gravel parking area will be enhanced to include six standard parking stalls and one paved concrete Americans with Disabilities Act (ADA) stall and loading zone. The gate will be replaced with ADA compliant bollards or similar.The existing gravel parking area located on private property will be enhanced on APN 305-021-006 near Elk River Road for access to a non-motorized boat launch on Swains Slough. This gravel parking lot will have four standard stalls. APN 304-191-001 will include two parking areas. The first is a gravel parking area with 14 standard stalls and one ADA stall. The second space will be for overflow parking and will also feature a bus drop off and turnaround area. Vehicular gates managed by CDFW will control access to both parking areas on APN 304-191-001 from Elk River Road.

Unpaved trails will also be located on APN 304-191-001 to support public access, maintenance, and fisheries monitoring in the mainstem Elk River. Existing developed areas related to an existing house (to be demolished), parking, and a barn will be repurposed for operational and visitor parking. Related ancillary features will also be installed, such as benches, picnic tables, and signage. A small farm bridge will be installed as needed across the new Orton Creek channel to support access to the mainstem Elk River for fisheries monitoring and seasonally appropriate public access.

Public access areas and amenities will be available to the general public free of charge during daylight hours (one hour before sunrise to one hour after sunset), seven days a week. Boating access will be limited to certain days, as determined by the landowner and CDFW. Uses consistent with the site could include passive, non-extractive, pedestrian-related activities and recreation (i.e., hiking, walking, bird watching) and non-motorized boat usage. Hunting will continue to be allowed in APN 305-031-011 and APN 302-181-012 during select times of the year as governed by CDFW's fishing and hunting regulations. Site security and access restrictions will be facilitated by gates and fencing. Fencing may be installed in select locations, including property perimeters and along berms to keep visitors out of restored areas and adjacent properties. Gates will be maintained and controlled by CDFW and private landowners.

3 CONSTRUCTION

3.1 Site Safety, Access, Staging Areas, and Utilities

All project and construction activities will maintain health and safety standards. The Project is designed by licensed engineers and constructed by general contractors licensed in the State of California, with independent construction oversight. Contractors and subcontractors will follow all applicable Best Management Practices (BMPs) and safety procedures contained within Cal-OSHA or other standard protocols.

Construction areas will be accessed via Elk River Road, Pine Hill Road, Showers Road, Humboldt Hill Road, several unimproved private roads, and participating private properties. No new permanent access roads will be constructed to implement the Project. Construction access locations are shown in Figure 3-1. Final construction access locations may adjust as-needed based on site specific conditions and constraints at the discretion of the contractor and the Project team, provided additional resource impacts due not result beyond what is addressed in Project permits and approvals.

Temporary disturbance will occur at pre-designated staging areas for each Project phase. Construction equipment, materials, and removed vegetation will be stockpiled in designated staging locations. Materials and soils will be temporarily stockpiled in these locations between Project phases as needed. All temporary disturbance areas for Project elements may be used as temporary staging areas. BMPs will be implemented to prevent construction materials, fuels and equipment supplies, and other hazardous materials from impacting the surrounding environment. Following construction of each Project phase, the associated staging area will be restored to pre-construction conditions. Existing utilities will be identified throughout the design process and marked out prior to construction. Existing utilities will be protected in place or relocated if necessary.

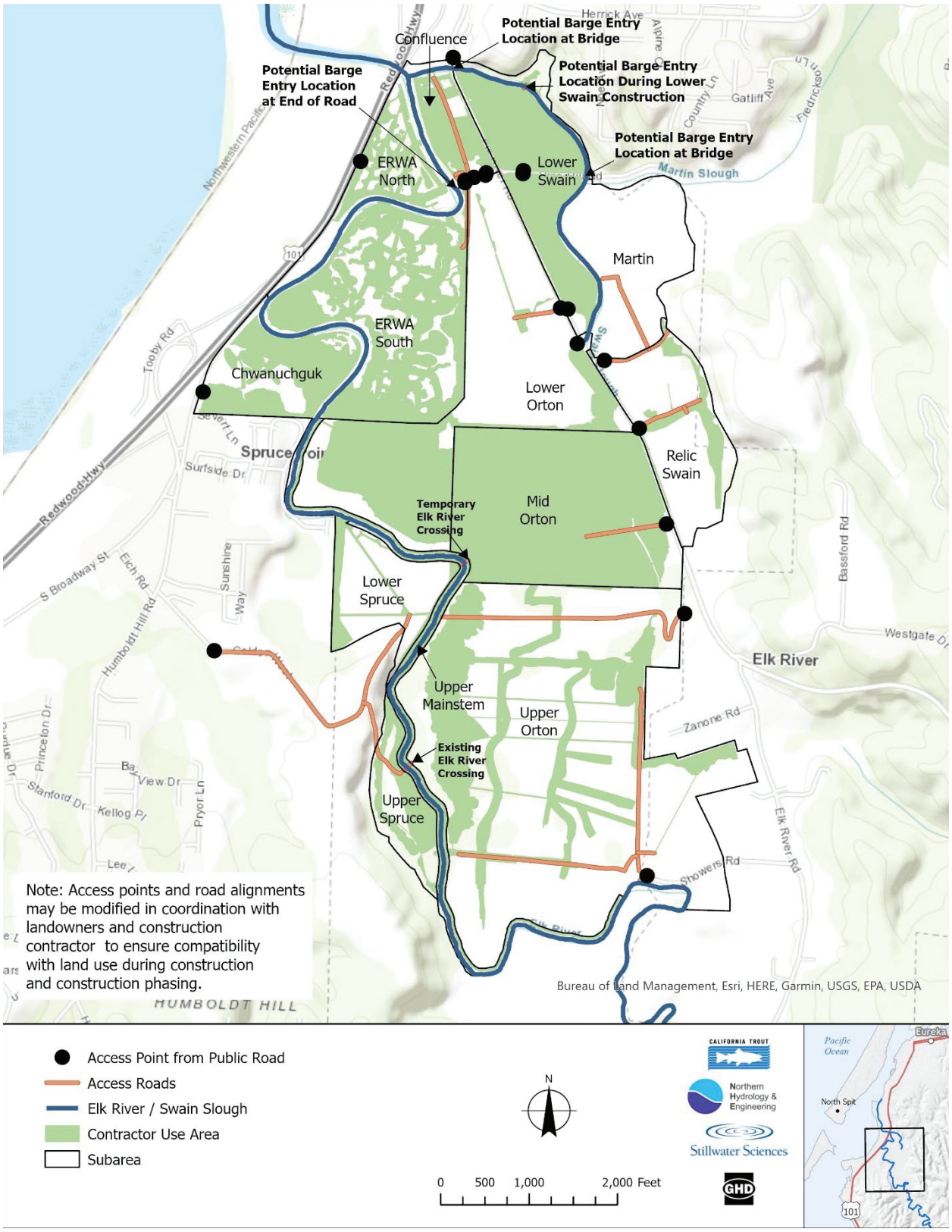


Figure 3-1. Construction-phase access.

3.2 Construction Schedule

Each Project phase will focus on enhancement and restoration actions within a specific river reach along single or multiple property ownerships. The total project duration is dependent on the availability of funding. Most construction activities will occur within the regulated in-water construction season, typically June 15 through October 15, i.e., during late summer and fall when stream flows are at their annual minimum. Work windows may need to be adjusted with the tides in certain areas. The presence of nesting birds in the Project area may delay the initiation of construction until after the nesting season on approximately August 15. If no rain is forecast, construction activities may be extended through October 31 with regulatory agency authorization. Equipment will work from the streambank and within the dewatered channel. Some pre-construction or maintenance activities outside the wetted channel may take place outside the construction season; for example, tree removals may take place prior to the bird nesting season to preclude nesting.

3.3 Equipment and Methods

Equipment required for construction will include tracked excavators, backhoes, graders, bulldozers, dump trucks, water trucks, skid steers, and pick-up trucks. In addition, small equipment such as generators, small water pumps, chainsaws, and wood and brush chippers and grinders will be used.

Excess soils and construction materials will be stored within designated staging areas prior to on-site placement for beneficial reuse within the Project area. Excess materials will not be stockpiled on-site once the Project is complete. If on-site beneficial re-use is not feasible, the contractor will haul additional excess materials off site for beneficial re-use, recycling, or legal disposal.

All construction activities will be accompanied by both temporary and permanent erosion and sediment control BMPs. Project construction will include the following activities:

- Clearing and grubbing to clear vegetation and brush from Project work areas and to construct Project features;
- grading throughout the Project area;
- excavation throughout the Project area to remove and place material, upgrade infrastructure, complete in-channel and channel-adjacent construction, modify floodplain surfaces, and place large wood;
- hauling to transport sediments and materials;
- revegetation of temporary and permanently impacted areas; and
- installation of erosion control measures.

Following construction, coffer dams and other structures used during dewatering will be removed and the temporary diversion site remediated to pre-Project conditions.

3.4 Dewatering and Fish Relocation

A Dewatering and Fish Relocation Plan will be developed with detailed methodology for dewatering channels, handling aquatic species, and relocation of aquatic species. Fish and wildlife removal and relocation will occur by qualified biologists following requirements from the CDFW and the National Marine Fisheries Service (NMFS).

3.5 Placement of RSP

Rock slope protection (RSP) will be necessary to support the design in key locations, summarized in Table 3-1 at the request of the California Coastal Commission. Quantities may adjust slightly as the design progresses, such as to account for access crossing upgrades to the Mid-Valley parcel.

Table 3-1. Rock Slope Protection Summary. Quantities may adjust slightly during design finalization or as directed during construction by the on-site engineer.

Location and Purpose	In/Out of Coastal Zone	Approx. Quantity (Cubic Yards)
Lower Swain: Scour protection of new culvert	In	80
Lower Swain: Scour protection of new tide gate on south side of Pine Hill Road	In	120
Lower Swain: Scour protection of new tide gate on north side of Pine Hill Road	In	130
Lower Swain: Scour protection of new culvert draining property through eco levee	In	90
Confluence: Scour protection of upgraded tide gate at new location through eco levee	In	180
Confluence: Scour protection of culvert through railroad grade/farm road	In	80
ERWA S: Scour protection of upgraded tide gates near entrance to ERWA from Pine Hill Road	In	1,970
ERWA S : Scour protection of new tide gates through eco levee and public access trail at the south end of ERWA S	In	720
Relic Swain: Scour protection of upgraded culvert at farm road crossing	In	100
Relic Swain: Scour protection of upgraded culvert at farm road crossing	In	90
Relic Swain: Scour protection of existing tide gate follow retrofit for a side hinge tide gate.	In	70
Relic Swain: Scour protection of new tide gate at Elk River Road	In	100
Lower Spruce: Scour protection of upgraded and relocated tide gate	In	130
Lower Spruce: Grade control at pond outlet to prevent downcutting and draining of the pond	In	20
Upper Spruce: Grade control and bank protection of channel	Out	670
Upper Spruce: Scour protection of new farm bridge	Out	160
Lower Orton: Scour protection of bank and tide gate following retrofit of tide gate with side hinge gate	In	570
Mid-Orton: Scour protection of upgraded culvert at public access	In	100
Mid-Orton: Scour protection of bridge abutments	In	220

Location and Purpose	In/Out of Coastal Zone	Approx. Quantity (Cubic Yards)
Upper Orton: Farm road armoring at crossing	Out	140
Upper Orton: Farm road armoring at crossing	Out	140
Upper Orton: Farm road armoring at crossing	Out	140
Upper Orton: Farm road armoring at crossing	Out	140
Upper Orton: Scour protection of abutments at new bridge crossing of Orton Creek	Out	220
Upper Orton: Scour protection of abutments at new bridge crossing of Orton Creek	Out	130
Upper Orton: Scour protection of gas Line	Out	20
Upper Orton: bank protection at Orton Creek channel realignment	Out	50
Upper Orton: bank protection at Orton Creek channel realignment	Out	50
ERWA N: Scour protection of retrofitted tide gate at Hwy 101.	In	50
Total		**6,680**

4 PERMITS AND REGULATORY REQUIREMENTS

CEQA will be completed through CDFW's Statutory Exemption for Restoration Projects (SERP) process. The following permits and regulatory requirements have been identified as applicable to PA1 (Table 4-1).

Table 4-1. PA1 permit requirements.

Regulatory Agency	Law / Regulation	Permit / Authorization Type
United States Army Corps of Engineers (USACE)	• Clean Water Act (CWA) Section 404 • Rivers and Harbors Act Section 10	• Individual or Nationwide Permit, TBD • Section 10 Compliance
US Fish and Wildlife Service (USFWS)	• Federal Endangered Species Act (FESA)	• Statewide Restoration Programmatic Biological Opinion issues in conjunction with USACE Section 404 compliance
National Marine Fisheries Service (NMFS)	• FESA	• Individual Consultation, Biological Opinion issued in conjunction with USACE Section 404 compliance
California Coastal Commission (CCC)	• Coastal Act	• Consolidated Coastal Development Permit
North Coast Regional Water Quality Control Board (RWB)	• CWA Section 401	• 401 Water Quality Certification issued through the Statewide Restoration General Order
California Department of Fish and Wildlife (CDFW)	• Fish and Game Code (F&G Code) Section 1600 • California Endangered Species Act (CESA) (F&G Code Section 2081[b])	• Restoration Management Permit (RMP)/Fish & Game Code (FGC) 1670 (combined Lake and Streambed Alteration Agreement and California Endangered Species Act coverage)
State Historic Preservation Officer (SHPO)	• National Historic Preservation Act (NHPA) Section 106	• Consultation in conjunction with USACE Section 404 compliance.
Humboldt Bay Harbor Recreation and Conservation District	• State Lands Commission deferred jurisdiction over tidelands and submerged lands of Humboldt Bay	• Shoreline Development Permit
Humboldt County	• County Code	• County Grading and Floodplain Management Permit. • Special Permit to construct in the Streamside Management Area. • Use Permit for restoration activities in the Coastal Zone.
Humboldt County	• Federal Code of Regulations Title 44 Emergency Management and Assistance	• Will require a Memo to the Humboldt County Floodplain Administrator stating the Project will not increase base flood elevations.

5 POST-CONSTRUCTION OPERATIONS

5.1 Regulatory and Performance Monitoring

The Elk River Recovery Plan will result in short-term impacts to the channel bed and banks, wetland and riparian habitat, listed salmonids, and agricultural lands. Compliance with CEQA, NEPA, ESA, and other applicable federal, state, and local regulatory statutes will require reporting of short-term impacts to these resources. A targeted, objective-driven monitoring program was developed to track the net balance of measurable short-term impacts and longer-term outcomes during each phase of Project implementation. The *Elk River Estuary PA1 Vegetation and Aquatic Resources Monitoring Plan (Monitoring Plan)* presents the monitoring program developed to evaluate the effectiveness of Project actions at achieving Stewardship Program objectives. This monitoring plan includes the anticipated required regulatory monitoring and reporting obligations as a condition of agency approvals and non-regulatory performance monitoring that will be conducted as funding is available.

5.2 Maintenance

Ongoing maintenance may be necessary for constructed features in PA1. Maintenance activities will be prioritized and implemented based on the monitoring outcome. Specific monitoring activities will generally include observations of physical character of the site and plant species to determine whether Project objectives have been met. The frequency of monitoring will be determined during Project permitting and will be subject to available funding.

5.2.1 Invasives

Targeted invasive plant species will be treated (suppressed and/or removed) in combination with restoration and enhancement of native riparian and wetland vegetation. The Project's *Invasive Plant Management Plan* (Stillwater Sciences 2025a) presents the invasive plant management strategy, the targeted invasive plant list, frequency and distribution of targeted invasives, schedule for phased management, and inclusion of best management practices during access, maintenance, and construction activities (see Section 2.2.1 for additional detail). Long-term invasive plant maintenance recommendations are also provided in the *Invasive Plant Management Plan*. Invasive plant maintenance during the regulatory monitoring and reporting period are further discussed in the *Monitoring Plan.*

5.2.2 Public Access Facilities

The ERWA is currently open to public access and hunting. This Project will increase public access and user types across all ERWA parcels. All regulations and management approaches will follow CDFW land management policies for wildlife refuges. CDFW will maintain the public access amenities on an as-needed basis. The non-motorized boat launch on APN 305-021-006 will be maintained by the landowner or CalTrout. CDFW may close the ERWA at their discretion, if requested by the Wiyot-affiliated tribes for ceremonial activities.

5.2.3 Water Control Structures and Eco-levees

Maintenance of water control structures and constructed eco-levees will largely be routine and on an as-needed basis, including observations of physical character, repair from erosion or burrowing animal damage, cleaning debris and sediment from drainage ditches and flood gates, and removing invasive vegetation and re-planting native species.

6 REFERENCES

Barnhart, R.A. 1992. The Ecology of Humboldt Bay, California: An Estuarine Profile. U.S. Fish and Wildlife Office, Arcata, CA.

Cal-IPC (California Invasive Plant Council). 2025. The Cal-IPC inventory. https://www.cal-ipc.org/

California Native Plant Society (CNPS). 2025. Manual of California Vegetation, online edition.

California Trout, Stillwater Sciences, and Northern Hydrology and Engineering. 2019. Elk River Recovery Assessment: Recovery Framework. Prepared by California Trout, Arcata, California; Stillwater Sciences, Arcata, California; and Northern Hydrology and Engineering, McKinleyville, California for North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Stillwater Sciences, Northern Hydrology & Engineering, and GHD. 2022. Elk River Watershed Stewardship Program: Sediment Remediation and Habitat Rehabilitation Recovery Plan. Prepared by California Trout, Arcata, California; Stillwater Sciences, Arcata, California; Northern Hydrology & Engineering, McKinleyville, California; and GHD, Eureka California, for the North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Northern Hydrology and Engineering, and Stillwater Sciences. 2023. Elk River Planning Area 1: 10% Design Report. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; and Stillwater Sciences, Arcata, California. https://caltrout.org/wp-content/uploads/2019/05/PA1-Design-Report_Master.pdf

Humboldt County Weed Management Area. 2010. Invasive Weeds of Humboldt County: A Guide for Concerned Citizens (2nd Edition). Arcata, California.

J.B. Lovelace & Associates. 2024. 2023 Annual Habitat Monitoring Report Salt River Ecosystem Restoration Project, Humboldt County, California. Prepared by J.B. Lovelace & Associates, Covelo, California for the Humboldt County Resource Conservation District, Eureka, California.

Laird, A. 2007. Historical Atlas of Humboldt Bay and Eel River Delta. Humboldt Bay Harbor, Recreation and Conservation District, Eureka CA

Loudon, Dylan. 2015. Analysis of Coastal Wetland Geography and Policy in Humboldt Bay: Adapting Wetland Policies for a Changing Climate.

North Coast Regional Water Board (NCRWB). 2015. Watershed information: Eureka Plain, Website: https://www.waterboards.ca.gov/northcoast/water_issues/programs/watershed_info/eureka_plain/

NMFS. 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Oncorhynchus kisutch). National Marine Fisheries Service. Arcata, California.

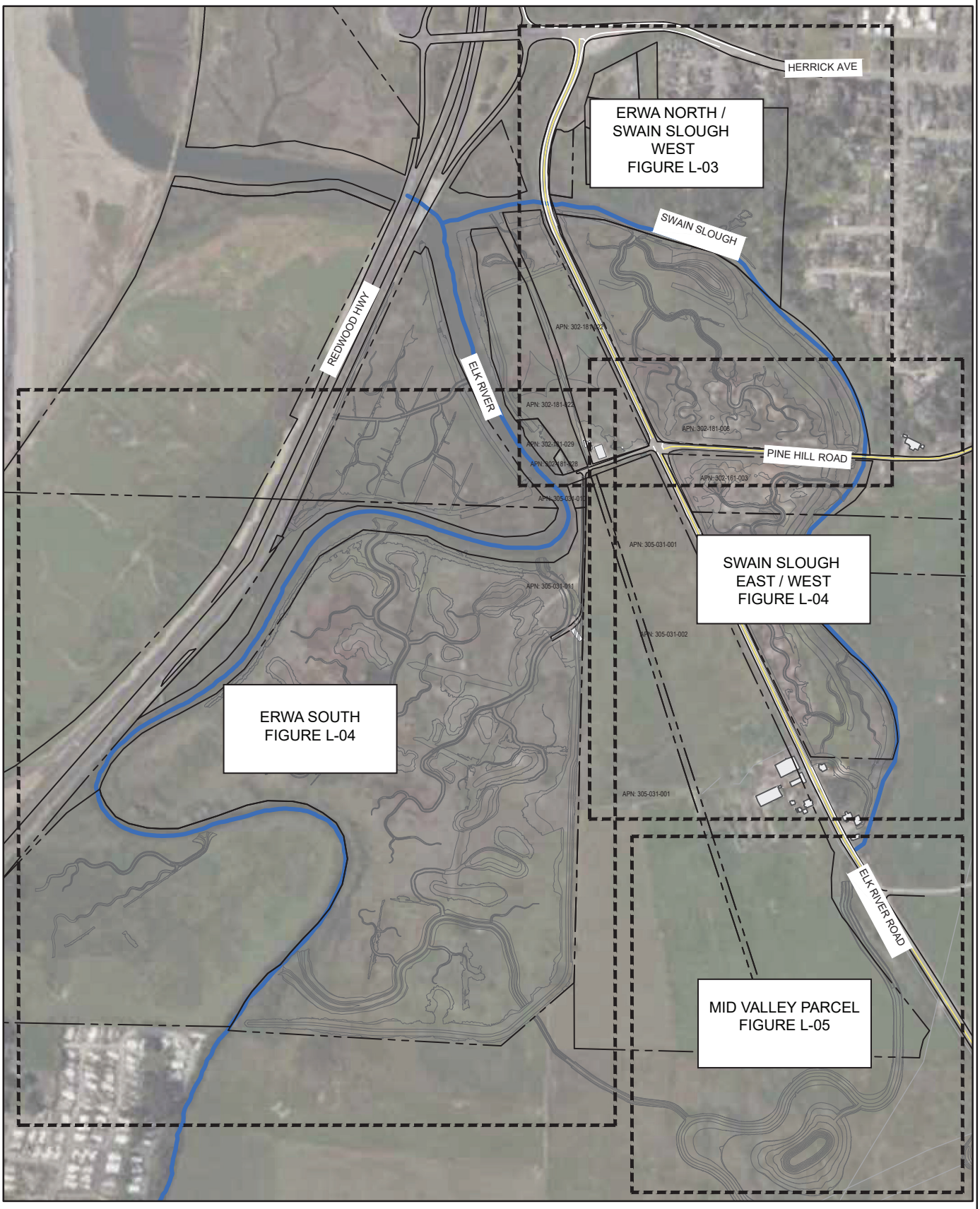
Stillwater Sciences. 2025a. Elk River Estuary (Planning Area 1) Restoration Project: Invasive Plant Management Plan. Draft Technical Report. Prepared by Stillwater Sciences, Arcata, California for CalTrout, Arcata, California.

Stillwater Sciences. 2025b. Biological Resources Evaluation for the Elk River Estuary (Planning Area 1) Restoration Project. Draft Technical Report. Prepared by Stillwater Sciences, Arcata, California for CalTrout, Arcata, California.

Wallace, K .J., J. C. Callaway, and J. B. Zedler. 2005. Evolution of tidal creek networks in a high sedimentation environment: A 5-year experiment at Tijuana Estuary, California. Estuaries 28: 795–811.

William Rich and Associates. 2023. A Cultural Resources Investigation for the Elk River Watershed Stewardship Program: Sediment Remediation and Habitat Rehabilitation Recovery Plan. Humboldt County, California.

Attachment 1
Public Access Design Overview



CONCEPTUAL - NOT FOR CONSTRUCTION

N

0 650' 1300'

GHD

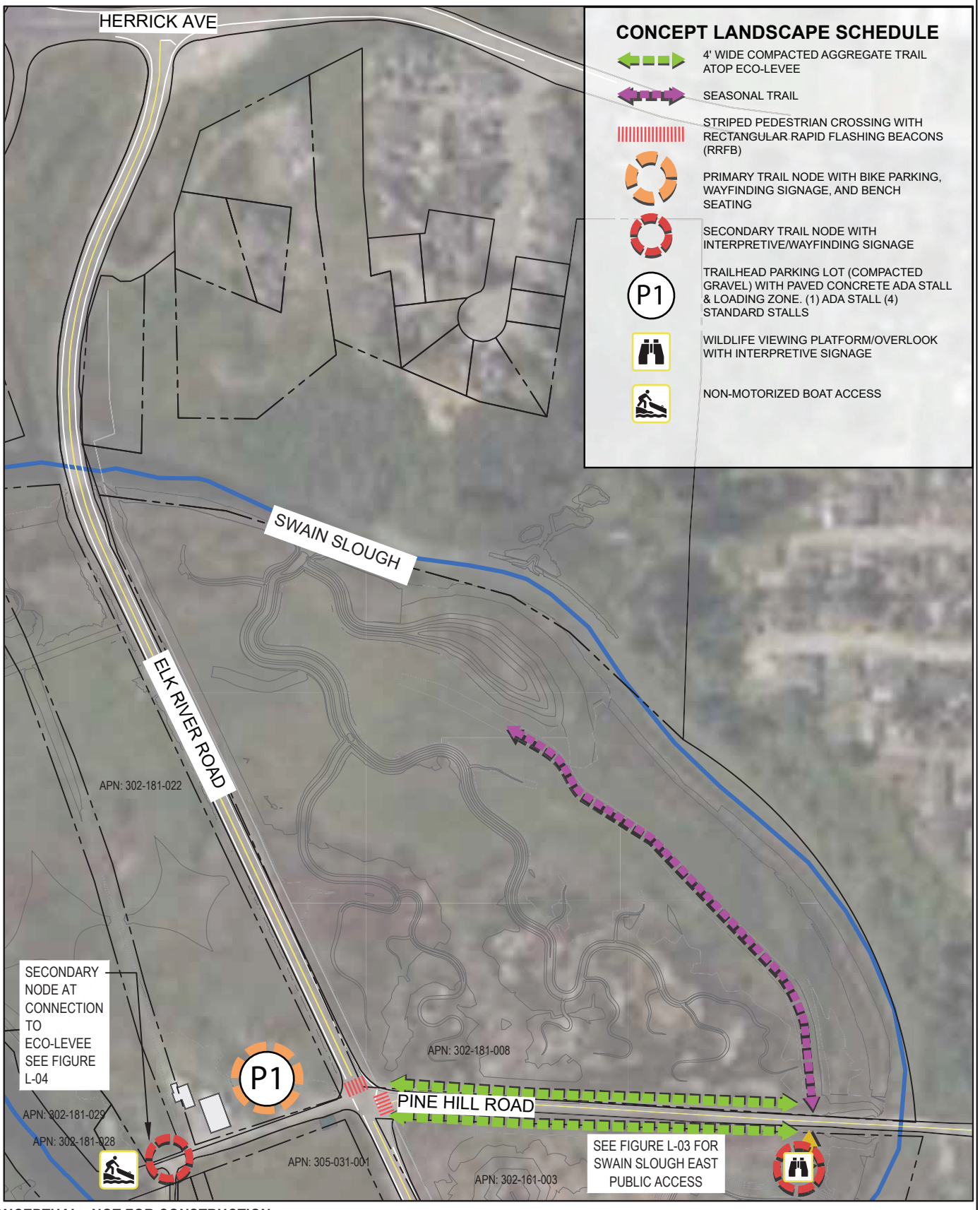
CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND HABITAT REHABILITATION PROJECT

EXISTING CONDITIONS AND KEY MAP

Project No. **12624303**
Date **July 8**

FIGURE L-01

Filename: \\ghdnet\ghd\US\Eureka\Projects\561\12624303\Digital_Design\ACAD 2022\Sheets\Archive\04242025\12624303_LandscapeFigures_ sh.dwg
Plot Date: 02 October 2025 12:03 PM



CONCEPTUAL - NOT FOR CONSTRUCTION

N

0 250' 500'

GHD

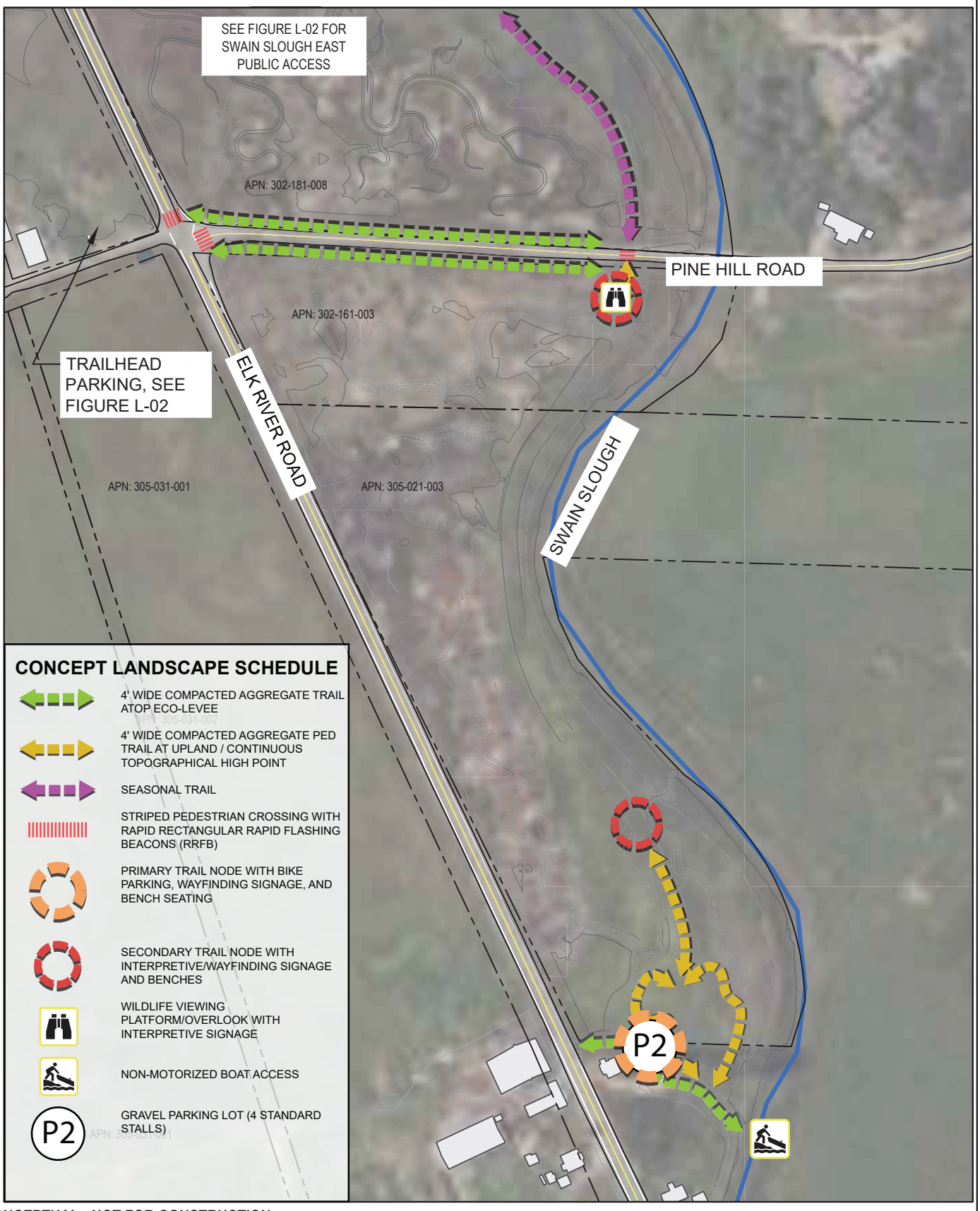
CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND HABITAT REHABILITATION PROJECT

ERWA NORTH/ SWAIN SLOUGH WEST - PUBLIC ACCESS EXHIBIT

Project No. **12624303**
Date **October 2**

FIGURE L-02

Filename: \\ghdnet\ghd\US\Eureka\Projects\561\12624303\Digital_Design\ACAD 2022\Sheets\Archive\04242025\12624303_LandscapeFigures_ sh.dwg
Plot Date: 02 October 2025 12:07 PM



CONCEPTUAL - NOT FOR CONSTRUCTION

N

0 250' 500'

GHD

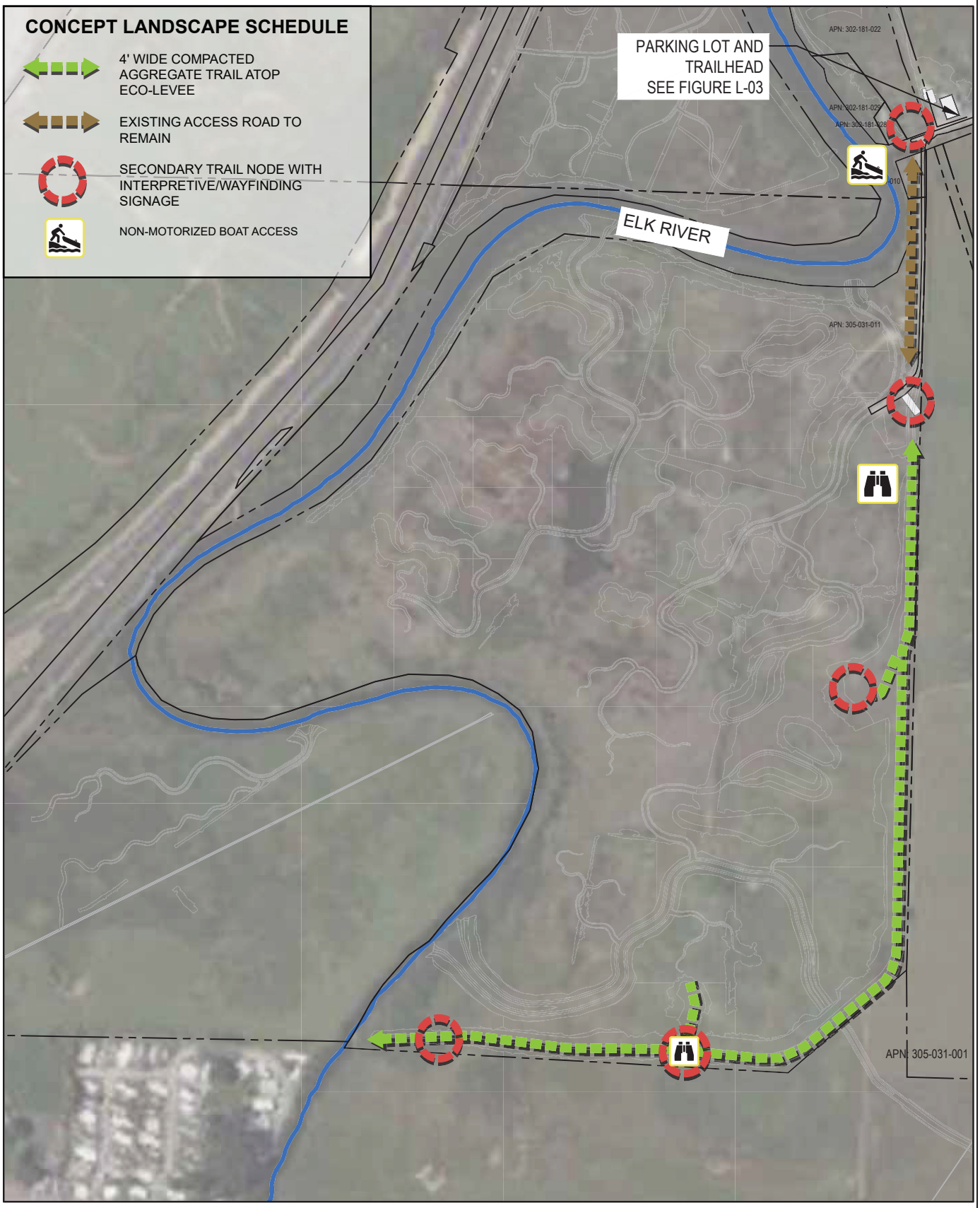
CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND HABITAT REHABILITATION PROJECT

SWAIN SLOUGH EAST/WEST - PUBLIC ACCESS EXHIBIT

Project No. **12624303**
Date **October 2**

FIGURE L-03

Filename: \\ghdnet\ghd\US\Eureka\Projects\561\12624303\Digital_Design\ACAD 2022\Sheets\Archive\04242025\12624303_LandscapeFigures_ sh.dwg
Plot Date: 02 October 2025 12:13 PM



CONCEPTUAL - NOT FOR CONSTRUCTION

N

0 400' 800'

GHD

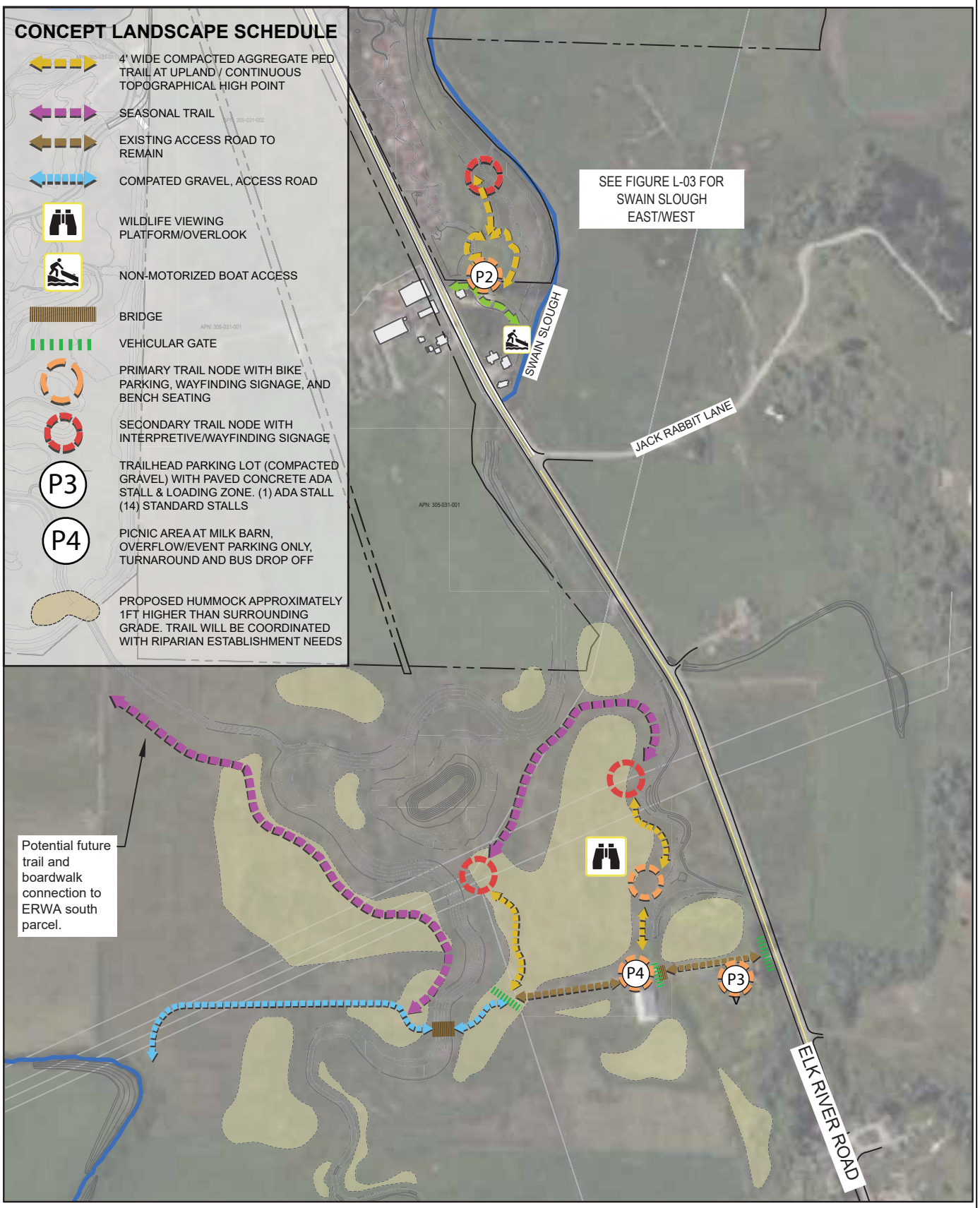
CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND HABITAT REHABILITATION PROJECT

ERWA SOUTH - PUBLIC ACCESS EXHIBIT

Project No. **12624303**
Date **October 2**

FIGURE L-04

Filename: \\ghdnet\ghd\US\Eureka\Projects\561\12624303\Digital_Design\ACAD 2022\Sheets\Archive\04242025\12624303_LandscapeFigures_ sh.dwg
Plot Date: 02 October 2025 12:10 PM



CONCEPTUAL - NOT FOR CONSTRUCTION

N

0 500' 1000'

GHD

CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND HABITAT REHABILITATION PROJECT

MID VALLEY - PUBLIC ACCESS EXHIBIT

Project No. **12624303**
Date **October 2**

FIGURE L-05

Filename: \\ghdnet\ghd\US\Eureka\Projects\561\12624303\Digital_Design\ACAD 2022\Sheets\Archive\04242025\12624303_LandscapeFigures_ sh.dwg
Plot Date: 02 October 2025 12:12 PM

Attachment 3

Biological Resources Evaluation

FINAL TECHNICAL REPORT ◦ OCTOBER 2025

Biological Resources Evaluation for the Elk River Estuary (Planning Area 1) Restoration Project

PREPARED FOR

California Trout
1380 9th Street
Arcata, CA 95521

PREPARED BY

Stillwater Sciences
850 G Street, Suite K
Arcata, CA 95521

Stillwater Sciences

Suggested citation:
Stillwater Sciences. 2025. Biological Resources Evaluation for the Elk River Estuary (Planning Area 1) Restoration Project. Final Technical Report. Prepared by Stillwater Sciences, Arcata, California for California Trout, Arcata, California.

Cover photos (clockwise from top left): View of a special-status plant *Carex lyngbyei* (Lyngbye's sedge) population along Elk River channel banks; muted tidal drainage in Elk River Wildlife Area South; shore bird evidence within muted tidal marsh plain along Swain Slough; and eelgrass beds, a sensitive natural community, within Swain Slough's main channel.

Table of Contents

Tables

Figures

Appendices

1 INTRODUCTION

1.1 Report Background

The Elk River Planning Area 1 (PA 1) Restoration Project (Project) is focused on one of four planning areas described in the Elk River Recovery Plan (CalTrout et al. 2022) as part of the Elk River Stewardship Program. In 2023, the Elk River Estuary Recovery design team (California Trout [CalTrout], Northern Hydrology and Engineering [NHE], Stillwater Sciences, and GHD) produced the *Elk River Planning Area 1 10% Design Report* that presented an initial biological resource and baseline condition assessment within Elk River's PA 1 to inform on early design development (i.e., reach-specific goals and objectives, identify opportunities and constraints, and develop habitat enhancement design concepts). Initial studies summarized in the 10% design report included: geomorphology, hydrology and water quality, fish utilization and habitat characterization, vegetation, wetlands, and land use (CalTrout et al. 2023). The PA 1 restoration design has since progressed towards 65% design and restoration actions have been further refined and developed as presented in the *Elk River Estuary (Planning Area 1) Restoration Project: Project Description* (CalTrout et al. 2025).

1.2 Project Location

Elk River's PA 1 encompasses the lower-most reaches of the Elk River mainstem at the downstream end of the Elk River valley (Figure 1-1). PA 1 includes 5.3 miles of channel length including Elk River and Swain Slough and spans 857 acres (ac) of former tidal and brackish wetlands, riparian forest, and prairie grasslands; it was historically interspersed with mixed conifer forest stands. The western edge of PA 1 is bordered by US Highway 101 (Hwy 101), although this is an artificial boundary; there are additional tidal wetlands on the west side of Hwy 101 owned by the City of Eureka that were hydraulically interconnected with PA 1 but are currently separated by Hwy 101. City of Eureka tidal wetlands north of PA 1 have undergone restoration and the construction of the Elk River Hikshari' Trail and are not part of the Stewardship Program. PA 1 is generally bounded to the south-west by the Elk River itself and to the north-east by Swain Slough and Elk River Road. The Elk River – Swain Slough confluence is at the downstream end of PA 1, just upstream of Hwy 101 at Station 7800; PA 1 extends up the sinuous Elk River to Showers Road. The total length of the channel, including Elk River and Swain Slough is 20,500 feet [ft] or 3.8 miles. Martin Slough branches off Swain Slough but is not considered part of the Stewardship Program.

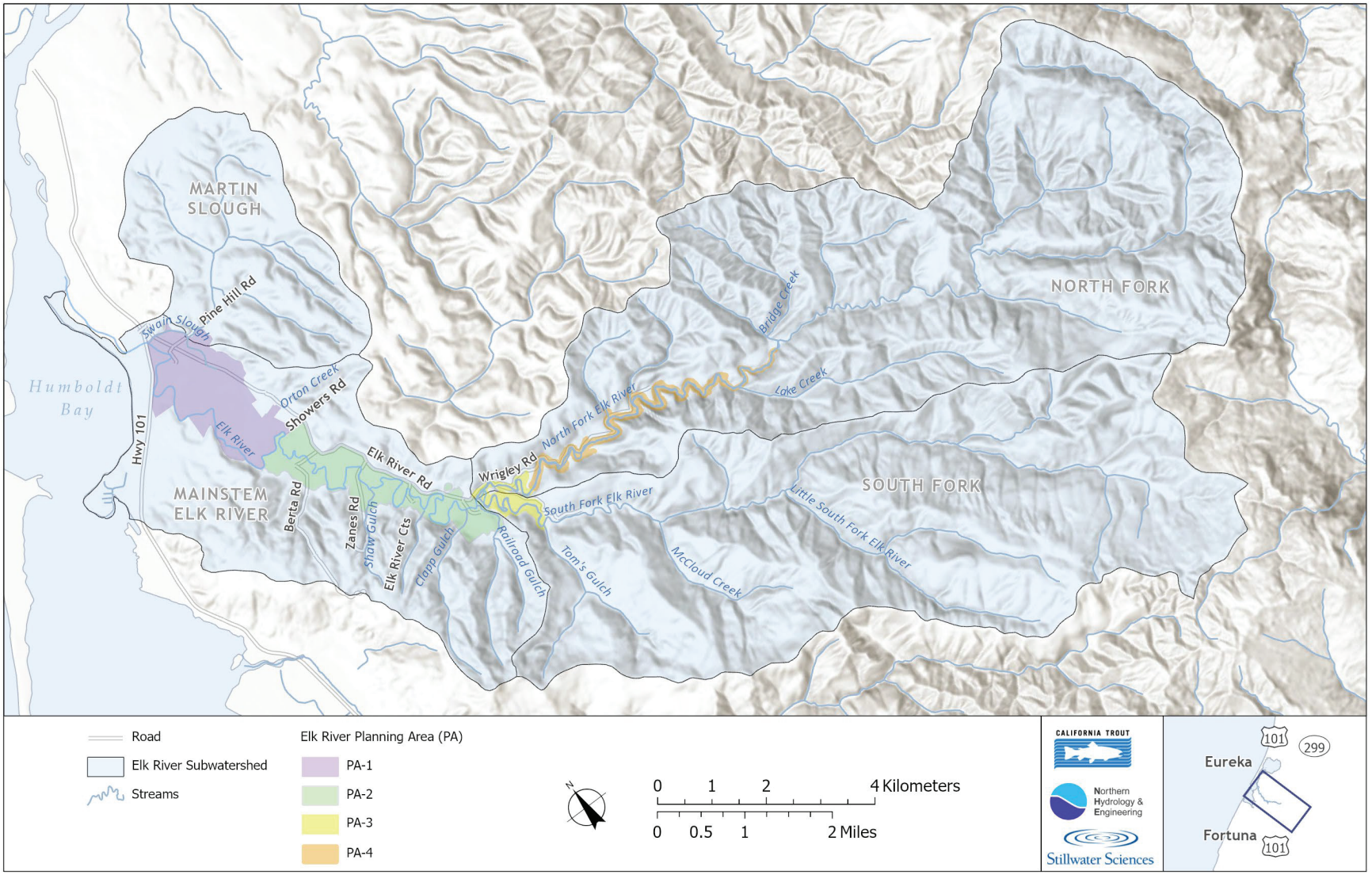


Figure 1-1. Vicinity map of Planning Area 1 and overview of the Elk River Stewardship Program area.

1.3 Project Overview

The Project Team has developed engineering designs to restore natural tidal and fluvial drainage patterns within the 857-acre planning area. PA 1 has eleven distinct subareas as presented in Figure 1-2. These subareas general align with former designations labeled Areas of Interest A–H that have been used to describe hydraulic conditions in earlier Project reports. The Project restoration scope includes the following elements:

- Remove and/or upgrade drainage infrastructure;
- Reduce or remove levees;
- Breach an abandoned railroad grade;
- Restore tidal sloughs and tidal creek channels and their connectivity to mainstem channels;
- Create backwater features for seasonal waterfowl and winter salmonid rearing habitat (primarily for federally listed coho salmon);
- Manage invasive vegetation;
- Expand native plant communities;
- Recontour portions of the floodplain to guide winter flood-flows across the floodplain and back into the slough channel network toward suitable aquatic habitat; and
- Public access facilities

The PA 1 site will provide a large area of highly productive slough-like habitat; fish will be able to move into tidal channels during higher tides, finding refugia and rearing in slower moving water and feeding on abundant food at the edges of tidal channels or entrained in water leaving the marsh plain. Reconnection of Orton Creek to Swain Slough in a subsequent construction phase that will enhance migratory pathways to this Project's restored habitats and provide stream-estuary ecotone habitat for juvenile salmonid winter rearing. A restored marsh will also provide habitat and food resources for other focal species, including longfin smelt, tidewater goby, and an abundance of marine species. Finally, this Project would connect other recently restored Elk Estuary habitats, including restoration completed in Martin Slough (funded in part by NOAA Restoration Center and California Coastal Conservancy) and the City of Eureka in lower Elk River (funded by United States Fish and Wildlife Service, National Fish and Wildlife Foundation, and the State Coastal Conservancy). The expected benefits to Elk River ecosystems would be substantial, including expansion and enhancement of fish rearing habitat in Swain Slough and increased longevity of salt marsh habitats through increased resilience to sea level rise.

Restoration actions will establish a full tidal prism in large portions PA 1 that will promote the recovery of estuarine sensitive natural communities. Constructed tidal channel networks throughout PA 1 will expand suitable habitat for the sensitive *Zostera marina* Association (eelgrass beds) observed in Swain Slough. Expansion of Orton Creek and revegetation within the Elk River floodplain will create perennial waters and sensitive aquatic and riparian habitats, as well as enhance existing brackish and freshwater marsh and coastal grassland communities that collectively form a functional stream to estuary ecotone beneficial to fish and wildlife. Riparian and coastal scrub planting will further enhance and expand existing forest and shrubland plant communities throughout PA 1 that will improve riparian function and generate more diverse wildlife habitat along the wetland to upland ecotone. Measures that will be implemented to avoid and minimize impact on sensitive biological resources within PA 1 during Project activities are detailed in Section 1.5.

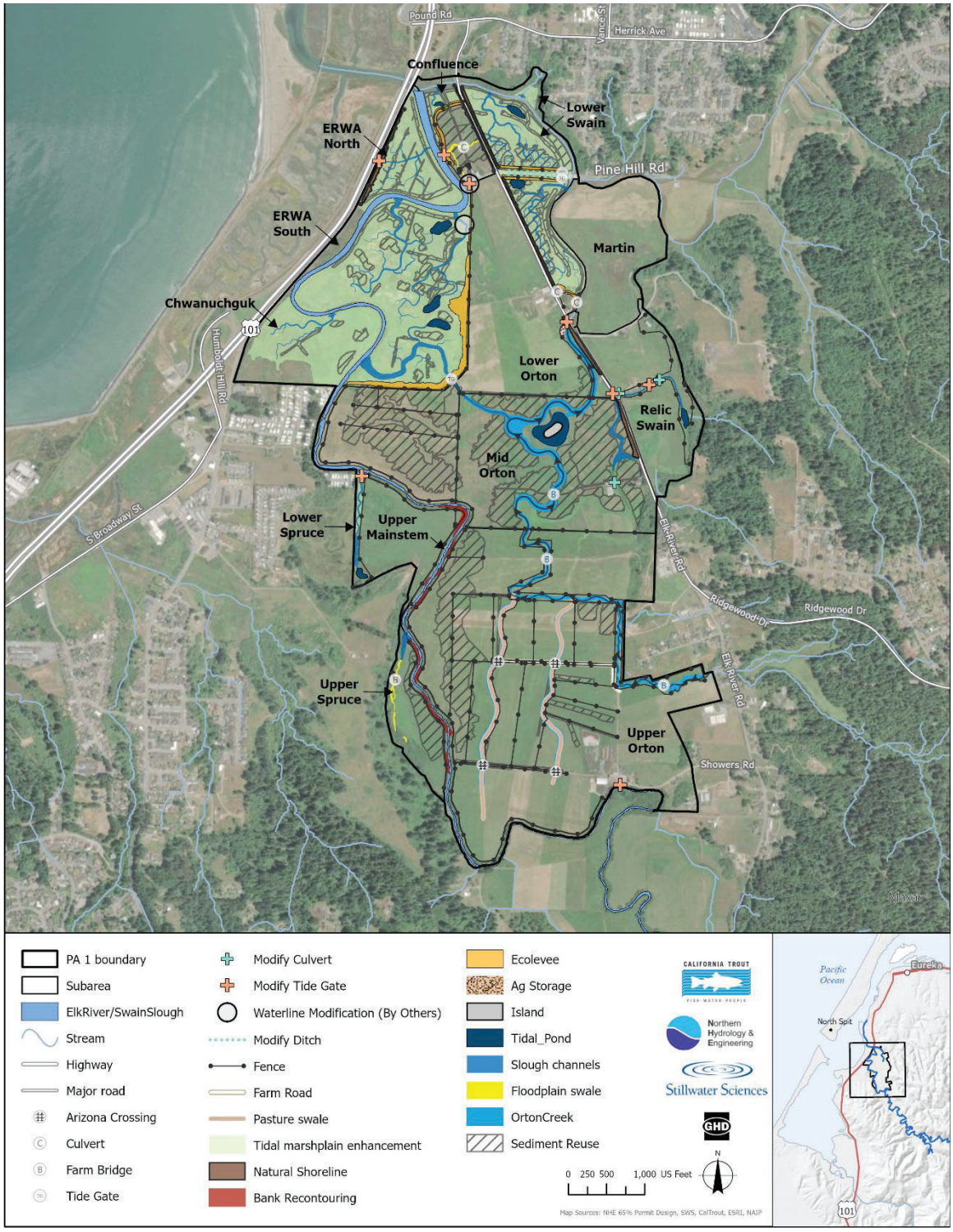


Figure 1-2. Overview of Planning Area 1 design enhancement actions.

1.4 Report Purpose

The purpose of this report is to present the latest results of the biological resource desktop assessments and field surveys which were conducted to characterize biological resources that occur or may occur within the Elk River PA 1; these results will inform design opportunities and constraints and provide baseline information for the regulatory review process. It presents the following: (1) vegetation characterization and floristic survey results documenting the presence of any special-status plant species[1] or sensitive natural communities[2] within PA 1, (2) potential for habitat recorded in PA 1 to support special-status wildlife, and/or fish species[3], and (3) avoidance and minimization measures to reduce potential adverse impacts on biological resources in PA 1 by restoration activities. A separate report, *Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project* (Stillwater Sciences 2025a), describes the preliminary jurisdictional Waters of the U.S and State.

1.5 Project Avoidance and Minimization Measures

Avoidance and minimization measures will be employed during Project construction activities (i.e., site preparation, invasive plant management, grading and earthwork, revegetation) to protect biological resources including special-status plant species, sensitive natural communities, and special-status fish and wildlife as follows:

- **BOT-1: Special-status Plants.** All special-status plant species documented with the graded construction footprint will be salvaged and/or its seed harvested. The planting contractor will reseed and/or translocate salvaged plant material to designated areas determined to provide suitable site conditions for the species as directed by a qualified botanist. All other occurrences will be flagged by a qualified botanist and avoided to the extent possible.
- **BOT-2: Sensitive Natural Communities/Native Vegetation.** Ground disturbance and vegetation clearing and/or trimming will be confined to the minimum amount necessary to facilitate Project implementation. If possible, viable native plants within the Project design footprint will be salvaged for reuse and relocated at suitable elevation grades during the revegetation stage of construction.
- **BOT-3: Invasive Plant Control.**
    - Measures to prevent the spread of invasive weeds and pathogens will be taken, including, where appropriate, inspecting equipment for soil, seeds, and vegetative matter; cleaning equipment; utilizing weed-free materials and native seed mixes for revegetation; and disposing properly of soil and vegetation.

[1] Special-status plant species are defined as those species listed, proposed, or under review as endangered or threatened under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); listed as rare under the California Native Plant Protection Act; and/or included on California Department of Fish and Wildlife's (CDFW) most recent *Special Vascular Plants, Bryophytes, and Lichens List* with a California Rare Plant Rank (CRPR) of 1, 2, 3, or 4 (CDFW 2025c).

[2] Sensitive natural communities are defined as those natural community types with a state ranking of S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) as listed in the most recent *California Sensitive Natural Community List* (CDFW 2025d).

[3] Special-status wildlife and fish species are defined as species: listed, proposed, or under review as endangered or threatened under ESA or CESA; designated as a species of special concern by CDFW; designated as Fully Protected under the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515); and/or protected under the federal Bald and Golden Eagle Protection Act.

  - Invasive plant material from Project construction activities will be disposed of as described in the *Elk River Estuary (Planning Area 1) Restoration Project: Invasive Plant Management Plan* (*PA 1 Invasive Plant Management Plan*) (Stillwater Sciences 2025b).
  - Any imported fill material, soil amendments, gravel, or other material required for construction or restoration activities that will be placed within the upper 12 inches of the ground surface will be certified free of weed seeds and plant material.
  - To minimize the spread of plant pathogens that can reduce plant establishment success, nursery stock procured for revegetation efforts will be sourced from plant nurseries that follow best management practices to produce clean nursery stock free of Phytophthora and other soilborne disease. Standard BMPs are available online at: http://phytosphere.com/BMPsnursery/Index.htm

- **AQU-1: Aquatic eelgrass bed.**
  - Disturbance in and adjacent to eelgrass beds may be required to connect new tidal channels to the mainstem Elk River or Swain Slough and removal of channel adjacent berms. Disturbance will be limited to the minimum necessary.
  - If used during construction, a barge positioned in open water will avoid grounding or anchoring in eelgrass habitat if feasible.
  - Construction activities will avoid shading established eelgrass beds for long periods of time (i.e., greater than 12 hours daily).
  - If necessary, a floating surface boom will be positioned to capture any floating surface debris in open waters.
- **AQU-2: Work window for fish.** To protect the most vulnerable life stages of special-status fish species with the potential to occur within PA 1, all in-channel work will be restricted to the permitted in-water work period between **June 15 and October 15**. Work extensions may be requested from regulatory agencies through October 31, pending weather. This seasonal work window correlates to the period of the year when special-status fish species are least likely to occur within PA 1.
- **AQU-3: Fish.** Measures to protect all special-status fish during construction activities will comply with the NMFS Biological Opinion and USFWS Statewide Restoration Programmatic Biological Opinion.
- **WIL-1: Wildlife**
  - Injured wildlife will be transported to the nearest wildlife rehabilitation facility (Humboldt Wildlife Care Center near Arcata, California), at the discretion of the monitoring biologist.
  - All trash and waste items (including microtrash) generated by Project activities will be properly contained and removed from the work area at the end of each workday to prevent attracting wildlife.
  - Trenches, holes, or open ends of pipes will be covered, equipped with escape ramps, or elevated to a minimum of three feet above the ground if left overnight. Open trenches or holes will be inspected for trapped wildlife every morning prior to work. If any wildlife species are documented, and have the potential to be affected, the qualified wildlife biologist will be notified immediately.
- **WIL-2: Amphibians/Reptiles**
  - **Northwestern pond turtle:** Measures will comply with the USFWS Programmatic Biological Opinion.

- **Work window and pre-construction surveys for northern red-legged frog.** Modification of waterways and wetlands with standing water that have the potential to support northern red-legged frog breeding will be limited to the period of the year between **June 15 and October 31** to avoid disturbance to breeding northern red-legged frogs, **or a biologist will surveys suitable habitat** prior to disturbance to confirm no individuals and egg masses are present during the initiation of Project construction or, if present, relocate individuals and egg masses to nearby suitable habitat and/or implement a no-disturbance buffer until the threat on the species has lifted. For construction activities within suitable habitat **outside of the breeding period (November 1 through June 14) will also be surveyed** in a similar manner. If Project construction activities at a given location cease for more than seven consecutive days, and there is potential for special-status species to reoccupy habitat at that site, the biologist will resurvey the area prior to resuming construction.

- **WIL-3: Birds**
  - **Pre-construction bird nesting survey.** For areas where ground disturbance, vegetation removal, and/or structure modification/removal occurs during the **bird breeding season (March 15–August 15)** a pre-construction bird nest survey will be conducted. Surveys will occur within 7 days of the activity, and if construction activities at a given location cease for more than **7 days** during the breeding season, and there is potential for special-status species to reoccupy habitat at that site, the biologist will **resurvey** the area prior to resuming construction activities. If active nests (nests containing eggs or young) protected by the Migratory Bird Treaty Act are identified, a no-disturbance buffer zone will be established around the nest using flagging, fencing, and/or signage as appropriate. The buffer will be determined by a qualified biologist in coordination with CDFW based on site-specific topography, ambient conditions, and sensitivity of the bird, typically ranging from 50 to 500 feet, depending on the species. No construction activities will occur within the buffer zone until a qualified biologist has determined that the young have fledged or that construction activities within the buffer zone are not disturbing the nesting birds.

- **WIL-4: Bats**
  - **Tree removal.**
    - Prior to tree removal, a bat biologist will conduct a **bat habitat assessment** to identify trees with high-quality crevice-roosting habitat (e.g., tree cavities, basal hollows, loose or peeling bark, larger snags) to be retained, when feasible.
    - **If a *high-quality roost tree* will be removed during the maternity season (May 1 through August 31) and/or torpor season (November 1 through March 31),** a biologist will assess the potential for a day roost through visual inspection or emergence survey. If a colony is documented, then the tree will not be felled until the colony has left. If a survey or inspection is infeasible due to existing site conditions, a biologist will recommend site-specific means to modify and disturb the habitat to allow bats, if present, to wake and leave the roost prior to tree felling. These disturbances may include (1) modifying habitat conditions such as removing smaller non-habitat trees at least a day prior to removing habitat trees; (2) creating a vibrational disturbance over the course of a few minutes with a chainsaw, knocking the tree with a sledgehammer, using equipment to shake the tree, or removing the tree in pieces (sections or limbs) over the course of a few days; (3) changing the structure of the potential roost by lifting bark to modify temperature, wind, light, and precipitation; and/or (4) using ultrasound deterrents.

    - **If a *high-quality roost tree* is removed outside of the sensitive maternity and/or torpor season,** then a contractor will create a vibrational disturbance over the course of a few minutes prior to removing the tree (as described above) to allow individuals to leave, if present.
  - **Structure removal.** If a structure is to be removed during the maternity season (May 1 through August 31) and/or torpor season (November 1 through March 31), a qualified bat biologist will examine the structure through appropriate day inspection and/or evening emergence survey to confirm no day-roosting bats are present.
- **BIO-1: Environmental Awareness Training.** Prior to the initiation of Project construction activities, a qualified biologist will provide all contractors and equipment operators a worker environmental awareness training to educate them on the environmental resources of the Project. Training will include information about environmental permits for the Project and the consequences of noncompliance. Personnel will be informed regarding the identification, life history, habitat requirements, and avoidance and minimization measures for all special-status species and sensitive natural communities with the potential to occur within or immediately adjacent to the construction footprint. Training will also include information on state and federal laws protecting biological resources. Personnel will be informed of the procedures to follow should special-status species be encountered or disturbed. This training will be conducted prior to construction and provided to any new staff/contractors added during implementation of the Project.
- **BIO-2: Site Practices**
  - Heavy equipment and vehicles will be restricted to existing and designated access roads and staging areas to the extent possible.
  - Construction materials will be stored in designated staging areas.
  - Erosion control measures will be implemented where necessary to reduce sedimentation in wetland areas and waterways. Modifications, repairs, and improvements to erosion control measures will be made as needed to protect water quality. Only non-monofilament, wildlife-safe fabrics will be used.
  - All machinery or heavy equipment that will be entering the wetland areas and waterways will be cleaned of materials deleterious to aquatic life including oil, lubricants, coolants, hydraulic fluid, soil, and other debris. Cleaning of equipment will take place outside of the wetland areas and waterways.
  - Refueling of machinery or heavy equipment, or adding or draining oil, lubricants, coolants, or hydraulic fluids will not take place within waterways, with the exception of portable generators. Generators will be equipped with appropriately sized secondary spill containment devices at all times. Heavy equipment used or stored within wetland areas and waterways will use drip pans or other devices (i.e., absorbent blankets, sheet barriers or other materials) as needed to prevent soil and water contamination. Absorbent pads and spill cleanup kits will be onsite during all refueling activities.
- **BIO-3: A Spill Communication Plan** will be developed by the implementation contractor(s) and implemented if construction activities cause any material hazardous or toxic to aquatic life to enter wetland areas and waterways. Agencies will be consulted regarding clean-up procedures.

2 METHODS

2.1 Vegetation and Special-status Plants

2.1.1 Database queries

A list of special-status plants and sensitive natural communities with the potential to occur within PA 1 was developed by querying the following resources:

- The U.S. Fish and Wildlife Service (USFWS) online *Information for Planning and Consultation* (IPaC) (includes the official species list) (USFWS 2025);
- The California Native Plant Society's (CNPS) online *Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2025b); and
- California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) including Biogeographic Information and Observation System (BIOS) (CDFW 2025a, 2025b).[4]

The CNPS and CNDDB database queries were each based on a search of the USGS 7.5-minute quadrangles in which PA 1 is located (Fields Landing and Eureka), and the surrounding California quadrangles (Tyee City, Arcata North, Arcata South, McWhinney Creek, Hydesville, Fortuna, Ferndale, and Cannibal Island); hereinafter referred to as the Project vicinity. The USFWS query was based on the boundaries of PA 1. Appendix Table A-1 summarizes query results.

2.1.2 Pre-field review

Prior to the field, results of the special-status plant database query (Appendix Table A-1) and sensitive natural community database query (Appendix Table A-2) were reviewed. The following categories were assigned to the special-status plant database query to compile a targeted list of species with potential to occur in PA 1:

- **None:** PA 1 is outside the species' current distributional or elevation range and/or the species' required habitat is lacking from PA 1 (e.g., cismontane woodland).
- **Low:** the species' known distribution and elevation range overlaps with PA 1; however, the species' required habitat is of very low quality or quantity in PA 1.
- **Moderate:** the species' known distribution, elevation range, and required habitat overlap PA 1 and documented occurrences are within five[4] miles of PA 1.
- **High:** the species' known distribution, elevation range, and required habitat overlap PA 1 and documented occurrences are in, or within one mile of, PA 1.

The results of this assessment are presented in Appendix Table A-1. Subsequently the following steps were taken:

[4] BIOS provides a visualization of data in CNDDB plus unprocessed data that has not been incorporated into CNDDB. Sensitive natural communities in CNDDB are legacy data only based on the Holland (1986) classification scheme which has been superseded by the *Manual of California* (MCV; CNPS 2025a) classification scheme. Vegetation mapping data based on MCV is sometimes included in BIOS for visualization with source information on how to obtain the data.

- Key identifying characteristics[5] and life history stages (e.g., bloom time) of the targeted special-status plant species and sensitive natural communities PA 1 were reviewed.
- Survey periods that would coincide with the phenological stage (e.g., flowering or fruiting) during which the special-status plant species are most easily identifiable in the field determined; and
- Field maps of known locations of targeted special-status plants and sensitive natural communities within PA 1 were created.

2.1.3 Field surveys

Vegetation characterization and protocol-level surveys for special-status plant species and sensitive natural communities were conducted on May 12–14, 2021, and July 12–14, 2021. Additional surveys were conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27, May 12 and 26) to update information on special-status plant occurrences and vegetation communities.

Surveys were conducted by qualified botanists with: (1) experience conducting floristic surveys; (2) knowledge of plant taxonomy and plant community ecology and classification; (3) familiarity with the plant species of the area; (4) familiarity with appropriate state and federal statutes related to plants and plant collecting; and (5) experience with analyzing impacts of a project on native plant species and natural communities. The survey followed the methods of the *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996) and *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018).

2.1.3.1 Vegetation mapping

Vegetation community types are distinct plant assemblages with a characteristic appearance (size, shape, spacing) based on their interaction with the landscape (e.g., topography, soils, hydrology, geology, climate, slope, exposure, disturbance, substrate) (CNPS 2025a). These distinct patterns form the basis for habitat classification and description. For this survey effort, vegetation types were defined to the alliance[6]- or more fine-scale associate-level[7] as described in the online edition of *A Manual of California Vegetation* (CNPS 2025a). This standardized vegetation classification follows established protocols that conform with the State of California standard vegetation classification system. Classification was taken to the association level, as opposed to the alliance level, where necessary to verify the presence of sensitive natural communities. Semi-natural stands or alliances characterize a vegetation type that is dominated by invasive, non-native

[5] To familiarize surveyors with key characteristics and natural variation of those characteristics of each special-status plant species, information was obtained through a review of: (1) CNPS (2025b) and CDFW (2025a) data; (2) photographs on CalPhotos (University of California, Berkeley 2025); (3) key characteristics using the online Jepson eFlora (Jepson Flora Project 2025), and (4) documented occurrence information in CNDDB (CDFW 2025a), Consortium of California Herbaria (CCH 2025) Manual of California Vegetation (MCV) (CNPS 2025a), and CalFlora (2025).

[6] A classification unit of vegetation, containing one or more associations and defined by one or more diagnostic species, often of high cover, in the uppermost layer or the layer with the highest canopy cover. Alliances reflect physiognomy as well as regional to subregional climates, substrates, hydrology, and disturbance regimes (Jennings et al. 2006, FGDC 2008 *as cited in* CNPS 2025a)

[7] A vegetation classification unit defined by a diagnostic species, a characteristic range of species composition, physiognomy, and distinctive habitat conditions that also reflect local topo-edaphic climates, substrates, hydrology, and disturbance regimes (Jennings et al. 2006, CNPS 2025a)

vegetation (CNPS 2025a). Provisional alliances were created for distinct species assemblages that were frequently observed in similar landform position within PA 1; this data will be shared with the Vegetation Classification and Mapping Program (VegCAMP).

Available regional vegetation datasets (i.e., CALVEG, FRAP) were reviewed and compared against available aerial photography (i.e., high-resolution [1.5-in pixel] orthorectified aerial photography created for the City of Eureka collected on July 24, 2019 [Office of Coastal Management 2020] and UAS-flown imagery collected on October 13, 2021, by Stillwater Sciences). Aerial photography captured both low and high tide stages in PA 1. As such, the full extent of vegetation polygons was captured within the regularly flooded intertidal zone. Preliminary boundaries of vegetation communities were digitized using photo-interpretive techniques and verification points were collected during the 2021 floristic surveys using the ArcGIS Collector application on handheld tablets (Samsung Galaxy Tablet, Apple iPad). Data collected were used to support the interpretation of vegetation community signatures in aerial photos, verify dominant vegetation signatures, and refine vegetation type boundaries. The initial 2021 vegetation map was revised in 2025 using PA 1 refined topographic Existing Ground (EG) surface (CalTrout et al. 2023), updated 2024 and 2025 field verification surveys, and from review of the latest available imagery (NAIP 2024, ESRI World Imagery). Alliance/association boundaries were mapped to canopy extent; therefore, mapped vegetation alliance/association boundaries may include overstory canopy over open water or herbaceous communities.

2.1.3.2 Special-status plant surveys

Special-status plant surveys were comprehensive for vascular plants such that "every plant taxon that occurs in the Project area is identified to the taxonomic level necessary to determine rarity and listing status" (CDFW 2018) following the taxonomy of the *Jepson eFlora* (Jepson Flora Project 2025). If identification was not possible in the field, the plants were collected for identification in the laboratory (using the "1 in 20" rule, Wagner 1991) or, if potentially a special-status plant, according to the botanists' current CDFW plant voucher collection permit guidelines (e.g., not more than 5 individuals or 2% of the population, whichever is less, for one voucher sheet).

The location and population boundaries of any identified special-status species were recorded in the field using a handheld GPS unit and a CNDDB form was completed for each occurrence. Information collected for each special-status population included the following:

- numbers of individuals;
- phenology;
- habitat description (e.g., surrounding plant communities, dominant species, associated species, substrates/soils, aspects/slopes);
- relative condition of the population (i.e., a qualitative assessment of site quality and occurrence viability [excellent, good, fair, or poor]); and
- recognizable risk factors.

In addition, photographs were taken to document diagnostic floral characteristics, growth forms, and habitat characteristics of special-status species. The GPS data were post-processed and corrected, then incorporated into a GIS database.

2.1.3.3 Target Invasive Plant Inventory

Invasive plant species are known to have severe or substantial ecological impacts on physical processes, plant and animal communities, and vegetation structure. When present, they often displace native species, reducing native species recruitment and overall species richness. For the purposes of this report, target invasive plant species are defined as species rated by the California Invasive Plant Council (Cal-IPC) as high or moderate and listed as invasive in *Invasive Weeds of Humboldt County* (Humboldt County Weed Management Area 2010), and/or those species which are known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities.

All target invasive plant species will be targeted for control during restoration efforts. Stand-level occurrences characterized by invasive plants are anticipated to require a high intensity approach for control and management (e.g., mechanical excavation or scraping of topsoil). Documented individual or patch size target invasive plant occurrences will require targeted treatments prior to or concurrent with construction activities. Recommended management and control of invasive plants are described in the *PA 1 Invasive Plant Management Plan* (Stillwater Sciences 2025b).

Concurrent with the floristic and vegetation mapping surveys, any target invasive plant occurrence that was not depicted by a vegetation stand type, was mapped to inform vegetation management during design implementation.

2.2 Special-status Fish and Wildlife

2.2.1 Database queries

A list of special-status fish and wildlife with the potential to occur within PA 1 was developed by querying the following resources:

- U.S. Fish and Wildlife Service's (USFWS's) *Information for Planning and Conservation* (IPaC) portal (USFWS 2025);
- CDFW's CNDDB (CDFW 2025a); and
- National Marine Fisheries Service's (NMFS) *California Species List Tools* database (NMFS 2022).

The USFWS query was based on the location of PA 1. The CDFW and NMFS database queries were each based on a search of the USGS 7.5-minute quadrangles in which PA 1 is located (Fields Landing and Eureka), and the surrounding California quadrangles (Tyee City, Arcata North, Arcata South, McWhinney Creek, Hydesville, Fortuna, Ferndale, and Cannibal Island).

The following resources were also utilized to inform evaluations of special-status wildlife species with potential to occur within PA 1:

- CDFW's CNDDB Spotted Owl Observation Database (CDFW 2025e),
- eBird (eBird 2025),
- North American Bat Acoustic Monitoring Portal (Conservation Biology Institute and USFS 2025) (closest grid cells 88752, 130175, and 938, located between about 1–13 miles from PA 1), and
- Western Milkweed Monarch Mapper (Western Monarch and Milkweed Occurrence Database 2025).

2.2.2 Pre-field review

Special-status fish and wildlife species were evaluated to determine the likelihood for each species, as identified from the database queries, to occur within PA 1 based on species habitat requirements, known distribution, location and date of recorded observations, and professional judgement (Appendix A; Table A-3). The likelihood of occurrence was rated as one of the following:

- None: The habitat required to support the species is not present within PA 1 or the area is outside the current or historical distribution.
- Low: The habitat is of very low quality or quantity within PA 1; suitable key habitat or habitat elements may be present but may be of poor quality or isolated from the nearest extant occurrences.
- Moderate: The habitat required to support the species is present within PA 1.
- High: The species has been documented within and/or adjacent to PA 1 and/or required habitat components are present and are high quality.

2.2.3 Additional assessments

The following additional assessments were developed and supported the evaluation of the potential for special-status fish and wildlife to be present within PA 1.

- ***Fish Utilization and Habitat Characterization***: presents the known seasonal distribution and life history characteristics of focal fish species that includes most of the special-status species identified in this report. It characterizes existing fish habitat conditions in PA 1. This summary is provided in Appendix C.
- ***Bat Habitat Assessment:*** summarizes the results of a February 2025 site evaluation to assess the potential for existing structures within PA 1 to support bats and recommendations to enhance structures and trees to promote bat roosting opportunities. This summary is provided in Appendix D.

3 RESULTS

3.1 Vegetation and Land Cover Types

The vegetation map of PA 1 includes five native and two nonnative forest associations, four native and one nonnative shrubland associations, and 24 native and 10 nonnative herbaceous alliances/associations as presented in Table 3-1 and Figure 3-1. Other cover types include developed/disturbed and open waters. Development and disturbed areas were associated with agricultural land use (e.g., barns, access roads), paved roadways, private residential, and utilities (i.e., substation, former railroad grade). Since vegetation was mapped based on areal extent of vegetative canopy, open waters in the vegetation map are associated with waterways that lacked an overstory canopy including narrow drainages throughout the Elk River floodplain. Extent of potential jurisdictional waters and wetlands within PA 1 are provided in *Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project* (Stillwater Sciences 2025a).

Most of the Elk River valley bottom was occupied by nonnative grassland associations related to active agricultural land use, primarily grazing pasture for dairy cows, steer, and hay production (Table 3-1, Figure 31). Nonnative grassland communities totaled 539 ac (63%) of PA 1.

Additional native coastal grassland communities were observed in the estuarine marsh-upland ecotone and within depressions and drainages in agriculture pastures that formed an additional 2% of PA 1 (or 17 ac) (Table 3-1). Leaky tide gates and degraded earthen berms along Elk River and Swain Slough have returned tidal influence back onto historical tidelands in and adjacent to Elk River Wildlife Area (ERWA) and some parcels along Swain Slough. These tidally influenced locations are no longer managed for agriculture land use and thereby contain most of the native and naturalized herbaceous vegetation types documented within PA 1. Tidal regimes in reclaimed tidelands of Elk River and Swain Slough formed intertidal coastal salt marsh and brackish marsh communities (see estuarine cover types in Table 3-1, Figure 3-1). In PA 1, the Elk River riparian corridor was narrowed by land use and composed mostly of willow species (*Salix hookeriana, Salix lasiolepis, Salix lucida* [coast, arroyo, and Pacific willow; respectively]), although a small stand of intact evergreen conifers (*Picea sitchensis* [Sitka spruce]) was observed within the ERWA South enhancement area (Figure 3-1). Lowland swales and drainages throughout the valley bottom were composed of hydrophytic herbaceous species like *Potentilla anserina* subsp. *pacifica* (silverleaf cinquefoil), *Eleocharis macrostachya* (pale spikerush), *Juncus effusus* (Pacific rush) and *Scirpus microcarpus* (small-fruited bulrush) that formed freshwater and brackish marsh communities often surrounded by pasture (Figure 3-1). Levee crests and upland earthen berms were composed of species assemblages associated with coastal scrub habitat including upland shrub species *Baccharis pilularis* (coyote bush).

Sensitive natural communities total 163-acres or approximately 19% of PA 1 and include three forest, two shrubland, and nineteen herbaceous cover types (associations or alliances) (see bold text in Table 3-1, Figure 3-1). Cover types include riparian, coastal scrub, estuarine, freshwater and brackish marsh, and coastal grassland communities (Table 3-1). Disturbances within these sensitive natural communities included: (1) presence by invasive plants, (2) codominant cover by naturalized nonnative species, (3) agriculture land use disturbance, (4) impaired drainage, and/or (5) a muted tidal regime.

Table 3-1. Vegetation and land cover types within Planning Area 1.

Alliance and cover types	Association	State rank[1]	Area (ac)
Coastal and Agricultural Grasslands			
***Alopecurus geniculatus* Provisional Herbaceous Alliance (Water foxtail meadows)**	–	**S3?**	**2.4**
***Deschampsia cespitosa - Hordeum brachyantherum - Danthonia californica* Herbaceous Alliance (Coastal tufted hair grass - Meadow barley - California oatgrass meadow)**	***Deschampsia (cespitosa, holciformis)* Association**	**S3**	**0.7**
	Deschampsia cespitosa/Rosa nutkana Association	**S3**	**2.4**
	***Hordeum brachyantherum Lowland* Association**	**S3**	**10.4**
Glyceria declinata Provisional Alliance	–	–	2.8
Holcus lanatus - Anthoxanthum odoratum Herbaceous Semi-Natural Alliance (Common velvet grass - sweet vernal grass meadows)	*Holcus lanatus* Association	SNA	54.1
***Leymus cinereus – Leymus triticoides* Herbaceous Alliance (Ashy ryegrass – Creeping wildrye turfs)**	***Leymus triticoides* Association**	**S3**	**1.0**

Alliance and cover types	Association	State rank[1]	Area (ac)
Lolium perenne Herbaceous Semi-Natural Alliance (Perennial rye grass fields)	*Lolium perenne* Association	SNA	169.7
	Lolium perenne - Festuca arundinacea Association	SNA	133.7
Phalaris aquatica - Phalaris arundinacea Herbaceous Semi-Natural Alliance (Harding grass - Reed Canary grass swards)	*Phalaris arundinacea* Association	SNA	7.3
Poa pratensis - Agrostis gigantea - Agrostis stolonifera Herbaceous Semi-Natural Alliance (Kentucky bluegrass - Redtop - Creeping bentgrass meadows)	*Agrostis (gigantea, stolonifera)* Association	SNA	19.5
	Agrostis stolonifera - Festuca arundinacea Association	SNA	87.8
	Poa pratensis Association	SNA	64.1
Coastal Scrub			
Baccharis pilularis Shrubland Alliance (Coyote brush scrub)	*Baccharis pilularis* Association	S5	8.0
Gaultheria shallon - Rubus (*ursinus*) Shrubland Alliance (Salal - berry brambles)	***Rubus ursinus* Association**	**S3?**	**17.7**
Rubus armeniacus - Sesbania punicea - Ficus carica Shrubland Semi-Natural Alliance (Himalayan blackberry - rattlebox - edible fig riparian scrub)	*Rubus armeniacus* Association	SNA	8.8
Estuarine			
Atriplex prostrata - Cotula coronopifolia Herbaceous Semi-Natural Alliance (Fields of fat hen and brass buttons[3])	*Cotula coronopifolia* Association	SNA	0.4
***Carex lyngbyei* Provisional Herbaceous Alliance (Lyngbye's sedge swathes)**	–	**S1**	**6.2**
Distichlis spicata - Frankenia salina Coastal Herbaceous Alliance (Saltgrass - Alkali heath Coastal)	*Distichlis spicata - Parapholis strigosa* Association	S4	4.3
	***Distichlis spicata - Sarcocornia pacifica* Association**	**S3**	**12.3**
	Distichlis spicata Coastal Association	S4	1.1
	***Grindelia stricta* Association**	**S3**	**0.3**
	***Juncus (lescurii) - Distichlis spicata* Association**	**S3**	**2.3**
***Sarcocornia pacifica* (*Salicornia depressa*) Herbaceous Alliance (Pickleweed mats)**	***Sarcocornia pacifica - Distichlis spicata* Association**	**S3**	**16.5**
	***Sarcocornia pacifica - Distichlis spicata* Association*[2]**	**S3/SNA[2]**	**35.2**
	***Triglochin maritima* Provisional Association**	**S3**	**8.6**
Spartina (*alterniflora, densiflora*) Herbaceous Semi-Natural Alliance Smooth or Chilean cordgrass marshes	*Spartina densiflora* Association	SNA	2.1
***Zostera* (*marina, pacifica*) Pacific Aquatic Herbaceous Alliance (Eelgrass beds)**	***Zostera marina*` Association**	**S3**	**0.5**
Freshwater and Brackish Marsh			
***Juncus* (*effusus, patens*) - *Carex* (*pansa, praegracilis*) Herbaceous Alliance (Soft and western rush - Sedge marshes)**	***Eleocharis macrostachya Lowland* Association**	**S3S4**	**0.9**
	Juncus effusus Association	S4?	21.7

Alliance and cover types	Association	State rank[1]	Area (ac)
***Carex obnupta - Oenanthe sarmentosa - Scirpus microcarpus* Herbaceous Alliance (Slough sedge - Water-parsley - Small-fruited bulrush marsh)**	***Argentina egedii* Association**	**S3**	**37.5**
	***Argentina egedii - Eleocharis macrostachya* Association**	**S3**	**1.1**
	***Juncus lescurii* Association**	**S3**	**6.8**
	***Oenanthe sarmentosa* Association**	**S3**	**0.03**
	***Scirpus microcarpus Pacific Coast* Association**	**S3**	**5.9**
	***Carex obnupta* Association**	**S3**	**0.2**
Typha (*angustifolia, domingensis, latifolia*) Herbaceous Alliance (Cattail marshes)	*Typha* (*latifolia, angustifolia*) Association	S5	1.5
Riparian			
Alnus rubra Forest Alliance (Red alder forest)	–	S4	5.2
Hesperocyparis macrocarpa - Pinus radiata Forest & Woodland Semi-Natural Alliance (Monterey cypress - Monterey pine stands)	*Hesperocyparis macrocarpa* Ruderal Association	SNA	0.5
	Pinus radiata Association	SNA	0.1
***Picea sitchensis* Forest & Woodland Alliance (Sitka spruce forest and woodland)**	–	**S2**	**1.5**
***Salix hookeriana - Salix sitchensis - Spiraea douglasii* Shrubland Alliance (Coastal dune willow – Sitka willow-Douglas spiraea thickets)**	***Salix hookeriana* Association**	**S3**	**7.8**
Salis lasiolepis Shrubland Alliance (Arroyo willow thickets)	–	S4	22.9
***Salix lucida ssp. lasiandra* Forest & Woodland Alliance (Shining willow groves)**	***Salix lucida* subsp. *lasiandra / Urtica urens – Urtica dioica* Association**	**S3**	**1.9**
	***Salix lucida* subsp. *lasiandra* Association**	**S3**	**2.2**
***Sequoia sempervirens* Forest & Woodland Alliance (Redwood forest and woodland)**	***Sequoia sempervirens* Association[3]**	**S3**	**0.04**
Other			
Developed/Disturbed	–	N/A	31.8
Open water	–	N/A	28.5

[1] State Rank (MCV, NatureServe 2025)
- SNA No rating was provided where the eponymous species of an alliance/association was classified by a nonnative species (semi-natural alliances).
- S1 Critically imperiled statewide
- S2 Imperiled statewide
- S3 Vulnerable statewide
- S4 Apparently secure statewide
- S5 Secure statewide
- 0.2 Threatened
- (?) Denotes an inexact numeric rank because of insufficient samples over the full expected range of the type, but existing information points to this rank.

[2] The cover type "*Sarcocornia pacifica - Distichlis spicata*"* has inclusions of the *Atriplex prostrata - Cotula coronopifolia* Herbaceous Semi-Natural Alliance (Fields of fat hen and brass buttons, SNA). This mixed cover type was mapped within the dynamic estuarine tidal marsh that had shifting patterns by these two vegetation alliances throughout the survey period (2021 to present [2025]).

[3] This cover type captures a single occurrence of a coast redwood adjacent to a private residence on the Elk River floodplain.

3.1.1 *Zostera* (*marina*, *pacifica*) Pacific Aquatic Herbaceous Alliance (eelgrass beds)

One sensitive natural community in PA 1, *Zostera* (*marina*, *pacifica*) Pacific Aquatic Herbaceous Alliance (eelgrass beds), is also a listed special aquatic site under 404(b)(1) guidelines of the Clean Water Act (40 C.F.R. § 230.43) and is a designated essential fish habitat (EFH) habitat area of particular concern (HAPC) for various federally-managed fish species within the Pacific Coast Groundfish Fishery Management Plan (PFMC 2008) pursuant to the Magnuson Stevens Fishery Conservation and Management Act.

Patchy distribution of eelgrass was detected within Swain Slough from the confluence with Elk River near HWY 101 bridge to approximately 600 ft upstream of the Elk River Road crossing (Figure 3-1). Areal extent was mapped from UAV-collected imagery and survey data points collected in June 2021 and totaled 0.5 ac in PA 1 (Table 3-1). The Project's recovered tidal slough channels will connect to Elk River and Swain Slough and increase suitable habitat for eelgrass recruitment.

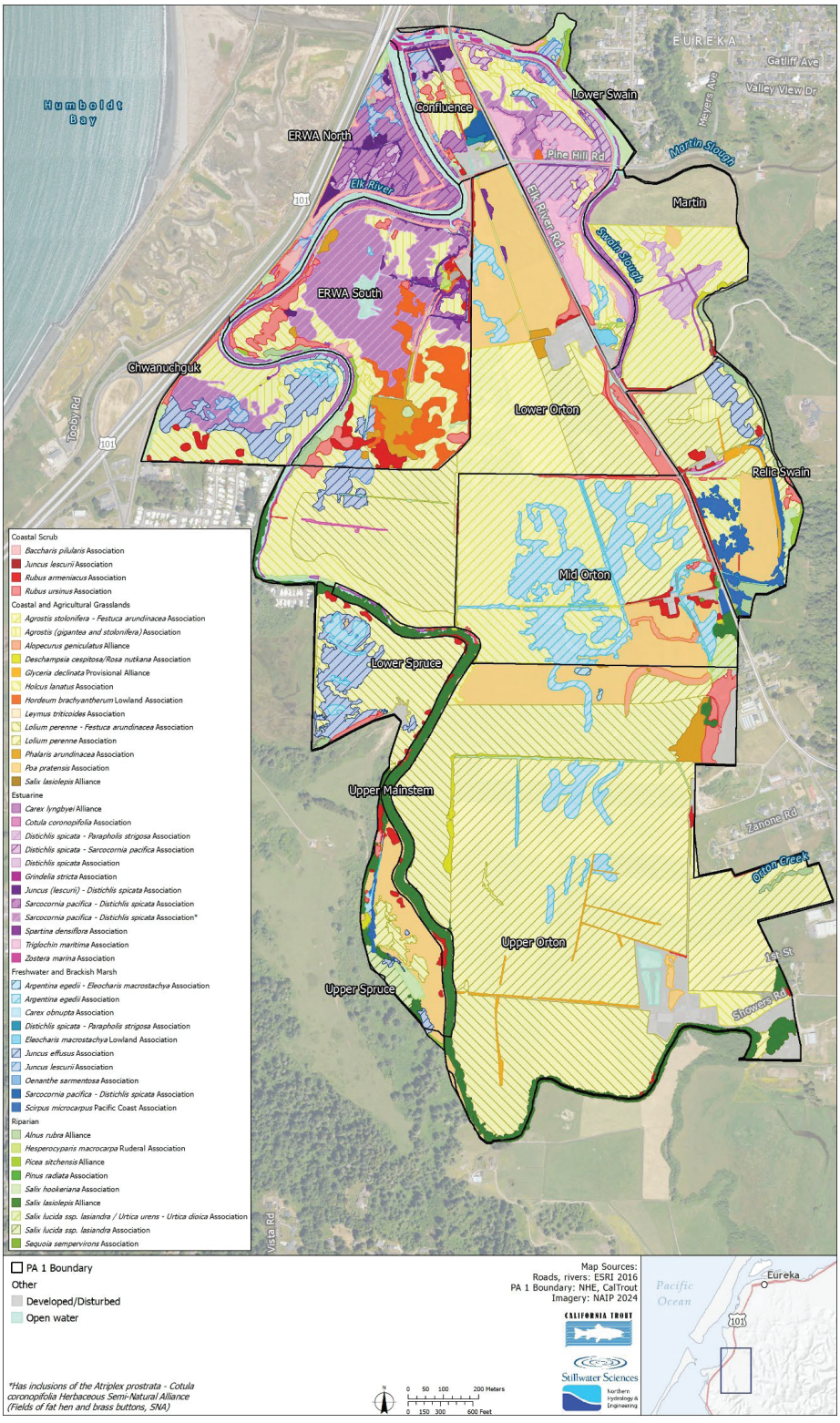


Figure 3-1. Vegetation cover types classified within Planning Area 1.

3.2 Special-status Plants

Five special-status plant species were documented within PA 1 (Table 3-2). A comprehensive list of all species observed within PA 1 is provided in Appendix B. Characteristics of each special-status plant species documented on site and information regarding occurrences within PA 1 is provided below. The conservation strategy for all special-status plant species is described in Section 1.5 (see BOT-01). Revegetation activities will promote the expansion of existing special-status plant populations by restoring suitable special-status plant habitat (e.g., fully tidal marsh communities) and seeding or planting special-status plants into suitable planting zones.

In late 2024, one new occurrence of special-status plant *Chloropyron maritimum* subsp. *palustre* (Point Reyes bird's-beak) was documented just outside of PA 1, along Elk River (Figure 3-2). Approximately 20 individuals, occurring in two patches, were observed in the restored City of Eureka's Hikshari' Trail Project, approximately 0.5 miles downstream of PA 1 (CHMAR 001 (Figure 3-2). This occurrence was documented within the high coastal salt marsh adjacent to Elk River just within the high tide line. Associated species included pickleweed and San Francisco rush. Although outside of PA 1, this new finding is a positive indicator for Point Reyes bird's-beak's potential expansion and recovery within Elk River's restored estuarine wetlands.

Table 3-2. Special-status plant species documented[1] within Planning Area 1.

Species name (common name)	Status[1] (Federal/ State/CRPR)	Existing CNDDB occurrence?	Occurrence label	Population size
Angelica lucida (sea-watch)	–/–/4.2	No	ANLUC 001	22 patches (1,954 m^2)
			ANLUC 002	45 patches (1,170 m^2)
Carex lyngbyei (Lyngbye's sedge)	–/–/2B.2	Yes, Occurrence 9	CALYN 001	20 patches (1,681 m^2)
			CALYN 002	32 patches (11,417 m^2)
			CALYN 003	10 patches (9,338 m^2)
			CALYN 004	7 patches (1,452 m^2)
			CALYN 005	16 patches (178 m^2)
Castilleja ambigua subsp. *humboldtiensis* (Humboldt Bay owl's-clover)	–/–/1B.2	Yes, Occurrence 13	CAAMB 001	19 patches (1,490 m^2)
			CAAMB 002	3 patches (733 m^2)
			CAAMB 003	6 patches (2,498 m^2)
			CAAMB 004	75 patches (3,297 m^2)
Chrysosplenium glechomifolium (Pacific golden saxifrage)	–/–/4.3	No	CHGLE 001	1 patch (29 m^2)
Spergularia canadensis var. *occidentalis* (western sand-spurrey)	–/–/2B.1	No	SPCAN 001	1 patch (67 m^2)

[1] Floristic surveys conducted on May 12–14, 2021, and July 12–14, 2021 and supplemental survey work conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27, May 12, 26).

[2] Status:

California Rare Plant Rank

List 1B Plants rare, threatened, or endangered in California and elsewhere
List 2B Plants rare, threatened, or endangered in California, but more common elsewhere
List 4 Plants of limited distribution, a watch list

CNPS Threat Ranks:

0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

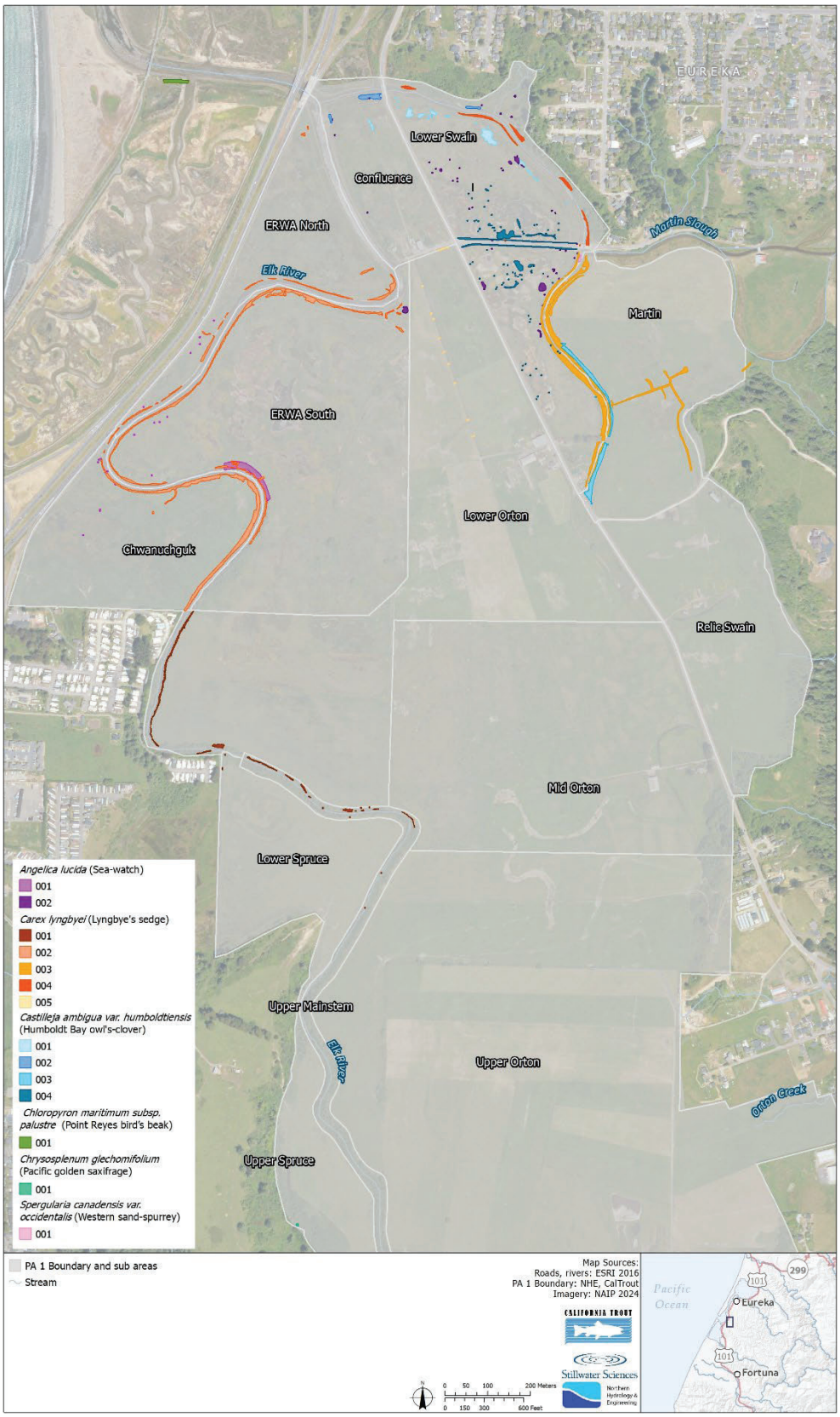


Figure 3-2. Special-status plant occurrences within Planning Area 1.

3.2.1 *Angelica lucida* (sea-watch)

Angelica lucida (sea-watch) is a native perennial herb in the Apiaceae family with a CRPR of 4.2 (i.e., plants of limited distribution; fairly threatened in California). It is limited to the North Coast, specifically Humboldt, Mendocino, and Del Norte counties, from 0 to 164 ft above sea level. Sea-watch typically occurs in coastal bluff scrub, coastal dunes, coastal scrub, and coastal salt marshes and blooms from May to September. Populations of sea watch are threatened by non-native plants (CNPS 2025b, Jepson Flora Project 2025).

Three large populations of sea-watch were documented within PA 1 mostly in transitions from marsh to coastal scrub habitats along Elk River and Swain Slough, typically near or on levees and earthen berms (Figure 3-2, Table 3-2). One population (ANLUC 001) was documented in scrub habitats along Elk River. Another population (ANLUC 002) was documented within Swain Slough's wetland to upland ecotone. The third, more interior, population (ANLUC 003) was documented in scattered patches in transitional estuarine wetlands and adjacent to roadsides (Figure 3-2). Plant associates included woody shrubs and vines common to coastal scrublands *Lonicera involucrata* (coast twinberry), *Rubus ursinus* (California blackberry), coyote brush, and the invasive *Rubus armeniacus* (Himalayan blackberry). Associated herbaceous plants included *Juncus lescurii* (San Francisco rush), *Symphyotrichum chilense* (Pacific aster), silverweed cinquefoil, *Triglochin maritima* (common arrow-grass), *Deschampsia cespitosa* (tufted hair grass), *Achillea millefolium* (common yarrow), *Atriplex prostrata* (fat-hen), *Scrophularia californica* (California bee plant), *Conium maculatum* (poison hemlock), and *Lotus corniculatus* (bird's foot trefoil). Potential site-specific threats include competition by non-native plants, bank erosion, and sea-level rise.

3.2.2 *Carex lyngbyei* (Lyngbye's sedge)

Carex lyngbyei (Lyngbye's sedge) is a perennial rhizomatous herb in the Cyperaceae family with a California Rare Plant Rank (CRPR) of 2B.2 (i.e., plants rare, threatened, or endangered in California, but more common elsewhere; fairly threatened in California). In California, it is known to occur in Del Norte, Humboldt, Mendocino, Marin, and Napa counties and is limited to the North and Central coast at 0 to 33 ft elevation. It occurs in brackish and freshwater marshes, swamps, and riverbanks and blooms from April through August. Threats to Lyngbye's sedge include grazing, non-native plants, and habitat disturbance (CNPS 2025b, Jepson Flora Project 2025).

During the 2021 surveys, Lyngbye's sedge was frequently documented in dense stands along the tidally influenced channels of Elk River and Swain Slough and their adjoining drainages (Figure 3-2). These populations were associated with the CDFW reported CNDDB occurrence 9 (Table 3-2); however, the CNDDB documented occurrence did not capture the full

extent of this species. Thousands of Lyngbye's sedge individuals were documented within five populations distinguished by geographic locale, associated waterbody, habitat, unique threats and disturbances, and overall occurrence quality (Table 3-2). Two occurrences (CALYN 001 and 002) were documented along the lower intertidal banks of Elk River. The largest occurrence (CALYN 002, pictured above) consists of intertidal, dense, monotypic bands of vegetation along both sides of Elk River. The upstream occurrence in Elk River (CALYN 001), was restricted to openings within the otherwise forested riparian corridor. Similarly, along Swain Slough, occurrence CALYN 004 was composed of several patches growing within openings of a partially forested riparian corridor. The upstream Swain Slough occurrence (CALYN 003) represented another healthy Lyngbye's sedge stand. This occurrence formed a dense, monotypic band growing in the intertidal zone along both banks of the slough. These four occurrences along Elk River and Swain Slough showed little signs of disturbance and appeared to be in excellent condition. Potential site-specific threats include competition by *Spartina densiflora* (dense-flowered cord grass) along the upper marsh elevation extent, bank erosion, and sea-level rise. Finally, a fifth occurrence (CALYN 005) was documented along the sides of shallow drainages within an actively grazed agricultural field east of Swain Slough. These drainages were subject to tidal influence from a leaky tide gate upstream of Martin Slough. This population was sparse and patchy with signs of herbivory where livestock had access.

In general, Lyngbye's sedge populations were immediately bordered by mixed salt marsh communities including associations to the *Sarcocornia pacifica (Salicornia depressa)* Herbaceous Alliance (pickleweed mats) as well as the *Juncus lescurii* Association (high marsh community) and patches of dense-flowered cord grass. Herbaceous plants observed along the intertidal channel benches adjacent to Lyngbye's sedge populations included San Francisco rush, Pacific aster, silverweed cinquefoil, common arrow-grass, *Distichlis spicata* (salt grass), tufted hair grass, and *Salicornia pacifica* (pickleweed). Shrubs associated with the species included coastal willow and *Sambucus racemosa* (red elderberry).

3.2.3 *Castilleja ambigua* var. *humboldtiensis* (Humboldt bay owl's clover)

Castilleja ambigua var. *humboldtiensis* (Humboldt Bay owl's clover) is a hemi-parasitic annual herb in the Orobanchaceae family with a CRPR of 1B.2 (i.e., plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California). It is limited to the north and Central Coast specifically Humboldt, Mendocino, and Marin counties, at 0 to 10 ft elevation. It occurs in coastal salt marshes and swamps and blooms from April through August. Populations of Humboldt Bay owl's clover are threatened by habitat disturbance and development (CNPS 2025b, Jepson Flora Project 2025).

Three populations of Humboldt Bay owl's-clover were initially observed within PA 1 during the 2021 botanical surveys. This species was previously documented along lower Elk River and Swain Slough at the downstream end of PA 1 (CDFW 2025a). Although upstream of the CNDDB documented occurrence (occurrence # 13), these sightings were attributed to this population (Table 3-2). In May 2024 and May 2025 anew population was documented within the high marsh adjacent to the roadside drainages of Pine Hill Road (Figure 3-2). This population was attributed to 2023 revegetation activities for the County of Humboldt Department of Public Works Pine Hill Road over Swain

Slough Bridge project. Similar to Lyngbye's sedge characterization, the Humboldt Bay owl's clover occurrences within PA 1 were grouped based on geographic connectivity, habitat, unique threats and disturbances, and overall occurrence quality. Two populations, CAAMB 002 and CAAMB 003, were attributed to salt marsh habitat on intertidal benches along Swain Slough. A third population was located along muted tidelands interior of existing levees along Swain Slough (CAAMB 001). This location was historically converted to agricultural fields; however, over the last several decades, it has been reintroduced to tidal influence and is transitioning back to estuarine wetlands (Figure 3-2). The fourth population (CAAMB 004) was located in 2024 along Pine Hill Road within gravelly drainages subject to tidal inundation and flooding during winter conditions and later in 2025 spreading further into the adjacent tidal marsh (Figure 3-2). Associated plants observed among populations of Humboldt Bay owl's-clover were tufted hairgrass, salt gras, pickleweed, brass-buttons, San Francisco rush, *Spergularia marina* (saltmarsh sand-spurrey), common arrow-grass, and dense-flowered cord grass.

Three populations appeared to be in excellent condition with minimal disturbances or threats observed. Plant associates included pickleweed, *Jaumea carnosa* (marsh jaumea), salt grass, San Francisco rush, common arrow-grass, silverweed cinquefoil, brass-buttons, and dense-flowered cord grass. Threats to populations of Humboldt Bay owl's-clover included encroachment by invasive plants, dense-flowered cord grass and common brass buttons, and potential ground disturbance from agriculture; yet these threats seemed of little impact to current populations. The population along Pine Hill Road, appeared healthy but had high disturbance from road maintenance activities, nonnative plant encroachment, pedestrian traffic, and roadway debris.

3.2.4 *Chrysosplenium glechomifolium* (Pacific golden saxifrage)

Chrysosplenium glechomifolium (Pacific golden saxifrage) is a perennial stoloniferous herb in the Saxifragaceae family with a CRPR of 4.3 (i.e., plants of limited distribution; not very threatened in California). In California, this species is known to occur only in Mendocino, Humboldt, and Del Norte County at 35 to 1,770 ft elevation within seeps and along streambanks in North Coast coniferous and riparian forests and blooms February through June (CNPS 2025b, Jepson Flora Project 2025). The primary threat to this obligate wetland species includes the alteration to pre-existing hydrology or water flow.

One new occurrence of Pacific golden saxifrage (CHGLE 001) was documented within PA 1 within a riparian forest, adjacent to a seep leading to a freshwater marsh, and consisted of approximately 50 individuals (Figure 3-2, Table 3-2). The dominant tree species in the riparian forest were arroyo willow and Pacific willow, which formed dense cover in the overstory (70–85% canopy cover). Associated herbaceous plants included *Ranunculus repens* (creeping buttercup), *Oenanthe sarmentosa* (water parsley), *Tolmiea diplomenziesii* (pigaback plant), California blackberry, *Urtica dioica* (stinging nettle), and small-fruited bulrush. Potential threats to occurrences within PA 1 include competition by nonnative plants (e.g., creeping buttercup), hydrological alterations, and cattle grazing and trampling.

3.2.5 *Spergularia canadensis* var. *occidentalis* (western sand-spurrey)

Spergularia canadensis var. *occidentalis* (western sand-spurrey) is an annual herb in the Carophyllaceae family with a CRPR of 2B.1 (i.e., plants rare, threatened, or endangered in California, but more common elsewhere; seriously threatened in California). In California, this species is known to occur only in Humboldt County at 0 to 10 ft elevation within coastal salt marsh and swamp habitats and blooms from June through August. Threats to western sand spurrey include habitat disturbance and non-native plants (CNPS 2025b, Jepson Flora Project 2025).

During the 2021 surveys, one new occurrence of western sand-spurrey, SPCAN 001, was documented within PA 1 consisting of approximately 100 individuals. It was observed in a lower intertidal mudflat location in the Swain Slough channel that was exposed during low tide events (Figure 3-2). Vegetative cover at this location was sparse with western sand-spurrey providing the highest cover (~15% absolute cover). In addition, some dense-flowered cord grass and brass-buttons were documented, each with less than 5% absolute cover. The high inundation times between low tide events in the Swain Slough seem to maintain control of both nonnative plant associates. Other potential site-specific threats to this occurrence include mudflat erosion and sea-level rise. The western sand-spurrey population will be avoided during all Project activities due to its limited presence.

3.3 Target Invasive Plants

Invasive weeds within PA 1 occur in a range of patterns, from large stands to discrete patches or single individuals within native vegetation communities. Invasive plants that formed documented stand-level occurrences with PA 1 included: *Phalaris arundinacea* (reed canary grass), dense-flowered cord grass, *Rubus armeniacus* (Himalayan blackberry), and *Glyceria declinata* (low manna grass) (Tables 3-1 and 3-3). These species occupy various habitats within PA 1 including estuarine, freshwater wetland, and riparian areas (Tables 3-1 and 3-3; Figures 3-1 and 3-3).

Other invasives plants that were observed as single or small patch-size occurrences within PA 1 are summarized in Table 3-3.

Table 3-3. Invasive plants documented within Planning Area 1.

Scientific name	Common name	Cal-IPC rating[1]	Regionally listed[2]
Cirsium arvense	Canada thistle	Moderate	Yes
Cirsium vulgare	Bull thistle	Moderate	Yes
Conium maculatum	Poison hemlock	Moderate	Yes
Cortaderia jubata	purple pampas grass	High	Yes
Cotoneaster spp.	Cotoneaster	Moderate	Yes
Cytisus scoparius	Scotch broom	High	Yes
Dipsacus fullonum	wild teasel	Moderate	Yes
Erica lusitanica	heather	Limited	Yes
Foeniculum vulgare	fennel	Moderate	Yes
Genista monspessulana	French broom	High	Yes
Glyceria declinata	low manna grass	Moderate	No
Hedera helix	English ivy	High	Yes
Ilex aquifolium	English holly	Limited	Yes
Phalaris arundinacea	reed canary grass	None[3]	Yes[3]
Rubus armeniacus	Himalayan blackberry	High	Yes
Spartina densiflora	dense-flowered cord grass	High	Yes
Vinca major	periwinkle	Moderate	Yes

[1] **Cal-IPC rankings**

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent-but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

None – No rating listed.

[2] Species listed as invasive to Humboldt County, California (Humboldt County Weed Management Area 2010)

[3] Known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities (Humboldt County Resource Conservation District 2024).

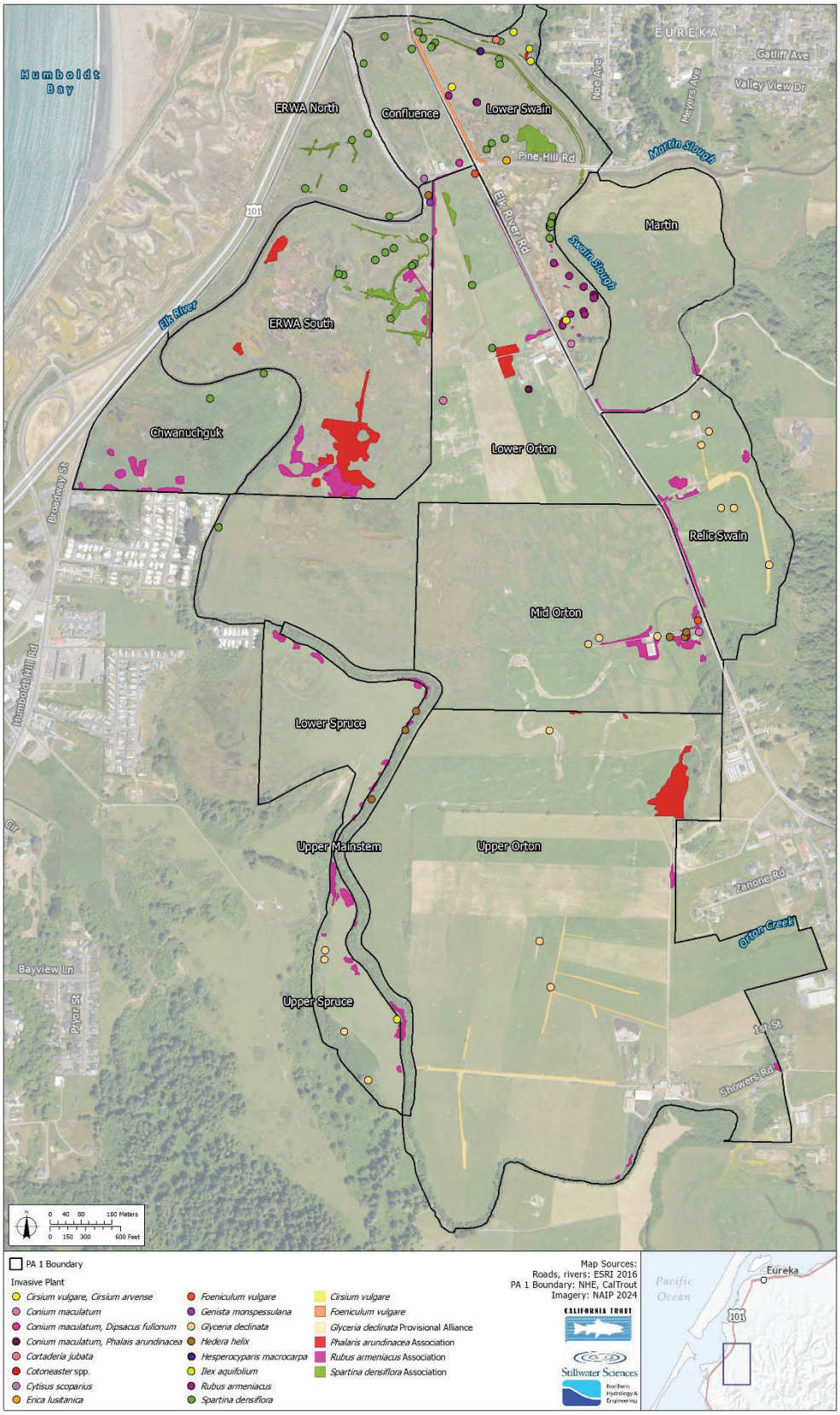


Figure 3-3. Invasive plant occurrences documented within Planning Area 1.

3.4 Special-status Fish and Wildlife

The special-status wildlife (i.e., invertebrate, fish, amphibian, reptile, bird, and mammal) species identified from the database queries are presented in Appendix A, Table A-3. Species with either a low or no potential to occur were eliminated from further consideration. The special-status wildlife species with a moderate or high potential to occur within PA 1 are summarized in Table 3-4.

Table 3-4. Special-status fish and wildlife with the potential to occur within Planning Area 1.

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Invertebrates						
Monarch butterfly (California overwintering population) *Danaus plexippus plexippus*	USFWS	FC/–	Range includes most of California; it breeds throughout California and overwinters in suitable groves along the California coast	Adults forage on a variety of flowering plants during breeding and migration; larva (caterpillars) require milkweed (*Asclepias* spp.) as a host plant. Overwinter roosts include eucalyptus (*Eucalyptus* spp.), Monterey pines (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) trees or groves.	**Moderate (foraging only):** No breeding habitat (milkweed species) were observed during the comprehensive botanical surveys in 2021 (Appendix B) while foraging habitat (flowering plants) is present within PA 1. An occurrence of an adult monarch was observed within 0.5 miles of PA 1 in 2022 and an adult monarch and eggs were documented on milkweed within two miles of PA 1 in 2024 (Western Monarch Milkweed Occurrence Database 2025). Critical habitat has been proposed for this species and is not present within PA 1.	Breeding season: March through October Overwintering season: November through February
Fish						
Pacific lamprey *Entosphenus tridentatus*	CDFW	–/SSC	Most coastal flowing watersheds between Mexico and Oregon.	Anadromous species that spawns and rears in freshwater before emigrating to the ocean to feed and grow. Generally distributed wherever salmon and steelhead occur. Adult spawning: coarse gravel or small cobble in pool tails or low-gradient riffles. Larval rearing: Mostly freshwater (below 12 parts per thousand [ppt] salinity) and low-velocity areas where they burrow into fine silt and sand substrates that often contain organic matter. Water temperatures less than approximately 22°C.	**High:** While no spawning habitat is present within PA 1, adults will move through the lower portion of PA 1 via the Elk River and Swain Slough as they migrate upstream to freshwater spawning areas as will juveniles (macropthalmia) as they out-migrate to the bay and/or ocean. Larve (ammocoetes) are not expected to be present in the lowermost portion of PA 1 due to the high salinities resulting from the direct connection to Humboldt Bay, but are likely to be present in the middle and uppermost portions. Pacific lamprey have been documented within the Elk River watershed (Stillwater Sciences 2016) and neighboring Humboldt Bay tributaries such as Freshwater Creek (Anderson 2020), Fay Slough, and Freshwater Slough (CDFW 2025a). Adult and juveniles have been documented in the North Fork Elk River 4 miles upstream of PA 1 from 2014 (CDFW 2025a).	Adult migration: late winter to early summer Spawning: March through July Egg hatching: 15 days after eggs deposited into the redd Emergence: 15 days following hatching Juvenile rearing: 4–10 years Outmigration: fall to spring Ocean period: 18–40 months

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Western brook lamprey *Lampetra richardsoni*	CDFW	–/SSC	Coastal and Central Valley rivers and streams	Non-migratory species that remains in fresh water for its entire life cycle. Spawns in small gravel substrates in cool water streams; requires habitats with low water velocity and fine sediment for ammocoete rearing.	**Moderate:** While Western brook lamprey have been documented in the Elk River watershed (Stillwater Sciences 2016) and neighboring Humboldt Bay tributaries such as Freshwater Creek (Anderson 2020), Fay Slough, and Freshwater Slough (CDFW 2025a), the species is not expected to occur in waters with the higher salinities present in the lower portion of PA 1. In the upper portions of PA 1, larval rearing for the species may occur. Ammocoetes have been documented in the South Fork Elk River, 3 miles upstream of PA 1 in 2013 (CDFW 2025a).	Spawning: March through June Eggs hatching: approximately 15 days after fertilization and deposition in redd Larval emergence: approximately 15 days following hatching Larval rearing: 3–4 years
Longfin smelt *Spirinchus thaleichthys*	CDFW	–/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; historical populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults associated with nearshore coastal areas, large bays, and estuaries, and migrate into lower portions of freshwater streams and rivers to spawn over sandy/gravel substrates, rocks, and aquatic plants; juveniles and adults rear in estuarine habitats, with smolts preferring deep-water channels.	**High:** Spawning habitat is present in the upstream area of PA 1, and rearing habitat is present throughout PA 1, due to the close proximity to Humboldt Bay and the Elk River estuary. Present throughout Humboldt Bay including PA 1 (i.e., Elk River) in addition to other Humboldt Bay tributaries (Garwood 2017, Anderson 2023a). Species has been documented throughout Humboldt Bay, less than a mile from PA 1 in 2005 (CDFW 2025a). Additional information is provided in Appendix C.	Spawning: November through May (peak in February–April) Fry hatching and larval dispersal downstream to estuaries: 40 days following spawning (March through June) Larval rearing: 3 months following hatching (June through September)
Eulachon, southern DPS *Thaleichthys pacificus*	CDFW/ NMFS	FT/SSC	Skeena River in British Columbia (inclusive) south to Humboldt Bay and in smaller numbers south to Fort Brag in Northern California	An anadromous fish that generally spawns in freshwater rivers with eggs fertilized in the water column and sinking to the river bottom, typically in areas of gravel and coarse sand. Uses estuaries for migrating between the ocean and freshwater; spends approximately three years in the ocean.	**Moderate**: Adults and larvae have a moderate potential of migrating through PA 1; adults on their way upstream to spawn and larvae as they out-migrate to the bay and ocean. Adult eulachon have been documented in a tidally influenced area of Freshwater Creek, about 6 miles northeast of PA 1, in March 2023 (Anderson 2023b), which is a tributary to Humboldt Bay similar to Elk River. Historical accounts also include central and north Humboldt Bay, less than a mile from PA 1, in 1977 (CDFW 2025a). Critical habitat has been designated for this species and is not present within PA 1; critical habitat is located 12 miles north on the Mad River.	Adult migration: December through March Spawning: mid-March into May Fry emergence and larval outmigration: 30–40 days following spawning (mid-April through June)

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Coho salmon, southern Oregon/northern California Coast Evolutionary Significant Unit (ESU) *Oncorhynchus kisutch*	NMFS, CDFW	FT/ST	Range includes Punta Gorda north to the Oregon border	Low-gradient portions of coastal draining streams with sufficiently cool water temperatures. Adult spawning: fine to coarse gravel in pool tailouts or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: instream pool habitats often associated with large wood or off-channel features that provide low-velocity protection from high flows and cover from predation and water temperatures less than approximately 17°C.	**High:** PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration, juvenile downstream outmigration, and juvenile rearing. No spawning habitat is present. The species has been documented throughout the Elk River watershed in 2005, including PA 1, with Age-0 fish present April through December and Age-1 fish present January through August (Wallace and Allen 2009, CDFW 2025a). Additional information is provided in Appendix C. Critical habitat has been designated for this species and is present within PA 1.	Adult migration: fall and winter Spawning: few weeks following migration (December–February) Fry emergence: 3–4 months after spawning Juvenile rearing: year round Emigration from streams to mainstem: March–May Out-migration: April and May, peak in early May
Chinook salmon, California Coastal ESU *Oncorhynchus tshawytscha*	NMFS	FT/–	Range includes Russian River (Sonoma County) north to Redwood Creek (Humboldt County)	Coastal draining streams. Adult spawning: medium gravel to small cobble in pool tails or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: fry utilize shallow stream margins and juveniles utilize pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 19°C.	**High:** PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration and juvenile downstream out-migration. No spawning habitat is present. Species documented within PA 1, with Age-O fish present between May and September (Wallace and Allen 2009). Additional information is provided in Appendix C. Critical habitat has been designated for this species and is present within PA 1.	Adult migration: fall and winter (September–early November) Spawning: few weeks following freshwater entry (November–January, peak in December) Fry emergence: March–May Juvenile rearing: May to September Out-migration: summer–fall
Steelhead, northern California DPS winter-run *Oncorhynchus mykiss irideus*	NMFS, CDFW	FT/–	Range includes Coastal streams from the Russian River (exclusive) north to Redwood Creek (Humboldt County)	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat. Adult spawning: medium to coarse gravel in pool tails or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 22°C. Juveniles typically rear in fresh water for 1 or more years before migrating to the ocean.	**High:** PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration and juvenile downstream outmigration. Rearing habitat may be present in the upper portion of PA 1. No spawning habitat is present. Species documented within PA 1 with Age 1+ fish documented between February–October and December (Wallace and Allen 2009). Species has been documented throughout the Elk River watershed including PA 1 in 2022 (CDFW 2025a). Additional information is provided in Appendix C. Critical habitat has been designated for this species and is present within PA 1 (i.e., Elk River, Swain Slough and Martin Slough).	Adult migration: October through March Spawning: late February through April Fry emergence: 6 weeks following hatching (April–June) Juvenile rearing: year-round Outmigration: late-winter and spring (February–June [peak in March and April] and October–November)

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Coast cutthroat trout *Oncorhynchus clarkii clarkii*	CDFW	–/SSC	Small, low-gradient coastal streams and estuaries from northern Oregon to the Eel River, California	Shaded streams with water temperatures below 18°C and small gravel for spawning; have diverse life histories, including potadromous (migratory within freshwater portions of the river system), stream-resident, and anadromy, which includes rearing in freshwater and foraging in estuaries.	**High:** PA 1 is mostly inclusive of estuarine habitat that supports migratory and foraging habitat during adult upstream migration and juvenile downstream outmigration. Rearing habitat is present within PA 1. No spawning habitat is present. Species documented within PA 1 (Wallace and Allen 2009) with Age 1+ fish present in January and between April–December (Wallace and Allen 2009). Additional information is provided in Appendix C. Species has been documented throughout the Elk River watershed including PA 1 in 2014 (CDFW 2025a).	Adult spawning migration: August–November, with peak in January Fry emergence: 6 weeks following hatching (March–June) Juvenile rearing: year-round Juvenile outmigration: March–June, with peak in April
Tidewater goby *Eucyclogobius newberryi*	CDFW, USFWS	FE/–	Range includes San Diego County north to the mouth of the Smith River in Del Norte County	Typically in shallow waters of coastal lagoons and the uppermost zone of brackish large estuaries; prefer sandy substrate for spawning, but can be found on silt, mud, or rocky substrates; typically in shallow water, but can occur in water up to 15 feet in lagoons and within a wide range of salinity (0–42 ppt).	**High:** Suitable habitat is present within PA 1 for all life stages of the tidewater goby. Species was documented within PA 1 in 2010 along the lower, northwestern portion of PA 1 near the confluence of Elk River and Swain Slough (CDFW 2025a). Additional information is provided in Appendix C. Critical habitat has been designated for this species and is present within PA 1.	Breeding (egg laying and larval emergence): late April to July (peak), while can continue through December Larval rearing: one month following breeding (late May through August [peak], while can continue through January)
Amphibians						
Southern torrent salamander *Rhyacotriton variegatus*	CDFW	–/SSC	Coastal drainages from near Point Arena in Mendocino County to the Oregon border	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rocky substrate in redwood (*Sequoia sempervirons*, Douglas-fir (*Psuedotsuga menziesii*), mixed conifer, montane riparian and montane hardwood-conifer habitats. Elevational range extends from near sea level to about 3,940 ft.	**Moderate:** Suitable habitat is present within PA 1 (seeps and springs along the valley walls) but is of low quantity. The most recent occurrence is about seven miles north of PA 1 from 2013. Other observations in the vicinity include an observation within seven miles of PA 1 along Freshwater Creek from 1994, an occurrence along Salmon Creek near Headwaters Forest Reserve from 1995, and an occurrence in Kneeland about ten miles from PA 1 from 2010 (CDFW 2025a).	Breeding: may occur year-round, while peak oviposition period is in August and September Egg hatching: about 8 months following egg laying; peak egg hatching occurs in the spring Larval metamorphosis: 2–2.5 years following hatching

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Northern red-legged frog *Rana aurora*	CDFW	–/SSC	Ranges from Mills Creek in Mendocino County to Oregon border	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat.	**High:** Suitable aquatic habitat for breeding and terrestrial habitat for cover and dispersal is present within PA 1. Egg masses were observed within PA 1 during a site visit in January 2025 in the Western Off-Channel Habitat Upstream (M2-FP-3.9) (Draeger, B., NHE, and Dusek, L., Stillwater Sciences pers. comm., January 2025). Additional CNDDB occurrences include one within PA 1 at the Elk River Wildlife Area from 2009 (ERWA), an occurrence 0.5 miles from PA 1 in King Salmon from 2024, and an observation within 0.25 miles of PA 1 from 2003 (CDFW 2025a).	Active period: year-round Egg laying: November to April Egg hatching: about 4 weeks following egg laying Tadpole metamorphosis: 4–7 months following hatching Upland dispersal period: post-tadpole metamorphosis
Reptiles						
Northwestern pond turtle *Actinemys marmorata*	USFWS, CDFW	FPT/SSC	Range is from the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting.	**Moderate:** Suitable basking and breeding habitat is present within PA 1, and suitability is likely to increase in areas with a higher proportion of freshwater inflow. The nearest CNDDB occurrences are about 0.5 miles away from 2013 in the neighboring Martin Slough with six additional occurrences within about 5 miles of PA 1 in 2006, 2011, and 2017; two of these occurrences were on Elk River upstream of PA 1 (CDFW 2025a). Critical habitat has not been designated for this species.	General active period: February through November Mating: April–May Nesting: April–August Egg incubation: while unknown, laboratory hatching occurred in 73–81 days Hatchling emergence: late-summer or fall, but some may overwinter and emerge the following spring Hibernation: winter in either aquatic or terrestrial habitat Aestivation: summer in aquatic habitat

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Birds						
Numerous bird species protected under the Migratory Bird Treaty Act (MBTA)	USFWS	MBTA	Range encompasses California	Variable including, but not limited to, grasses, shrubs, and trees.	**High:** Suitable nesting trees, shrubs, grasses, and agriculture fields provide nesting and foraging habitat for MBTA-protected birds including those documented within PA 1 such as Allen's hummingbird (*Selasphorus sasin*), lesser yellowlegs (*Tringa flavipes*), chestnut-backed chickadee (*Poecile rufescens*), and wrentit (*Chamaea fasciata*) (eBird 2025). Inactive barn swallow nests were observed at structures during a site visit to PA 1 in February 2025 (L. Dusek, Stillwater Sciences, pers. comm., February 2025); see Appendix D for additional information.	Nesting bird season: typically ranges from mid- March through mid-August
Marbled murrelet *Brachyramphus marmoratus*	CDFW, USFWS	FT/SE	Nesting birds mostly concentrated near coastal waters in Del Norte and Humboldt counties, and in lesser numbers near San Mateo and Santa Cruz counties; species winters throughout the nesting range and in small numbers in southern California	Most time spent on the ocean; nests inland in large areas of old-growth conifers with suitable platforms, especially redwood or Douglas-fir forests near coastal areas.	**Moderate (flyover only)**: No suitable nesting habitat within PA 1, although may be present in adjacent, forested habitat. There is a high potential for individuals to be flying over PA 1 during daily migrations to forage at the ocean. The nearest CNDDB occurrence is about seven miles from PA 1 in Headwaters Forest Reserve in 1995 (CDFW 2025a). Critical habitat has been designated for this species and occurs 4.5 miles from PA 1.	Nesting initiated: May, while as late as July Egg laying: variable occurring between March through August Incubation period: 28–30 days following egg laying Nestling period: 30 days following hatching
White-tailed kite *Elanus leucurus*	CDFW	–/SFP	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	**High.** Suitable foraging and nesting habitat is present within PA 1. A foraging white-tailed kite was observed during a site visit in February 2025 (L. Dusek, Stillwater Sciences, pers. comm., February 2025). The nearest CNDDB occurrences include an observation less than a mile away from PA 1 from 2014, and another about one mile away from 2015 (CDFW 2025a).	Breeding: February–October, with peak breeding in May–August Incubation period: 30-32 days following egg laying Nestling period: 35–38 days following hatching
Golden eagle *Aquila chrysaetos*	USFWS	BGECP/ SFP	Species is an uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or medium to tall trees	**Moderate (flyovers and possibly foraging):** Suitable foraging habitat is present in grasslands within PA 1. While preferred nesting habitat of cliffs is lacking within PA 1, medium to tall trees are present in adjacent forested areas. Multiple occurrences are from within six miles of PA 1 at the nearby Humboldt Bay National Wildlife Refuge, Hookton Slough, and Fay Slough Wildlife Area (2009–2012 and 2016–2021) (eBird 2025). The nearest CNDDB occurrence is about 12 miles away from 2006 (CDFW 2025a).	General breeding season: late January through August Nesting initiated: late January Egg laying: typically, in March, while may occur 1–3 months after nest is constructed Incubation period: 41–45 days following egg laying Nestling period: 45–81 days following hatching

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Northern harrier *Circus hudsonius*	CDFW	–/SSC	Summer resident in eastern Sierra Nevada in Mono County.	Coastal scrub, Great Basin grasslands, Valley & foothill grasslands, wetlands, marshes & swamps, coastal salt and freshwater marsh, and riparian scrub. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on the ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	**High:** Suitable foraging and nesting habitat is present in upland grassland and agricultural areas within PA 1. Numerous occurrences within PA 1 (eBird 2025).	Breeding: April–September with peak breeding during June and July. Roosting: The breeding pair and juveniles roost communally until the following spring.
Bald eagle *Haliaeetus leucocephalus*	CDFW, USFWS	BGECP/ SE, SFP	Species is a permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses snags or other perches; nests in advanced-successional conifer forest near open water	**Moderate (flyovers and possibly foraging):** No suitable nesting trees are present within PA 1, while suitable nesting habitat may be present in adjacent forests. Eagles typically nest near foraging habitat, and while the most suitable foraging habitat in the area is Humboldt Bay, which is about 0.25 miles from PA 1, the lower estuary habitat within PA 1 may also support foraging habitat. An eagle was observed within PA 1 in 2018 and there have been numerous other occurrences spanning multiple years within one mile of PA 1 (eBird 2025). The nearest CNDDB occurrence is within three miles of PA 1 in 2005, and the most recent is six miles from PA 1 from 2022 (CDFW 2025a).	Breeding season: February through August Nest building: typically, 1 to 3 months before egg-laying
Bank swallow *Riparia riparia*	CDFW	–/ST	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam	**Moderate (foraging only):** Suitable nesting habitat does not exist within PA 1, but foraging habitat is present in grasslands, agricultural fields, and riparian areas. One occurrence within 0.25 miles of PA 1 in 2022 and multiple 2024 occurrences in the Project vicinity (Arcata Marsh, Humboldt Bay National Wildlife Refuge, north and south spits of Humboldt Bay) (eBird 2025). The most recent CNDDB occurrence is about 12 miles from PA 1 from 2012 (CDFW 2025a).	Not applicable
Grasshopper sparrow *Ammodramus savannarum*	CDFW	–/SSC	Summer resident; nests in Humboldt, Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	**Moderate:** Suitable nesting and foraging habitat exists within PA 1. One CNDDB occurrence is documented near the Eel River in 2017 (CDFW 2025a). The nearest eBird occurrence is 1.5 miles away from PA 1 in Humboldt Hill from 2014, and there have been many occurrences at the Arcata Marsh, Table Bluff Ecological Reserve, and Humboldt Bay National Wildlife Refuge from 2020–2024 (eBird 2025).	Breeding season: mid-March to August Incubation Period: 11–13 days Nestling Period: 6–9 days

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing[b]
Mammals						
Townsend's big-eared bat *Corynorhinus townsendii*	CDFW	–/SSC	Throughout California, found in all but subalpine and alpine habitats, details of distribution not well known	Roosts in cavities, most often in tunnels, caves, mines, and buildings, but also rock shelters, preferentially close to water. Most abundant in mesic habitats, also found in oak woodlands, desert, vegetated drainages, caves or cave-like structures (including basal hollows in large trees, mines, tunnels, and buildings).	**Moderate:** While preferred roosting habitat is lacking (caves and mines), species have been known to roost in buildings, which are present within PA 1 (Appendix D, Bat Habitat Assessment). It is unlikely that trees within PA 1 support large basal hollows for roosting. Suitable foraging habitat present in upland open areas of PA 1. Species documented acoustically about 8 miles northeast at the closest grid cell to PA 1 in July and August 2019 and July 2020 (Conservation Biology Institute and USFS 2025). The nearest CNDDB occurrence is about three miles from PA 1 in 1949 and the most recent CNDDB occurrence is about six miles away in Eureka in 1998 (CDFW 2025a).	Maternity season: May 1 through August 31 Torpor season: November 1 through March 31
Pallid bat *Antrozous pallidus*	CDFW	–/SSC	Throughout California except for elevations greater than 3,000 m in the Sierra Nevada	Roosts in rock crevices, cavities in live or dead trees hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open woodland habitats and most frequently in riparian zone, in open oak savannah, and open mixed deciduous forest.	**Moderate:** Buildings and trees with cavities may provide roosting habitat (Appendix D, Bat Habitat Assessment). Upland foraging habitat is present within PA 1. The only CNDDB occurrence near PA 1 is about ten miles south from 1924 (CDFW 2025a). The species was not documented acoustically at the closest grid cell to PA 1, located about 8 miles northeast (Conservation Biology Institute and USFS 2025).	Maternity season: May 1 through August 31 Torpor season: November 1 through March 31

Notes: CDFW = California Department Fish and Wildlife; CNDDB = California Natural Diversity Database; ppt = parts per thousand; USFWS = U.S. Fish and Wildlife Service

[a] Status codes:

Federal

FE	Listed as endangered under the federal Endangered Species Act
FT	Listed as threatened under the federal Endangered Species Act
FC	Federal candidate species
FPT	Federally proposed for listing as threatened
BGECP	Protected under the Bald and Golden Eagle Protection Act
MBTA	Protected under the Migratory Bird Treaty Act

State

SE	Listed as Endangered under the California Endangered Species Act
ST	Listed as Threatened under the California Endangered Species Act
SSC	CDFW Species of Special Concern
SFP	State Fully Protected
–	No state status

[b] Sensitive life history timing was identified for species with a moderate to high potential to occur within the Planning Area.

4 REFERENCES

Allen, M. B., R. O. Engle, J. S. Zendt, F. C. Shrier, J. T. Wilson, and P. J. Connolly. 2016. Salmon and steelhead in the White Salmon River after the removal of condit dam-planning efforts and recolonization results. Fisheries 41: 190–203.

Anderson. C. 2020. Results of Freshwater Creek Salmonid Life Cycle Monitoring Station 2019–2020. Scientific Report Prepared in Partial Fulfillment of Fisheries Restoration Grant Project No: P1610508. Prepared by Anderson and Humboldt State University, Department of Fisheries Biology, Arcata, California for California Department of Fish and Wildlife, Sacramento, California.

Anderson, C. 2023a. Recent longfin smelt captures Northern California. Unpublished data.

Anderson, C. 2023b. Recent eulachon captures Northern California. Unpublished data.

Barnhart, R. A. 1991. Steelhead (*Oncorhynchus mykiss*). Pages 324–336 *in* J. Stolz and J. Schnell, editors. Trout. Stackpole Books, Harrisburg, Pennsylvania.

Beck, M. W., K. L. Heck, K. W. Able, D. L. Childers, D. B. Eggleston, B. M. Gillanders, B. Haplern, C. G. Hays, K. Hoshino, T. J. Minello, R. J. Orth, P. F. Sheridan, m. P. Weinstein. 2001. The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates: a better understanding of the habitats that serve as nurseries for marine species and the factors that create site-specific variability in nursery quality will improve conservation and management of these areas. Bioscience 51: 633–641.

Bond, M. H. 2006. Importance of estuarine rearing to Central California steelhead (*Oncorhynchus mykiss*) growth and marine survival. Master's thesis. University of California, Santa Cruz, California.

Bond, M. H., S. A. Hayes, C. V. Hanson, and R. B. MacFarlane. 2008. Marine survival of steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. Canadian Journal of Fisheries and Aquatic Sciences 65: 2,242–2,252.

Bottom, D. L., K. K. Jones, T. J. Cornwell, A. Gray, and C. A., Simenstad. 2005. Patterns of Chinook salmon migration and residency in the Salmon River Estuary (Oregon). Estuarine Coastal and Shelf Science 64: 79–93.

Bourret, S. L., C. C. Caudill, and M. L. Keefer. 2016. Diversity of juvenile Chinook salmon life history pathways. Reviews in Fish Biology and Fisheries 26: 375–403.
Calflora. 2025. Calflora. Website. https://www.calflora.org/ [Accessed December 2024–January 2025]. Prepared by Calflora, Berkeley, California.

Cal-IPC (California Invasive Plant Council). 2025. The Cal-IPC inventory. https://www.cal-ipc.org/

California Trout, Stillwater Sciences, and Northern Hydrology and Engineering. 2019. Elk River Recovery Assessment: Recovery Framework. Prepared by California Trout, Arcata, California;

Stillwater Sciences, Arcata, California; and Northern Hydrology and Engineering, McKinleyville, California for North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Stillwater Sciences, Northern Hydrology & Engineering, and GHD. 2022. Elk River Watershed Stewardship Program: Sediment Remediation and Habitat Rehabilitation Recovery Plan. Prepared by California Trout, Arcata, California; Stillwater Sciences, Arcata, California; Northern Hydrology & Engineering, McKinleyville, California; and GHD, Eureka California, for the North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Northern Hydrology and Engineering, and Stillwater Sciences. 2023. Elk River Planning Area 1 10% Design Report. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; and Stillwater Sciences, Arcata, California.

California Trout, Northern Hydrology and Engineering, Stillwater Sciences, and GHD. 2025. Elk River Planning Area 1 Project Description. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; Stillwater Sciences, Arcata, California; and GHD, Eureka, California.

CCH (Consortium of California Herbaria). 2024. Specimen data from CCH contributing herbaria. Website. https://www.calflora.org/ [Accessed December 2024].

CDFW (California Department of Fish and Wildlife). 2018. Protocols for surveying and evaluating impacts to special-status native plant populations and sensitive natural communities.

CDFW. 2025a. California Natural Diversity Database (CNDDB), Version 5.3.0. Website. https://map.dfg.ca.gov/rarefind/view/RareFind.aspx [Accessed December 2024–January 2025]. Prepared by California Department of Fish and Wildlife, Sacramento, California.

CDFW. 2025b. CNDDB QuickView Tool. Biogeographic Information and Observation System (BIOS) (Version 6.24.071). California Department of Fish and Wildlife. Available at: https://wildlife.ca.gov/Data/BIOS.

CDFW. 2025c. Special Vascular Plants, Bryophytes, and Lichens List. California Department of Fish and Wildlife. Sacramento, CA.

CDFW. 2025d. California Sensitive Natural Communities List. Prepared by CDFW, Vegetation Classification and Mapping Program, Sacramento, California. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153398&inlinehttps://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153398&inline.

CDFW. 2025e. Spotted owl observations database. Website. https://apps.wildlife.ca.gov/bios6/?bookmark=327. [Accessed January 2025].

Chamberlain, C. D. 2006. Environmental variables of northern California lagoons and estuaries and the distribution of tidewater goby (*Eucyclogobius newberryi*). Draft technical report No. TR 2006-04. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California.

CNPS (California Native Plant Society). 2025a. A manual of California vegetation, online edition. Website. http://www.cnps.org/cnps/vegetation/ [Accessed December 2024–January 2025]. Prepared by CNPS, Sacramento, California.

CNPS. 2025b. Inventory of Rare and Endangered Plants of California (online edition, v9.5). https://www.rareplants.cnps.org [Accessed December 2024–January 2025]. Prepared by CNPS, Sacramento, California.

Conservation Biology Institute and USFS (U.S. Department of Agriculture Forest Service). 2025. Bat Acoustic Monitoring Visualization Tool. https://visualize.batamp.databasin.org/ [Accessed January 2025].

eBird. 2025. eBird: An online database of bird distribution and abundance. Website. http://www.ebird.org. [Accessed: December 2024]. eBird, Cornell Lab of Ornithology, Ithaca, New York.

FGDC (Federal Geographic Data Committee). 2008. National Vegetation Classification Standard, Version 2. FGDC-STD-005-2008, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey, Reston, Virginia. Available: http://www.fgdc.gov/standards/standards_publications/index_htm

Flitcroft, R. L., S. L. Lewis, I. Arismendi, R. LovellFord, M. V. Santelmann, M. Safeeq, and G. Grant. 2016. Linking hydroclimate to fish phenology and habitat use with ichthyographs. PLoS ONE 11: e0168831. doi:10.1371/journal.pone.0168831.

Garwood. R. S., 2017. Historic and contemporary distribution of Longfin Smelt (*Spirinchus thaleichthys*) along the California coast. California Fish and Game 103: 96–117.

Hayes, S. A., M. H. Bond, C. V. Hanson, E. V. Freund, J. J. Smith, E. C. Anderson, A. J. Ammann, and R. B. MacFarlane. 2008. Steelhead growth in a small central California watershed: upstream and estuarine rearing patterns. Transactions of the American Fisheries Society 137: 114–128.

HBWAC (Humboldt Bay Watershed Advisory Committee). 2005. Humboldt Bay Watershed Salmon and Steelhead Conservation Plan. Available at: http://www.nrsrcaa.org/nrs/projcurr/pdfs/EnhancePlanComplete.pdf.

Healey M. C. 1982. Catch, escapement and stock-recruitment for British Columbia Chinook salmon since 1951. Can Tech Rep Fish Aquat Sci 1107: 1–77

Healey, M. C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 311–393 *in* C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia.

Hering, D. K., D. L. Bottom, E. F. Prentice, K. K. Jones, and I. A. Fleming. 2010. Tidal movements and residency of subyearling Chinook salmon (*Oncorhynchus tshawytscha*) in an Oregon salt marsh channel. Canadian Journal of Fisheries and Aquatic Sciences 67: 524–533.

Humboldt County Resource Conservation District. 2024. Salt River Ecosystem Restoration Project habitat mitigation and monitoring plan: monitoring report 2023. Prepared by Humboldt County Resource Conservation District, Eureka, California.

Jepson Flora Project, editors. 2025. Jepson eFlora. Available at: http://ucjeps.berkeley.edu/eflora/.

Jennings, M. D., D. Faber-Langendoen, R. K. Peet, O. L. Loucks, D. C. Glenn-Lewin, A. Damman, M. G. Barbour, R. Pfister, D. H. Grossman, D. Roberts, D. Tart, M. Walker, S. S. Talbot, J. Walker, G. S. Hartshorn, G. Waggoner, M. D. Abrams, A. Hill, and M. Rejmanek. 2006. Description, documentation, and evaluation of associations and alliances within the U.S. National Vegetation Classification, Version 4.5. Vegetation Classification Panel, The Ecological Society of America, Washington, D.C.

Jones, K. K., T. J. Cornwell, D. L. Bottom, L. A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult *Onchorynchus kisutch*. Journal of Fish Biology 85: 52–80.

Koski, K. V. 2009. The fate of coho salmon nomads: the story of an estuarine-rearing strategy promoting resilience. Ecology and Society 14: 4.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999a. Extirpation and decolonization in a metapopulation of an endangered fish, the tidewater goby. Conservation Biology 13: 1,447–1,453.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999b. Postflood persistence and recolonization of endangered tidewater goby populations. North American Journal of Fisheries Management 19: 618–622.

Levy, D. A., T. G. Northcote, and G. J. Birch. 1979. Juvenile salmon utilization of tidal channels in the Fraser River estuary, British Columbia. West-water Res. Cent. Univ. Br. Col. Tech. Rep. 23.

Miller, B. A., and S. Sadro. 2003. Residence time and seasonal movements of juvenile coho salmon in the ecotone and lower estuary of Winchester Creek, South Slough, Oregon. Transactions of the American Fisheries Society 132: 546–559.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley.

Moyle, P. B., R. M. Quiñones, J. V. Katz and J. Weaver. 2015. Fish Species of Special Concern in California. Sacramento: California Department of Fish and Wildlife.

NAIP (National Agriculture Imagery Program). 2024. Humboldt County NAIP imagery. USDA Farm Production and Conservation Business Center (FPAC-BC) Geospatial Enterprise Operations (GEO) Branch.

Natural Resources Services. 2022. Martin Slough Enhancement Project 2021 Monitoring Report March 2022 Prepared by Natural Resources Services, a division of Redwood Community Action Agency, Eureka, California.

NatureServe. 2025. Definitions of NatureServe Conservation Status Ranks. Website. https://help.natureserve.org/biotics/content/record_management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#National [Accessed April 2025].

NMFS (National Marine Fisheries Service). 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Oncorhynchus kisutch). National Marine Fisheries Service. Arcata, California.

NMFS. 2016. Coastal Multispecies Final Recovery Plan: California Coastal Chinook Salmon ESU, Northern California Steelhead DPS and Central California Coast Steelhead DPS. West Coast Region, Santa Rosa, California. October.

NMFS. 2022. California Species List Tools database. Available at: https://www.fisheries.noaa.gov/resource/map/protected-resources-app.

Office of Coastal Management. 2020. Aerial photography (1.5-inch pixel) orthorectified aerial photography. Collected on July 24, 2019. Prepared for the City of Eureka.

Otto, R. G. 1971. Effects of salinity on the survival and growth of pre-smolt coho salmon (*Oncorhynchus kisutch*). Journal of the Fisheries Research Board of Canada 28: 343–349.

PFMC (Pacific Fishery Management Council). 2008. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery as Amended Through Amendment 19.

Reimers, P. E. 1971. The length of residence of juvenile fall Chinook salmon in Sixes River, Oregon. Doctoral dissertation. Oregon State University, Corvallis.

Ricker, S. J., D. Ward, and C. W. Anderson. 2014. Results of Freshwater Creek Salmonid Life Cycle Monitoring Station 2010–2013. California Department of Fish and Game, Anadromous Fisheries Resource Assessment and Monitoring Program, 50 Ericson Ct., Arcata, CA 95521.

Rosenfield, J. A. 2010. Life history conceptual model and sub-models for longfin smelt, San Francisco Estuary Population. Prepared for Delta Regional Ecosystem Restoration Implementation Plan.

Shapovalov, L., and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*) with special reference to Waddell Creek, California, and recommendations regarding their management. Fisheries Bulletin No. 98. Prepared by California Department of Fish and Game, Sacramento, California.

Shuford, W. D., and T. Gardali, editors. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Stillwater Sciences. 2006. Guidelines to evaluate, modify, and develop estuarine restoration projects for tidewater goby habitat. Prepared by Stillwater Sciences, Arcata, California for US Fish and Wildlife Service, Arcata, California.

Stillwater Sciences. 2016. Pacific lamprey in Humboldt Bay tributaries: a summary of information and identification of research needs. Prepared by Stillwater Sciences, Arcata, California for Wiyot Tribe, Loleta, California.

Stillwater Sciences. 2025a. Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project. Prepared by Stillwater Sciences, Arcata, California.

Stillwater Sciences. 2025b. Elk River Estuary (Planning Area 1) Restoration Project: Invasive Plant Management Plan. Prepared by Stillwater Sciences, Arcata, California.

Swift, C. C., J. L. Nelson, C. Maslow, and T. Stein. 1989. Biology and distribution of the tidewater goby, *Eucyclogobius newberri* (Pisces: Gobiidae) of California. Contributions in Science 404: 1–19.

Tetra Tech, Inc. 2000. Final report intensive habitat survey for Lake Earl and Lake Talawa, Del Norte County, California. Prepared by Tetra Tech, Inc., San Francisco, California for US Army Corps of Engineers, San Francisco District, San Francisco, California.

Tschaplinski, P. J. 1987. The use of estuaries as rearing habitats by juvenile coho salmon. Pages 123–142 *in* T. W. Chamberlain, editor. Proceedings of the workshop: applying 15 years of Carnation Creek results. Department of Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo, British Columbia, Canada.

University of California, Berkeley. 2025. CalPhotos: plants. Biodiversity Sciences Technology Group (BSCIT), University of California, Berkeley, California. Available at: http://calphotos.berkeley.edu/flora/

USFWS (U.S. Fish and Wildlife Service). 1996. Guidelines for conducting and reporting botanical inventories for federally listed, proposed and candidate plants.

USFWS. 2025. Information for Planning and Consultation (IPaC): online project planning tool. https://ecos.fws.gov/ipac/ [Accessed December 2024].

Wallace, M., and S. Allan. 2009. Juvenile Salmonid Use of the Tidal Portions of Selected Tributaries to Humboldt Bay, California, 2007-2009. Prepared by Michael Wallace, Natural Stocks Assessment Project, California Department of Fish and Game and Stan Allen, Pacific States Marine Fisheries Commission.

Wallace, M., S. Ricker, J. Garwood, A. Frimodig, and S. Allen. 2015. Importance of the stream-estuary ecotone to juvenile Coho Salmon (*Oncorhynchus kisutch*) in Humboldt Bay, California. California Fish and Game 101: 241–266.

Wallace, M., E. Ojerholm, A. Scheiff, and S. Allen. 2018. Juvenile salmonid use and restoration assessment of the tidal portions of selected tributaries to Humboldt Bay, California, 2015–2017. Fisheries Restoration Grant Program Final Report for Grant P1310520. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=159379

Western Monarch and Milkweed Occurrence Database. 2025. Data accessed from the Western Monarch Milkweed Mapper. Website. www.monarchmilkweedmapper.org [Accessed January 2025]. Prepared by the Xerces Society, U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, and Washington Department of Fish and Wildlife.

Appendices

Appendix A

Database Query Results for Special-status Species and Sensitive Natural Communities Previously Documented in the Project Vicinity

Table A-1. Database query results for special-status plant species documented within the Project vicinity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Angelica lucida (sea-watch)[3]	Apiaceae	perennial herb	–/–/4.2	Coastal bluff scrub, coastal dunes, coastal scrub, coastal salt marshes and swamps; 0–490 ft. Blooming period: May–September	**High:** the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within one mile of PA 1.
Astragalus pycnostachyus var. *pycnostachyus* (coastal marsh milk-vetch)	Fabaceae	perennial herb	–/–/1B.2	Mesic coastal dunes, coastal scrub, and coastal salt and streamside marshes and swamps; 0–100 ft. Blooming period: (April) June–October	**Low:** suitable habitat is present within PA 1; however, the two occurrences within the Project vicinity are both over 100 years old (CDFW 2025a).
Cardamine angulata (seaside bittercress)	Brassicaceae	perennial herb	–/–/2B.2	Wet areas and streambanks in Lower montane coniferous forest, and North Coast coniferous forest; 80–3,000 ft. Blooming period: (January)March–July	**Low:** suitable habitat is present within PA 1; however, the nearest occurrence is from 1964 (CDFW 2025a).
Carex arcta (northern clustered sedge)	Cyperaceae	perennial herb	–/–/2B.2	Bogs and fens, and North Coast coniferous forest (mesic); 195–4595 ft. Blooming period: June–September	**Low:** suitable habitat is present within PA 1; however, PA 1 is slightly under the species' elevation range. The nearest occurrence is over fifteen miles away in 2007 (CDFW 2025a).
Carex leptalea (bristle-stalked sedge)	Cyperaceae	perennial rhizomatous herb	–/–/2B.2	Bogs and fens, mesic meadows and seeps, and marshes and swamps; 0–2,295 ft. Blooming period: March–July	**Low:** suitable habitat is present within PA 1; however, nearest occurrence is known from a 1926 Tracy collection occurring in a mossy bog along a north slope (CDFW 2025a).
Carex lyngbyei (Lyngbye's sedge)[3]	Cyperaceae	perennial rhizomatous herb	–/–/2B.2	Brackish or freshwater marshes and swamps; 0–35 ft. Blooming period: April–August	**High:** the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 (CDFW 2025a).

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Carex praticola (northern meadow sedge)	Cyperaceae	perennial herb	–/–/2B.2	Mesic meadows and seeps; 0–10,500 ft. Blooming period: May–July	**Low:** suitable habitat is present within PA 1; however, the nearest documented occurrence within 10 miles of PA 1 is known from a 1914 and 1915 Tracy collection attributed to the Ryan Slough region (CDFW 2025a).
Castilleja ambigua var. *humboldtiensis* (Humboldt Bay owl's-clover)[3]	Orobanchaceae	annual herb (hemiparasitic)	–/–/1B.2	Coastal salt marshes and swamps; 0–10 ft. Blooming period: April–August	**High:** the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 (CDFW 2025a).
Chloropyron maritimum subsp. *palustre* (Point Reyes bird's-beak)[3]	Orobanchaceae	annual herb (hemiparasitic)	–/–/1B.2	Coastal salt marshes and swamps; 0–35 ft. Blooming period: June–October	**High**: suitable habitat is present within PA 1 and an occurrence was documented just downstream (0.25 mi) of PA 1 in 2024 (Stillwater Sciences, field obs., 2024).
Chrysosplenium glechomifolium (Pacific golden saxifrage)[3]	Saxifragaceae	perennial herb	–/–/4.3	Streambanks, sometimes seeps, sometimes roadsides in North Coast coniferous forest and riparian forest; 30–2,100 ft. Blooming period: February–June (July)	**High:** the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were observed within one-mile of PA 1 (Stillwater Sciences, field obs., 2023).
Eleocharis parvula (small spikerush)	Cyperaceae	perennial herb	–/–/4.3	Marshes and swamps; 5–9,910 ft. Blooming period: (April)June-August (September)	**Low:** suitable habitat is present within PA 1; however, few occurrences within ten miles of PA 1. The most recent occurrence is from 2019 within the Arcata South quadrangle (CalFlora 2025).
Fissidens pauperculus (minute pocket moss)	Fissidentaceae	moss	–/–/1B.2	North Coast coniferous forest (damp coastal soil); 30–3,360 ft. Blooming period: N/A	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Gilia capitata subsp. *pacifica* (Pacific gilia)	Polemoniaceae	annual herb	–/–/1B.2	Coastal bluff scrub, chaparral (openings), coastal prairie, valley and foothill grassland; 15–5,465 ft. Blooming period: April–August	**Low:** suitable habitat is of low quantity and quality within PA 1. The only documented occurrence within 10 miles of PA 1 is known from a 1905 Tracy collection located in a sandy field near Bucksport (Eureka) (CDFW 2025a).
Hosackia gracilis (harlequin lotus)	Fabaceae	perennial rhizomatous herb	–/–/4.2	Generally in mesic areas of Broadleafed upland forest, mixed coniferous forest, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps, Meadows and seeps, North Coast coniferous forest, Valley and foothill grassland. Sometimes on roadsides; 0–2,295 ft. Blooming period: March–July	**Low:** suitable habitat is of low quantity and quality within PA 1. The nearest occurrence within the last decade is about seven miles PA 1 in Table Bluff (CDFW 2025a).
Lasthenia californica subsp. *macrantha* (perennial goldfields)	Asteraceae	perennial herb	–/–/1B.2	Coastal bluff scrub, coastal dunes, and coastal scrub; 15–1,705 ft. Blooming period: January–November	**Low:** suitable habitat is of low quantity and quality within PA 1. The only known occurrence within 10 miles of PA 1 is known from 1913 Hutchinson collection in the Eureka area (CDFW 2025a).
Lathyrus palustris (marsh pea)	Fabaceae	perennial herb	–/–/2B.2	Mesic in bogs and fens, coastal prairie, coastal scrub, lower montane coniferous forest, marshes and swamps, and North Coast coniferous forest; 0–330 ft. Blooming period: March–August	**Moderate:** suitable habitat is present and a single occurrence near PA 1 was documented in a marsh north of Elk River Slough in 2003 (CDFW 2025a).

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Lilium occidentale (western lily)	Liliaceae	perennial bulbiferous herb	FE/SE/1B.1	Bogs and fens, coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps (freshwater), and North Coast coniferous forest (openings); 5–605 ft. Blooming period: June–July	**Low:** nearby occurrences are under CDFW management in the Table Bluff Ecological Reserve and are not known to occur within PA 1.
Mitellastra caulescens (leafy-stemmed mitrewort)	Saxifragaceae	perennial rhizomatous herb	–/–/4.2	Mesic, sometimes roadsides in broadleafed upland forest, lower montane coniferous forest, meadows and seeps, and North Coast coniferous forest; 15–5,575 ft. Blooming period: (March) April–October	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity within PA 1. The most recent occurrence is from 2021 in the Arcata Community Forest (CalFlora 2025).
Monotropa uniflora (ghost-pipe)	Ericaceae	perennial herb (achlorophyllous)	–/–/2B.2	Broadleafed upland forest and North Coast coniferous forest; 30–1,805 ft. Blooming period: June–August (September)	**Low:** the species' known distribution and elevation range overlaps with PA 1 the species' required habitat is of very low quality or quantity.
Montia howellii (Howell's montia)	Montiaceae	annual herb	–/–/2B.2	Vernally mesic, sometimes roadsides in meadows and seeps, North Coast coniferous forest, and vernal pools; 0–2,740 ft. Blooming period: (January–February) March–May	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.
Packera bolanderi var. *bolanderi* (seacoast ragwort)	Asteraceae	perennial rhizomatous herb	–/–/2B.2	Sometimes roadsides in coastal scrub, and North Coast coniferous forest; 95–2,135 ft. Blooming period: (January–April) May–July (August)	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Pityopus californicus (California pinefoot)	Ericaceae	perennial herb (achlorophyllous)	–/–/4.2	Mesic areas in broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest, and upper montane coniferous forest; 45–7,300 ft. Blooming period: (March–April) May–August	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.
Pleuropogon refractus (nodding semaphore grass)	Poaceae	perennial rhizomatous herb	–/–/4.2	Mesic areas in lower montane coniferous forest, meadows and seeps, North Coast coniferous forest, and riparian forest; 0–5,250 ft. Blooming period: (March) April–August	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.
Polemonium carneum (Oregon polemonium)	Polemoniaceae	perennial herb	–/–/2B.2	Coastal prairie, coastal scrub, and lower montane coniferous forest; 0–6,005 ft. Blooming period: April–September	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.
Puccinellia pumila (dwarf alkali grass)	Poaceae	perennial herb	–/–/2B.2	Coastal salt marshes and swamps; 0–35 ft. Blooming period: July	**Low:** suitable habitat is present within PA 1 however only known occurrence within 10-miles of PA 1 is from a 1938 Tracy collection near the Eel River mouth (CDFW 2025a).
Ribes laxiflorum (trailing black currant)	Grossulariaceae	perennial deciduous shrub	–/–/4.3	North Coast coniferous forest (sometimes roadsides); 15–4,575 ft. Blooming period: March–July (August)	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Sidalcea malachroides (maple-leaved checkerbloom)	Malvaceae	perennial herb	–/–/4.2	Often in disturbed areas in broadleafed upland forest, coastal prairie, coastal scrub, North Coast coniferous forest, and riparian woodland; 0–2395 ft. Blooming period: (March) April–August	**Moderate:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is present within PA 1. The nearest occurrence (2001) is within two miles of PA 1 in a mesic redwood forest (CDFW 2025a).
Sidalcea malviflora subsp. *patula* (Siskiyou checkerbloom)	Malvaceae	perennial rhizomatous herb	–/–/1B.2	Often roadcuts in coastal bluff scrub, coastal prairie, and North Coast coniferous forest; 45–2,885 ft. Blooming period: (April) May–August	**Low:** suitable habitat is present within PA 1; however, known occurrences within 10-miles of PA 1 are from pre-1950 Tracy collections in Eureka and Table Bluff (CDFW 2025a).
Sidalcea oregana subsp. *eximia* (coast checkerbloom)	Malvaceae	perennial herb	–/–/1B.2	Lower montane coniferous forest, meadows and seeps, and North Coast coniferous forest; 15–4,395 ft. Blooming period: June–August	**Moderate:** suitable habitat is present within PA 1. A single occurrence within PA 1 was documented from a 1907 Tracy collection along a ditch in the Elk River (CDFW 2025a).
Silene scouleri subsp. *scouleri* (Scouler's catchfly)	Caryophyllaceae	perennial herb	–/–/2B.2	Coastal bluff scrub, coastal prairie, and valley and foothill grassland; 0–1,970 ft. Blooming period: (March–May) June–August (September)	**Low:** suitable habitat is present within PA 1 however, known occurrences within 10-miles of PA 1 are from a 1904 Tracy Collection near Bucksport (Eureka) (CDFW 2025a).
Spergularia canadensis var. *occidentalis* (western sand-spurrey)[1]	Caryophyllaceae	annual herb	–/–/2B.1	Coastal salt marshes and swamps; 0–10 ft. Blooming period: June–August	**High:** the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 during botanical surveys in 2021.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR)[1]	Habitat association, elevation range, and blooming period[2]	Pre-field assessment of potential to occur
Sulcaria spiralifera (twisted horsehair lichen)	Parmeliaceae	fruticose lichen (epiphytic)	–/–/1B.2	Usually on conifers in Coastal dunes (SLO Co.), North Coast coniferous forest (immediate coast); 0–295 ft. Blooming period: N/A	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.
Viola palustris (alpine marsh violet)	Violaceae	perennial rhizomatous herb	–/–/2B.2	Bogs and fens (coastal) and coastal scrub (mesic); 0–490 ft. Blooming period: March–August	**Low:** the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.

Table Source: CNPS 2025b, CDFW 2025a

[1] Status:

Federal

None No federal status

FE Federally Endangered

State

None No state status

SE State Endangered

California Rare Plant Rank

List 1B Plants rare, threatened, or endangered in California and elsewhere

List 2B Plants rare, threatened, or endangered in California, but more common elsewhere

List 4 Plants of limited distribution, a watch list

CNPS Threat Ranks:

0.1 Seriously threatened in California (high degree/immediacy of threat)

0.2 Fairly threatened in California (moderate degree/immediacy of threat)

0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

[2] Months within parentheses are uncommon; N/A = Not applicable (CNPS 2025b)

[3] Observed in PA 1 during floristic surveys conducted between 2021–2025.

Table A-2. Database query results for sensitive natural communities documented within the Project vicinity.

Holland type	Corresponding MCV Alliances/Associations that are sensitive natural communities	Common name	State status[1]	Corresponding CWHR type	Documented within PA 1?
Northern Coastal Salt Marsh	*Arthrocnemum subterminale* Herbaceous Alliance	Parish's glasswort patches	S2	Saline emergent wetland	No
	Carex obnupta - Oenanthe sarmentosa - Scirpus microcarpus Herbaceous Alliance	slough sedge - water-parsley - small-fruited bulrush marsh	S3	Fresh emergent wetland, saline emergent wetland	Yes
	Deschampsia cespitosa - Festuca rubra Brackish Salt Marsh Provisional Herbaceous Alliance	tufted hairgrass - red fescue brackish salt marsh	S2	Saline emergent wetland	No
	Frankenia salina Herbaceous Alliance	alkali heath marsh	S3	Saline emergent wetland	No
	Grindelia (*stricta*) Provisional Herbaceous Alliance	gum plant patches	S2S3	Saline emergent wetland	Yes
	Sarcocornia pacifica (*Salicornia depressa*) Herbaceous Alliance	pickleweed mats	S3	Saline emergent wetland	Yes
	Sesuvium verrucosum Herbaceous Alliance	Western sea-purslane marshes	S2.2?	Saline emergent wetland	No
	Spartina foliosa Herbaceous Alliance	California cordgrass marsh	S3.2	Saline emergent wetland	No
Coastal Terrace Prairie	*Calamagrostis nutkaensis* Herbaceous Alliance	Pacific reed grass meadows	S2	Perennial grassland	No
	Deschampsia cespitosa - Hordeum brachyantherum - Danthonia californica Herbaceous Alliance	Coastal tufted hair grass - meadow barley - California oatgrass meadow	S3	Fresh emergent wetland, perennial grassland, wet meadow	Yes
	Festuca idahoensis - Danthonia californica Herbaceous Alliance	Idaho fescue - California oatgrass grassland	S3	Perennial grassland	No
Sitka Spruce Forest	*Abies grandis* Forest Alliance	Grand fir forest	S2.1	Redwood	No
	Picea sitchensis Forest & Woodland Alliance	Sitka spruce forest and woodland	S2	Redwood	Yes

Table Source: CDFW 2025a, CNPS 2025a

[1] State status: S2: Imperiled statewide – At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3: Vulnerable statewide – At moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
0.1: Very threatened
0.2: Threatened
?: Inexact or uncertain numeric rank.

Table A-3. Database query results of special-status fish and wildlife species documented in the Project Vicinity.

Common name *Scientific name*	Query sources	Status[a] Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Invertebrates					
Western bumble bee *Bombus occidentalis*	CDFW	–/SCE	Current range includes northern California and northern Sierra Nevada Mountains	Forages on flowering plants in chaparral, scrub, mountain meadows, forested openings, open grassy areas, and urban parks and gardens. Host plant genera include, but are not limited to, *Ceanothus, Centaurea, Chrysothamnus, Cirsium, Eriogonum, Geranium, Grindellia, Lupinus, Melilotus, Monardella, Rubus, Solidago,* and *Trifolium*. Nests underground in pre-existing cavities (abandoned small mammal burrows) but can also nest above ground in thatched grass, brush piles, fallen logs, and human-made structures.	**Low:** While foraging habitat and potential nesting sites occur within PA 1, it is located in the southern portion of the species' current range, where observations have been sparse in the last few decades, which include 3.7 miles from PA 1 in 1993, 1.4 miles in 1976, and 26 miles in 2015 (CDFW 2025a).
Monarch butterfly (California overwintering population) *Danaus plexippus plexippus*	USFWS	FC/–	Range includes most of California; it breeds throughout California and overwinters in suitable groves along the California coast	Adults forage on a variety of flowering plants during breeding and migration; larva (caterpillars) require milkweed (*Asclepias* spp.) as a host plant. Overwinter roosts include eucalyptus (*Eucalyptus* sp.), Monterey pines (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) trees or groves.	**Moderate (foraging only):** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Fish					
Pacific lamprey *Entosphenus tridentatus*	CDFW	–/SSC	Most coastal flowing watersheds between Mexico and Oregon.	Anadromous species that spawns and rears in freshwater before emigrating to the ocean to feed and grow. Generally distributed wherever salmon and steelhead occur. Adult spawning: coarse gravel or small cobble in pool tails or low-gradient riffles. Larval rearing: Mostly freshwater (below 12 parts per thousand [ppt] salinity) and low-velocity areas where they burrow into fine silt and sand substrates that often contain organic matter. Water temperatures less than approximately 22°C.	**High:** See Section 3.4.
Western brook lamprey *Lampetra richardsoni*	CDFW	–/SSC	Coastal and Central Valley rivers and streams	Non-migratory species that remains in fresh water for its entire life cycle. Spawns in small gravel substrates in cool water streams; requires habitats with low water velocity and fine sediment for ammocoete rearing.	**Moderate:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Green sturgeon – southern distinct population segment (DPS) *Acipenser medirostris pop. 1*	CDFW/NMFS	FT/SSC	Present in estuaries such as San Francisco, San Pablo, Suisun, and Humboldt bays and Sacramento-San Joaquin Delta; spawn in the Sacramento and San Joaquin rivers, including the Sacramento, Feather, and Yuba rivers	Spawns in large river mainstem pools with cool water and cobble, clean sand, or bedrock substrate; in San Francisco Bay adults tend to utilize water depths less than 10 m (33 ft) to swim near the surface or forage along the sea floor.	**Low**: Subadults and adults are known to feed in the North Humboldt Bay (area of the bay north of the harbor entrance). While they are unlikely to venture into or inhabit the shallow channels within PA 1, critical habitat has been designated in the lower portion; therefore, subadults and adults may access these areas to feed. No breeding or juvenile rearing habitat in present in Humboldt Bay or tributaries, including Elk River and PA 1. Species has been documented throughout Humboldt Bay, less than a mile from PA 1 in 2020 (CDFW 2025a). Critical habitat has been designated for this species and is present in the western portion of PA 1 (i.e. Lower Elk River and Swain Slough).

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Longfin smelt *Spirinchus thaleichthys*	CDFW	–/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; historical populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults associated with nearshore coastal areas, large bays, and estuaries, and migrate into lower portions of freshwater streams and rivers to spawn over sandy/gravel substrates, rocks, and aquatic plants; juveniles and adults rear in estuarine habitats, with smolts preferring deep-water channels	**High:** See Section 3.4.
Eulachon, southern DPS *Thaleichthys pacificus*	CDFW, NMFS	FT/SSC	Skeena River in British Columbia (inclusive) south to Humboldt Bay and in smaller numbers south to Fort Brag in Northern California	An anadromous fish that generally spawns in freshwater rivers with eggs fertilized in the water column and sinking to the river bottom, typically in areas of gravel and coarse sand. Uses estuaries for migrating between the ocean and freshwater; spends approximately three years in the ocean.	**Moderate**: See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Coho salmon, southern Oregon/northern California Coast Evolutionary Significant Unit (ESU) *Oncorhynchus kisutch*	NMFS, CDFW	FT/ST	Range includes Punta Gorda north to the Oregon border	Low-gradient portions of coastal draining streams with sufficiently cool water temperatures. Adult spawning: fine to coarse gravel in pool tailouts or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: instream pool habitats often associated with large wood or off-channel features that provide low-velocity protection from high flows and cover from predation and water temperatures less than approximately 17°C.	**High:** See Section 3.4.
Chinook salmon, California Coastal ESU *Oncorhynchus tshawytscha*	NMFS	FT/–	Range includes Russian River (Sonoma County) north to Redwood Creek (Humboldt County)	Coastal draining streams. Adult spawning: medium gravel to small cobble in pool tails or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: fry utilize shallow stream margins and juveniles utilize pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 19°C.	**High:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Steelhead, northern California DPS winter-run *Oncorhynchus mykiss irideus*	NMFS, CDFW	FT/–	Range includes Coastal streams from the Russian River (exclusive) north to Redwood Creek (Humboldt County)	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat. Adult spawning: medium to coarse gravel in pool tails or low-gradient riffles with nearby cover or deep pools. Juvenile rearing: pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 22°C. Juveniles typically rear in fresh water for 1 or more years before migrating to the ocean.	**High:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Steelhead, northern California DPS summer-run *Oncorhynchus mykiss irideus*	CDFW	FT/SE	Range includes portions of Redwood Creek (Humboldt County) and the Mad, Eel, and Mattole River basins	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; juveniles typically rear in fresh water for 1 or more years before migrating to the ocean. Adults require suitable pools for holding prior to spawning and tend to spawn in smaller, higher-gradient streams than winter-run steelhead. Adults are capable of spawning upstream of partial barriers to movement, which are only passable at intermediate stream flows.	**None**: No adult habitat within the Humboldt Bay tributaries; therefore, no adults or juveniles would be present. The closest rivers where present include the Eel River 8 miles to the south and Mad River 12 miles to the north.
Coast cutthroat trout *Oncorhynchus clarkii clarkii*	CDFW	–/SSC	Small, low-gradient coastal streams and estuaries from northern Oregon to the Eel River, California	Shaded streams with water temperatures below 18°C and small gravel for spawning; have diverse life histories, including potadromous (migratory within freshwater portions of the river system), stream-resident, and anadromy, which includes rearing in freshwater and foraging in estuaries.	**High:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Tidewater goby *Eucyclogobius newberryi*	CDFW, USFWS	FE/–	Range includes San Diego County north to the mouth of the Smith River in Del Norte County	Typically in shallow waters of coastal lagoons and the uppermost zone of brackish large estuaries; prefer sandy substrate for spawning, but can be found on silt, mud, or rocky substrates; typically in shallow water, but can occur in water up to 15 feet in lagoons and within a wide range of salinity (0–42 ppt).	**High:** See Section 3.4.
Amphibians					
Southern torrent salamander *Rhyacotriton variegatus*	CDFW	–/SSC	Coastal drainages from near Point Arena in Mendocino County to the Oregon border	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rocky substrate in redwood, Douglas fir, mixed conifer, montane riparian and montane hardwood-conifer habitats. Elevational range extends from near sea level to about 3,940 ft.	**Moderate:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Pacific tailed frog (also known as coastal-tailed frog) *Ascaphus truei*	CDFW	–/SSC	Coastal Mendocino County north to the Oregon border, with an isolated population in Shasta region	Occurs in montane hardwood-conifer, redwood, Douglas-fir and ponderosa pine habitats. Restricted to perennial montane streams. In and adjacent to cold, clear, moderate- to fast-flowing, perennial montane streams. Tadpoles require water below 15°C. Elevation 0–8,400 feet.	**Low:** Suitable habitat is not present within PA 1 (e.g., the substrate in Orton Creek does not provide rocky substrate). Suitable habitat is present upstream of PA 1. CNDDB occurrences include an observation within seven miles of PA 1 in the North Fork Elk River from 2004, an occurrence about 11 miles from PA 1 in Salmon Creek from 2017, and an observation within six miles of PA 1 in Little South Fork Elk River from 1994 (CDFW 2025a).
Northern red-legged frog *Rana aurora*	CDFW	–/SSC	Ranges from Mills Creek in Mendocino County to Oregon border	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat	**High:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Foothill yellow-legged frog, North Coast clade *Rana boylii*	CDFW	–/SSC	North of San Francisco Bay through the Coast Range and Klamath Mountains	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	**Low:** Breeding habitat is not present within PA 1; therefore, it is unlikely that individuals would be present. Suitable habitat is present upstream of PA 1. While there is a CNDDB observation from 2014 in similar habitat as PA 1 (Humboldt National Wildlife Refuge, 3 miles away), the species is not typically found in estuarine habitats, but rather in upstream freshwater with cobble or boulder substrates, as noted by an occurrence in the North Fork Elk River from 2001 and multiple recent occurrences 13 miles north along the Mad River from 2018 (CDFW 2025a).
Leatherback Sea Turtle *Dermochelys coriacea*	NMFS	FE/SCE	Temperate and cool waters of the Pacific coast; most sightings in California are from boats out at sea; have been observed in open ocean near San Diego, Santa Barbara, Ventura, San Mateo, and Santa Cruz counties; does not nest in California	Pelagic, though also forages near coastal waters	**None:** No suitable habitat is present within PA 1. Critical habitat has been designated for this species and is not present within PA 1.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Green Sea Turtle *Chelonia mydas*	USFWS/NMFS	FT/–	Channel Islands south; does not nest in California	Uses convergence zones in the open ocean and benthic feeding grounds in coastal areas; nests on sandy ocean beaches	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.
Olive Ridley Sea Turtle *Lepidochelys olivacea*	NMFS	FT/–	Warm waters of the Pacific coast, primarily from southern California south; does not nest in California	Well out to sea in pelagic zone as well as coastal areas, including bays and estuaries; nests on sandy ocean beaches	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.
Northwestern pond turtle *Actinemys marmorata*	USFWS, CDFW	FPT/SSC	Range is from the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	**Moderate:** See Section 3.4.
Numerous bird species protected under the Migratory Bird Treaty Act (MBTA)	USFWS	MBTA	Range encompasses California	Variable including, but not limited to, grasses, shrubs, and trees	**High:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Yellow-billed cuckoo, western DPS *Coccyzus americanus*	CDFW, USFWS	FT/SE	Species breeds in limited portions of the Sacramento River and the South Fork Kern River; small populations may nest in Butte, Yuba, Sutter, San Bernardino, Riverside, Inyo, Los Angeles, and Imperial counties	Summer resident of valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation.	**Low:** While suitable habitat is present within PA 1, Humboldt County is outside of the known and preferred species' range. Occurrences in the area are rare and yellow-billed cuckoos are not known to breed nor overwinter in the area. Two CNDDB occurrences have been documented near PA 1—a 2010 observation on Cock Robin Island and a 2013 observation along the Salt River near Ferndale (CDFW 2025a). eBird occurrences include a 2015 observation at the Arcata Marsh, a 2015 observation at the Humboldt Bay Wildlife Sanctuary, and a 2013 observation along the north spit of Humboldt Bay (eBird 2025). Critical habitat has been designated for this species and is not present within PA 1.
California Ridgway's rail *Rallus obsoletus obsoletus*	CDFW	FE/SE, SFP	Salt water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay.	Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs	**None:** Outside of the species' current range. There has been one historical occurrence four miles from PA 1 in 1932.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Yellow rail *Coturnicops noveboracensis*	CDFW	–/SSC	Occurs year round in California, but in two primary seasonal roles: currently as a very local breeder in the northeastern interior and as a winter visitor (early Oct to mid-Apr) on the coast and in the Suisun Marsh region	Densely vegetated wetlands such as marshes and meadows. In summer, favors large wet meadows or shallow marshes dominated by sedges and grasses. In winter mostly in coastal salt marsh	**Low (overwintering only):** While suitable year-round habitat is present, Humboldt County is outside of the known current range. Only two observations of this species have been during the winter months (indicating winter presence only) including one from 1987 (CDFW 2025a) and one about four miles from PA 1 in the Eureka Slough from 2013 (eBird 2025). The lack of observations may be due to the elusive habit of this species (Shuford and Gardali 2008).

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Mountain plover *Charadrius montanus*	CDFW	–/SSC	Breeds in the high plains east of the Rocky Mountains from Montana to New Mexico and in western Texas and western Oklahoma south to central Mexico. Winters in central and southern California, southern Arizona, southern Texas, and northern Mexico; primary wintering areas are the Central and Imperial valleys of California.	Short grasslands, freshly plowed fields, newly sprouting grain fields, and sometimes sod farms. Areas with short vegetation, bare ground, and flat topography. Prefers grazed areas and areas with burrowing rodents.	**Low (overwintering only):** While suitable wintering habitat is present within PA 1, Humboldt County is outside of species current known and preferred range. Two CNDDB occurrences are documented within the vicinity of PA 1: at the Humboldt Bay south spit about 1.5 miles from PA 1 from 2017 and in the Arcata bottoms about seven miles from PA 1 from 2012 (CDFW 2025a). While there are numerous eBird occurrences (2007, 2009, 2010–2012, 2015, 2017, 2020–2023) along coastal Humboldt County, these observations are from winter months and likely represent stray migrants (eBird 2025).

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Western snowy plover *Charadrius nivosus nivosus*	CDFW, USFWS	FT/SSC	Species nests in locations along the California coast, including the Eel River in Humboldt County; nests in the interior of the state in the Central Valley, Klamath Basin, Modoc Plateau, and Great Basin, Mojave, and Colorado deserts; winters primarily along coast	Barren to sparsely vegetated beaches, barrier beaches, salt-evaporation pond levees, and shores of alkali lakes; also nests on gravel bars in rivers with wide flood plains; needs sandy, gravelly, or friable soils for nesting	**Low (flyover only):** Nesting habitat (coastal dunes and beaches) is not present within PA 1. The nearest and most recent occurrences are from coastal dunes of the north and south spits of Humboldt Bay from 2014 (CDFW 2025a). Critical habitat has been designated for this species and occurs about 1.5 miles from PA 1 along the north spit of Humboldt Bay.
Marbled murrelet *Brachyramphus marmoratus*	CDFW, USFWS	FT/SE	Nesting birds mostly concentrated near coastal waters in Del Norte and Humboldt counties, and in lesser numbers near San Mateo and Santa Cruz counties; species winters throughout the nesting range and in small numbers in southern California	Most time spent on the ocean; nests inland in large areas of old-growth conifers with suitable platforms, especially redwood or Douglas-fir forests near coastal areas	**Moderate (flyover only)**: See Section 3.4.
White-tailed kite *Elanus leucurus*	CDFW	–/SFP	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	**High.** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Golden eagle *Aquila chrysaetos*	USFWS	BGECP/ SFP	Species is an uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or medium to tall trees	**Moderate (flyovers and possibly foraging):** See Section 3.4.
Northern harrier *Circus hudsonius*	CDFW	–/SSC	Summer resident in eastern Sierra Nevada in Mono County.	Coastal scrub, Great Basin grasslands, Valley & foothill grasslands, wetlands, marshes & swamps, coastal salt and freshwater marsh, and riparian scrub. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on the ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	**High:** See Section 3.4.
Bald eagle *Haliaeetus leucocephalus*	CDFW, USFWS	BGECP/ SE, SFP	Species is a permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses snags or other perches; nests in advanced-successional conifer forest near open water	**Moderate (flyovers and possibly foraging):** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Northern spotted owl *Strix occidentalis caurina*	USFWS, CDFW	FT/SSC	Range includes Northwestern California south to Marin County, and southeast to the Pit River area of Shasta County	Typically found in older forested habitats; nests in complex stands dominated by conifers, especially coastal redwood, with hardwood understories; some open areas are important for foraging.	**Low:** Suitable nesting, roosting, and/or foraging habitat is not present within PA 1. Suitable habitat is present in the dense coniferous forest adjacent to PA 1, which may support older, more suitable nesting stands. The closest nesting owl location (activity center, HUM0550) is about 0.8 miles from PA 1 and the closest positive detections are 0.6 and 0.8 miles from PA 1 from 2018 and 2019, respectively (CDFW 2025e). Designated critical habitat has been designated for this species and is located about 14 miles away.
Bank swallow *Riparia riparia*	CDFW	–/ST	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam	**Moderate (foraging only):** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Grasshopper sparrow *Ammodramus savannarum*	CDFW	–/SSC	Summer resident; nests in Humboldt, Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	**Moderate:** See Section 3.4.
Tricolored blackbird *Agelaius tricolor*	CDFW	–/ST, SSC	Permanent resident in California, but makes extensive migrations both in breeding season and winter; common locally throughout Central Valley and in coastal areas in and south of Sonoma County	Generally found in freshwater marshes, swamps, and wetlands. Highly colonial species that requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of the colony. Often found in agricultural areas.	**Low:** Preferred breeding habitat (cattail marshes) is limited within PA 1 and Humboldt County is outside of the preferred range of the species. The only CNDDB occurrence within the vicinity of PA 1 is about 12 miles away near Fortuna and documents 32 birds nesting in blackberry/coyote brush patches in 1997 (CDFW 2025a). Two eBird occurrences have been documented within PA 1 in 2018 (Pine Hill Road) and 2021 (Elk River Wildlife Area) There have been multiple observations over numerous years at the Arcata Marsh and Wildlife Sanctuary and surrounding wetland areas (eBird 2025)

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Sonoma tree vole *Arborimus pomo*	CDFW	–/SSC	Along the North Coast from Sonoma County north to the Oregon border, generally along the fog belt	Primarily nests in old-growth or partially harvested old-growth stands, while also present in young stands. Associated with Douglas-fir, redwood, grand fir, and montane hardwood-conifer habitats in the fog belt. Feeds almost exclusively on Douglas fir needles.	**Low:** Suitable habitat is not present within PA 1 but may be present in adjacent forested areas. The nearest CNDDB occurrence is 2.5 miles from PA 1 in 1988 (CDFW 2025a).
Townsend's big-eared bat *Corynorhinus townsendii*	CDFW	–/SSC	Throughout California, found in all but subalpine and alpine habitats, details of distribution not well known	Roosts in cavities, most often in tunnels, caves, mines, and buildings, but also rock shelters, preferentially close to water. Most abundant in mesic habitats, also found in oak woodlands, desert, vegetated drainages, caves or cave-like structures (including basal hollows in large trees, mines, tunnels, and buildings).	**High:** See Section 3.4.
Pallid bat *Antrozous pallidus*	CDFW	–/SSC	Throughout California except for elevations greater than 3,000 m in the Sierra Nevada	Roosts in rock crevices, cavities in live or dead trees hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open woodland habitats and most frequently in riparian zone, in open oak savannah, and open mixed deciduous forest.	**Moderate:** See Section 3.4.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Humboldt marten, coastal DPS *Martes caurina humboldtensis*	CDFW	–/SSC	Occurs only in the coastal redwood zone from the Oregon border south to Sonoma County.	Mid- to advanced-successional stands of conifers with complex structure near the ground and dense canopy closure.	**Low:** Suitable habitat is not present within PA 1 but may be present in adjacent forested areas. The nearest CNDDB occurrence is eight miles from PA 1 (Headwaters Forest Reserve) from 2002 (CDFW 2025a).
Fisher, Northern California/Southern Oregon DPS *Pekania pennanti*	CDFW	–/SSC	The northern Coast Range, including the Trinity and Klamath forests	Dense (greater than 50% canopy cover), advanced-successional conifer forests, with complex forest structure; den in hollow trees and snags.	**Low:** Dense, advanced-successional conifer forests are lacking within PA 1, but may be used as a corridor to adjacent forests outside of PA 1, which may provide higher-quality later-successional forests. The most recent CNDDB occurrence is about ten miles from PA 1 from 2017 in the Arcata Community Forest and the nearest about ten miles from PA 1 in Headwaters Forest Reserve in 2009 (CDFW 2025a).
North Pacific Right Whale *Eubalaena glacialis*	NMFS	FE/SFP	Pacific Ocean	Deep ocean waters	**None:** No suitable habitat is present within PA 1. Critical habitat has been designated for this species and is not present within PA 1.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Sei Whale *Balaenoptera borealis*	NMFS	FE/–	Pacific Ocean	Deep ocean waters far from the coastline	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.
Blue Whale *Balaenoptera musculus*	NMFS	FE/–	Pacific Ocean	Deep ocean waters; also can be found in coastal waters	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.
Fin Whale *Balaenoptera physalus*	NMFS	FE/–	Pacific Ocean	Deep ocean waters	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.
Humpback Whale *Megaptera novaengliae*	NMFS	FE/–	Pacific Ocean	Deep ocean waters	**None:** No suitable habitat is present within PA 1. Critical habitat has been designated for this species and is not present within PA 1.
Killer Whale Southern Resident DPS *Orcinus orca*	NMFS	FE/–	Pacific Ocean	Coastal habitats of temperate waters, including bays	**None:** No suitable habitat is present within PA 1. Critical habitat has been designated for this species and is not present within PA 1.

Common name ***Scientific name***	**Query sources**	**Status[a] Federal/ State**	**Distribution in California**	**Habitat association**	**Likelihood to occur within Planning Area 1**
Sperm Whale *Physeter macrocephalus*	NMFS	FE/–	Pacific Ocean	Deep ocean waters	**None:** No suitable habitat is present within PA 1. Critical habitat has not been designated for this species.

Table Source: CDFW 2025a, USFWS 2005, NMFS 2022

Notes: CDFW = California Department Fish and Wildlife; CNDDB = California Natural Diversity Database; ppt = parts per thousand; USFWS = U.S. Fish and Wildlife Service

[a] Status codes:

Federal		State	
FE	Listed as endangered under the federal Endangered Species Act	SE	Listed as Endangered under the California Endangered Species Act
FT	Listed as threatened under the federal Endangered Species Act	ST	Listed as Threatened under the California Endangered Species Act
FC	Federal candidate species	SCE	State Candidate Endangered
FPT	Federally proposed for listing as threatened	SSC	CDFW Species of Special Concern
BGECP	Protected under the Bald and Golden Eagle Protection Act	SFP	State Fully-Protected
MBTA	Protected under the Migratory Bird Treaty Act	–	No state status

Appendix B

Comprehensive Plant Species List

Table B-1. Comprehensive list of plant species documented[1] in the Elk River.

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Abies grandis	grand fir	Pinaceae	Native	N/A	FACU
Achillea millefolium	common yarrow	Asteraceae	Native	N/A	FACU
Acmispon americanus var. *americanus*	American bird's-foot trefoil	Fabaceae	Native	N/A	FACU
Agrostis capillaris	colonial bent grass	Poaceae	Naturalized	None	FAC
Agrostis stolonifera	creeping bent grass	Poaceae	Naturalized	Limited	FAC
Aira caryophyllea	silver hair grass	Poaceae	Naturalized	None	FACU
Allium triquetrum	three corner leek	Alliaceae	Naturalized	None	NL/UPL
Alnus rubra	red alder	Betulaceae	Native	N/A	FAC
Alopecurus geniculatus	water foxtail	Poaceae	Native	N/A	OBL
Alopecurus pratensis	meadow foxtail	Poaceae	Naturalized	Watch	FAC
Angelica lucida	sea watch	Apiaceae	Native	N/A	FAC
Anthemis cotula	stinking chamomile	Asteraceae	Naturalized	None	FACU
Anthoxanthum odoratum	sweet vernal grass	Poaceae	Naturalized	Limited	FACU
Artemisia douglasiana	mugwort	Asteraceae	Native	N/A	FACW
Athyrium filix-femina var. *cyclosorum*	subarctic ladyfern	Athyriaceae	Native	N/A	FAC
Atriplex prostrata	fat hen	Chenopodiaceae	Naturalized	None	FAC
Avena fatua	wild oat	Poaceae	Naturalized	Moderate	NL/UPL
Baccharis pilularis	coyote brush	Asteraceae	Native	N/A	NL/UPL
Bellis perennis	English daisy	Asteraceae	Naturalized	None	NL/UPL
Bolboschoenus maritimus subsp. *paludosus*	saltmarsh bulrush	Cyperaceae	Native	N/A	OBL
Bolboschoenus robustus	seacoast bulrush	Cyperaceae	Native	N/A	OBL
Brassica nigra	black mustard	Brassicaceae	Naturalized	Moderate	NL/UPL
Brassica rapa	field mustard	Brassicaceae	Naturalized	Limited	FACU
Briza maxima	rattlesnake grass	Poaceae	Naturalized	Limited	NL/UPL
Briza minor	little quakinggrass	Poaceae	Naturalized	None	FAC

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Bromus diandrus	ripgut brome	Poaceae	Naturalized	Moderate	NL/UPL
Bromus hordeaceus	soft brome	Poaceae	Naturalized	Limited	FACU
Bromus sitchensis var. *carinatus*	California brome	Poaceae	Native	N/A	NL/UPL
Callitriche heterophylla	twoheaded water-starwort	Plantaginaceae	Native	N/A	OBL
Capsella bursa-pastoris	shepherd's purse	Brassicaceae	Naturalized	None	FACU
Cardamine oligosperma	little western bittercress	Brassicaceae	Native	N/A	FAC
Carduus pycnocephalus subsp. *pycnocephalus*	Italian thistle	Asteraceae	Naturalized	Moderate	NL/UPL
Carex lyngbyei	Lyngbye's sedge	Cyperaceae	Native	N/A	OBL
Carex obnupta	slough sedge	Cyperaceae	Native	N/A	OBL
Carex pachystachya	starry broomsedge	Cyperaceae	Native	N/A	FAC
Carex praegracilis	freeway sedge	Cyperaceae	Native	N/A	FACW
Castilleja ambigua subsp. *humboldtiensis*	Humboldt Bay owl's-clover	Orobanchaceae	Native	N/A	FACW
Cerastium fontanum subsp. *vulgare*	common mouse-ear chickweed	Caryophyllaceae	Naturalized	None	FACU
Chamerion angustifolium subsp. *circumvagum*	fireweed	Onagraceae	Native	N/A	FACU
Chloropyron maritimum subsp. *palustre*	Pt. Reyes bird's-beak	Orobanchaceae	Native	N/A	OBL
Chrysosplenium glechomifolium	Pacific golden saxifrage	Saxifragaceae	Native	N/A	OBL
Cichorium intybus	chicory	Asteraceae	Naturalized	None	FACU
Cirsium arvense	Canada thistle	Asteraceae	Naturalized	Moderate	FAC
Cirsium vulgare	bull thistle	Asteraceae	Naturalized	Moderate	FACU
Claytonia perfoliata	miner's lettuce	Montiaceae	Native	N/A	FAC
Conium maculatum	poison hemlock	Apiaceae	Naturalized	Moderate	FAC
Convolvulus arvensis	field bindweed	Convolvulaceae	Naturalized	None	NL/UPL
Cortaderia jubata	purple pampas grass	Poaceae	Naturalized	High	FACU
Cotoneaster franchetii	orange cotoneaster	Rosaceae	Naturalized	Moderate	NL/UPL
Cotula coronopifolia	common brassbuttons	Asteraceae	Naturalized	Limited	OBL
Crataegus monogyna	oneseed hawthorn	Rosaceae	Naturalized	Limited	FAC
Crocosmia x crocosmiiflora	montbretia	Iridaceae	Naturalized	Limited	FAC
Cuscuta pacifica var. *pacifica*	dodder	Convolvulaceae	Native	N/A	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Cyperus eragrostis	tall flatsedge	Cyperaceae	Native	N/A	FACW
Cytisus scoparius	Scotch broom	Fabaceae	Naturalized	High	NL/UPL
Dactylis glomerata	orchardgrass	Poaceae	Naturalized	Limited	FACU
Danthonia californica	California oatgrass	Poaceae	Native	N/A	FAC
Daucus carota	Queen Anne's lace	Apiaceae	Naturalized	None	FACU
Deschampsia cespitosa	tufted hairgrass	Poaceae	Native	N/A	FACW
Dipsacus fullonum	wild teasel	Dipsacaceae	Naturalized	Moderate	FAC
Distichlis spicata	saltgrass	Poaceae	Native	N/A	FACW
Dryopteris arguta	coastal woodfern	Dryopteridaceae	Native	N/A	NL/UPL
Dryopteris expansa	spreading woodfern	Dryopteridaceae	Native	N/A	FACW
Eleocharis macrostachya	pale spikerush	Cyperaceae	Native	N/A	OBL
Elymus triticoides	beardless wildrye	Poaceae	Native	N/A	FAC
Epilobium ciliatum	fringed willowherb	Onagraceae	Native	N/A	FACW
Epilobium ciliatum subsp. *ciliatum*	fringed willowherb	Onagraceae	Native	N/A	FACW
Equisetum arvense	field horsetail	Equisetaceae	Native	N/A	FAC
Erica lusitanica	Spanish heath	Ericaceae	Naturalized	Limited	NL/UPL
Erodium cicutarium	redstem stork's bill	Geraniaceae	Naturalized	Limited	NL/UPL
Erythranthe dentata	coastal monkeyflower	Phrymaceae	Native	N/A	OBL
Festuca arundinacea	tall fescue	Poaceae	Naturalized	Moderate	FAC
Festuca bromoides	brome fescue	Poaceae	Naturalized	None	FAC
Festuca microstachys	desert fescue	Poaceae	Native	N/A	NL/UPL
Festuca myuros	rattail sixweeks grass	Poaceae	Naturalized	Moderate	FACU
Festuca perennis	Italian ryegrass	Poaceae	Naturalized	Moderate	FAC
Foeniculum vulgare	sweet fennel	Apiaceae	Naturalized	Moderate	NL/UPL
Frangula purshiana	Cascara buckthorn	Rhamnaceae	Native	N/A	FAC
Galium aparine	stickywilly	Rubiaceae	Native	N/A	FACU
Genista monspessulana	French broom	Fabaceae	Naturalized	High	NL/UPL
Geranium dissectum	cutleaf geranium	Geraniaceae	Naturalized	Limited	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Glyceria ×occidentalis	western manna grass	Poaceae	Naturalized	None	OBL
Glyceria declinata	low manna grass	Poaceae	Naturalized	Moderate	FACW
Grindelia stricta	Oregon gumweed	Asteraceae	Native	N/A	FACW
Hedera helix	English ivy	Araliaceae	Naturalized	High	FACU
Helminthotheca echioides	bristly ox-tongue	Asteraceae	Naturalized	Limited	FAC
Heracleum maximum	cow parsnip	Apiaceae	Native	N/A	FAC
Hesperocyparis macrocarpa	Monterey cypress	Cupressaceae	Native	N/A	NL/UPL
Hirschfeldia incana	shortpod mustard	Brassicaceae	Naturalized	Moderate	NL/UPL
Holcus lanatus	common velvet grass	Poaceae	Naturalized	Moderate	FAC
Hordeum brachyantherum	meadow barley	Poaceae	Native	N/A	FACW
Hordeum jubatum subsp. *jubatum*	foxtail barley	Poaceae	Native	N/A	FAC
Hordeum murinum	wall barley	Poaceae	Naturalized	Moderate	FAC
Hydrocotyle ranunculoides	floating marshpennywort	Araliaceae	Native	N/A	OBL
Hypochaeris glabra	smooth cat's ear	Asteraceae	Naturalized	Limited	NL/UPL
Hypochaeris radicata	rough cat's-ear	Asteraceae	Naturalized	Moderate	FACU
Ilex aquafolium	holly	Aquifoliaceae	Naturalized	Limited	FACU
Iris douglasiana	Douglas iris	Iridaceae	Native	N/A	NL/UPL
Isolepis cernua	low bulrush	Cyperaceae	Native	N/A	OBL
Jaumea carnosa	marsh jaumea	Asteraceae	Native	N/A	OBL
Juncus balticus subsp. *ater*	baltic rush	Juncaceae	Native	N/A	FACW
Juncus bolanderi	Bolander's rush	Juncaceae	Native	N/A	OBL
Juncus breweri	Brewer's rush	Juncaceae	Native	N/A	FACW
Juncus bufonius	toad rush	Juncaceae	Native	N/A	FACW
Juncus effusus subsp. *pacificus*	Pacific rush	Juncaceae	Native	N/A	FACW
Juncus ensifolius	swordleaf rush	Juncaceae	Native	N/A	FACW
Juncus hesperius	coast rush	Juncaceae	Native	N/A	FACW
Juncus lescurii	San Francisco rush	Juncaceae	Native	N/A	FACW
Juncus patens	spreading rush	Juncaceae	Native	N/A	FACW

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Juncus xiphioides	iris-leaved rush	Juncaceae	Native	N/A	OBL
Lathyrus latifolius	perennial sweet pea	Fabaceae	Naturalized	None	NL/UPL
Lemna minor	common duckweed	Araceae	Native	N/A	OBL
Leontodon saxatilis	lesser hawkbit	Asteraceae	Naturalized	None	FACU
Lepidium didymum	lesser swinecress	Brassicaceae	Naturalized	None	NL/UPL
Leucanthemum vulgare	ox-eye daisy	Asteraceae	Naturalized	Moderate	FACU
Linum bienne	pale flax	Linaceae	Naturalized	None	NL/UPL
Lonicera involucrata	twinberry	Caprifoliaceae	Native	N/A	FAC
Lotus corniculatus	bird's-foot trefoil	Fabaceae	Naturalized	None	FAC
Lotus uliginosus	big trefoil	Fabaceae	Naturalized	None	FAC
Lupinus bicolor	miniature lupine	Fabaceae	Native	N/A	NL/UPL
Lupinus rivularis	riverbank lupine	Fabaceae	Native	N/A	FAC
Lysichiton americanus	yellow skunk-cabbage	Araceae	Native	N/A	OBL
Lysimachia arvensis	scarlet pimpernel	Myrsinaceae	Naturalized	None	FAC
Madia gracilis	grassy tarweed	Asteraceae	Native	N/A	NL/UPL
Madia sativa	coast tarweed	Asteraceae	Native	N/A	NL/UPL
Malus sp.	apple cultivar	Rosaceae	Naturalized	None	NL/UPL
Malva neglecta	common mallow	Malvaceae	Naturalized	None	NL/UPL
Malva parviflora	cheeseweed	Malvaceae	Naturalized	None	NL/UPL
Marah oregana	coastal manroot	Cucurbitaceae	Native	N/A	NL/UPL
Matricaria discoidea	pineapple weed	Asteraceae	Native	N/A	FACU
Medicago polymorpha	california burclover	Fabaceae	Naturalized	Limited	FACU
Melilotus albus	white sweetclover	Fabaceae	Naturalized	None	NL/UPL
Melilotus officinalis	yellow sweetclover	Fabaceae	Naturalized	None	FACU
Mentha spicata	spearmint	Lamiaceae	Naturalized	None	FACW
Modiola caroliniana	modiola	Malvaceae	Naturalized	None	FACU
Morella californica	wax myrtle	Myricaceae	Native	N/A	FACW
Narcissus pseudonarcissus	daffodil	Amaryllidaceae	Naturalized	None	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Nasturtium officinale	water cress	Brassicaceae	Native	N/A	OBL
Navarretia squarrosa	skunkweed	Polemoniaceae	Native	N/A	FACU
Oenanthe sarmentosa	water parsely	Apiaceae	Native	N/A	OBL
Opuntia ficus-indica	mission prickly-pear	Cactaceae	Naturalized	None	NL/UPL
Oxalis purpurea	purple wood-sorrel	Oxalidaceae	Naturalized	None	NL/UPL
Parapholis strigosa	strigose sicklegrass	Poaceae	Naturalized	None	OBL
Parentucellia viscosa	yellow glandweed	Orobanchaceae	Naturalized	Limited	FAC
Persicaria maculosa	lady's thumb	Polygonaceae	Naturalized	None	FACW
Phalaris arundinacea	reed canarygrass	Poaceae	Naturalized	None[4]	FACW
Phleum pratense	cultivated timothy	Poaceae	Naturalized	None	FAC
Picea sitchensis	Sitka spruce	Pinaceae	Native	N/A	FAC
Pinus contorta subsp. *contorta*	shore pine	Pinaceae	Native	N/A	FAC
Pinus radiata	Monterey pine	Pinaceae	Native	N/A	NL/UPL
Plantago coronopus	buckhorn plantain	Plantaginaceae	Naturalized	None	FAC
Plantago lanceolata	English plantain	Plantaginaceae	Naturalized	Limited	FACU
Plantago major	common plantain	Plantaginaceae	Naturalized	None	FAC
Plectritis congesta	shortspur seablush	Valerianaceae	Native	N/A	FACU
Poa annua	annual blue grass	Poaceae	Naturalized	None	FAC
Poa palustris	fowl blue grass	Poaceae	Naturalized	None	FAC
Poa pratensis subsp. *pratensis*	Kentucky blue grass	Poaceae	Naturalized	Limited	FAC
Polygonum aviculare	knotweed	Polygonaceae	Naturalized	None	FAC
Polypogon australis	Chilean beard grass	Poaceae	Naturalized	None	FACW
Polypogon monspeliensis	annual beard grass	Poaceae	Naturalized	Limited	FACW
Polystichum munitum	western swordfern	Dryopteridaceae	Native	N/A	FACU
Potentilla anserina	silverweed cinquefoil	Rosaceae	Native	N/A	OBL
Prunella vulgaris	common selfheal	Lamiaceae	Native	N/A	FACU
Pteridium aquilinum var. *pubescens*	hairy brackenfern	Dennstaedtiaceae	Native	N/A	FACU
Ranunculus occidentalis	western buttercup	Ranunculaceae	Native	N/A	FACW

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Ranunculus repens	creeping buttercup	Ranunculaceae	Naturalized	Limited	FAC
Raphanus raphanistrum	wild radish	Brassicaceae	Naturalized	None	NL/UPL
Raphanus sativus	cultivated radish	Brassicaceae	Naturalized	Limited	NL/UPL
Ribes divaricatum	spreading gooseberry	Grossulariaceae	Native	N/A	FAC
Ribes sanguineum	red-flowering currant	Grossulariaceae	Native	N/A	FACU
Rosa nutkana subsp. *nutkana*	Nootka rose	Rosaceae	Native	N/A	FAC
Rubus armeniacus	Himalayan blackberry	Rosaceae	Naturalized	High	FAC
Rubus leucodermis	whitebark raspberry	Rosaceae	Native	N/A	FACU
Rubus parviflorus	thimbleberry	Rosaceae	Native	N/A	FACU
Rubus spectabilis	salmonberry	Rosaceae	Native	N/A	FAC
Rubus ursinus	California blackberry	Rosaceae	Native	N/A	FACU
Rumex acetosella	sheep sorrel	Polygonaceae	Naturalized	Moderate	FACU
Rumex conglomeratus	clustered dock	Polygonaceae	Naturalized	None	FACW
Rumex crispus	curly dock	Polygonaceae	Naturalized	Limited	FAC
Rumex pulcher	fiddle dock	Polygonaceae	Naturalized	None	FAC
Salicornia pacifica	Pacific swampfire	Chenopodiaceae	Native	N/A	OBL
Salix hookeriana	coastal willow	Salicaceae	Native	N/A	FACW
Salix lasiandra	Pacific willow	Salicaceae	Native	N/A	FACW
Salix scouleriana	Scouler's willow	Salicaceae	Native	N/A	FAC
Salix sitchensis	Sitka willow	Salicaceae	Native	N/A	FACW
Sambucus racemosa	red elderberry	Adoxaceae	Native	N/A	FACU
Sanguisorba minor subsp. *balearica*	small burnet	Rosaceae	Native	N/A	FACW
Sanicula crassicaulis	Pacific blacksnakeroot	Apiaceae	Native	N/A	NL/UPL
Schoenoplectus acutus var. *occidentalis*	common tule	Cyperaceae	Native	N/A	OBL
Schoenoplectus pungens var. *longispicatus*	common three-square bulrush	Cyperaceae	Native	N/A	OBL
Scirpus microcarpus	panicled bulrush	Cyperaceae	Native	N/A	OBL
Scrophularia californica	California figwort	Scrophulariaceae	Native	N/A	FAC
Senecio jacobaea	tansy ragwort	Asteraceae	Naturalized	Limited	FACU

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Senecio minimus	coastal burnweed	Asteraceae	Naturalized	None	FACU
Sequoia sempervirens	redwood	Cupressaceae	Native	N/A	NL/UPL
Silybum marianum	blessed milkthistle	Asteraceae	Naturalized	Limited	NL/UPL
Sisymbrium officinale	hedge mustard	Brassicaceae	Naturalized	None	NL/UPL
Solanum americanum	American black nightshade	Solanaceae	Native	N/A	FACU
Sonchus asper subsp. *asper*	prickly sow thistle	Asteraceae	Naturalized	None	FACU
Sonchus oleraceus	common sow thistle	Asteraceae	Naturalized	None	UPL
Sparganium emersum	European bur-reed	Typhaceae	Native	N/A	OBL
Spartina densiflora	dense-flowered cord grass	Poaceae	Naturalized	High	OBL
Spergula arvensis	stickwort	Caryophyllaceae	Naturalized	None	NL/UPL
Spergularia canadensis var. *occidentalis*	western sand-spurrey	Caryophyllaceae	Native	N/A	FACW
Spergularia macrotheca var. *macrotheca*	sticky sand-spurry	Caryophyllaceae	Native	N/A	FAC
Spergularia marina	saltmarsh sand-spurrey	Caryophyllaceae	Native	N/A	OBL
Spergularia rubra	red sand-spurrey	Caryophyllaceae	Naturalized	None	FAC
Stachys chamissonis	coastal hedgenettle	Lamiaceae	Native	N/A	FACW
Stachys mexicana	Mexican hedgenettle	Lamiaceae	Native	N/A	FACW
Stellaria media	common chickweed	Caryophyllaceae	Naturalized	None	FACU
Symphyotrichum chilense	Pacific aster	Asteraceae	Native	N/A	FAC
Taraxacum officinale	common dandelion	Asteraceae	Naturalized	None	FACU
Tolmiea diplomenziesii	pig-a-back plant	Saxifragaceae	Native	N/A	FACW
Toxicodendron diversilobum	poison oak	Anacardiaceae	Native	N/A	FAC
Trifolium angustifolium	narrow-leaved clover	Fabaceae	Naturalized	None	NL/UPL
Trifolium arvense	rabbitfoot clover	Fabaceae	Naturalized	None	NL/UPL
Trifolium dubium	little hop clover	Fabaceae	Naturalized	None	FACU
Trifolium fragiferum	strawberry clover	Fabaceae	Naturalized	None	FACU
Trifolium pratense	red clover	Fabaceae	Naturalized	None	FACU
Trifolium repens	white clover	Fabaceae	Naturalized	None	FAC
Trifolium subterraneum	subterranean clover	Fabaceae	Naturalized	None	NL/UPL
Trifolium wormskioldii	cow clover	Fabaceae	Native	N/A	FACW
Triglochin maritima	common arrow-grass	Juncaginaceae	Native	N/A	OBL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating[2]	Wetland indicator status[3] (WMVC)
Triglochin striata	three-ribbed arrow-grass	Juncaginaceae	Native	N/A	OBL
Tropaeolum majus	garden nasturtium	Tropaeolaceae	Naturalized	None	UPL
Typha latifolia	broad-leaved cattail	Typhaceae	Native	N/A	OBL
Urtica dioica	stinging nettle	Urticaceae	Native	N/A	FAC
Urtica urens	dwarf nettle	Urticaceae	Naturalized	None	NL/UPL
Veronica americana	American speedwell	Plantaginaceae	Native	N/A	OBL
Vicia gigantea	giant vetch	Fabaceae	Native	N/A	NL/UPL
Vicia hirsuta	tiny vetch	Fabaceae	Naturalized	None	NL/UPL
Vicia sativa	garden vetch	Fabaceae	Naturalized	None	UPL
Vicia tetrasperma	sparrow vetch	Fabaceae	Naturalized	None	NL/UPL
Vinca major	greater periwinkle	Apocynaceae	Naturalized	Moderate	FACU
Woodwardia fimbriata	giant chain fern	Blechnaceae	Native	N/A	FACW
Zantedeschia aethiopica	calla-lily	Araceae	Naturalized	Limited	OBL
Zostera marina	eelgrass	Zosteraceae	Native	N/A	OBL

[1] Floristic surveys conducted on May 12–14, 2021, and July 12–14, 2021 and supplemental survey work conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27).

[2] **Cal-IPC rating**

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent-but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

Watch – These species have been assessed as posing a high risk of becoming invasive in the future in California.

None – No Cal-IPC rating listed for the nonnative species.

N/A – Not applicable, native species to California.

[3] **Wetland indicator status (Western Mountains, Valleys, and Coast Regional Supplement)**

OBL – Obligate. Almost always occur in wetlands

FACW – Facultative Wetland. Usually occur in wetlands but may occur in non-wetlands

FAC – Facultative. Occur in wetlands and non-wetlands

FACU – Facultative Upland. Usually occur in non-wetlands but may occur in wetlands

NL/UPL – Not Listed/Upland. Almost always occur in non-wetlands

[4] Known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities (Humboldt County Resource Conservation District 2024).

Appendix C

Fish Utilization and Habitat Characterization

FISH UTILIZATION AND HABITAT

The lower reaches of coastal watersheds where streams transition into estuaries are particularly valuable for habitat restoration and recovery of anadromous salmonids (Jones et al. 2014, Wallace et al. 2015, Flitcroft et al. 2016), as well as the federally listed Tidewater Goby and state listed Longfin Smelt (Stillwater Sciences 2006, Garwood 2017). In addition to providing unique and productive habitats that promote life history diversity within a population, these reaches play an outsized role in influencing growth, survival, and population dynamics of anadromous species since the entire population of the watershed must pass through them (Koski 2009, Jones et al. 2014, Wallace et al. 2015).

Healey (1982) proposed the concept of "estuarine dependence" in which tidal marshes are considered a requisite rearing habitat for juvenile salmonids. Numerous studies have shown that favorable growth conditions in estuaries may enable juvenile salmonids to recruit disproportionately to the adult population compared to fish that rear in upstream habitats, because larger individuals have higher ocean survival rates (Beck et al. 2001, Miller and Sadro 2003, Bond 2006, Ricker et al. 2014, Wallace et al. 2015). For example, the life-cycle monitoring station on Freshwater Creek operated by CDFW found that approximately 40% of the Coho Salmon smolts produced from the basin reared in the stream-estuary ecotone, and juveniles that reared in the stream-estuary ecotone were larger than those rearing in stream habitat upstream (Wallace et al. 2015)[8]. Factors hypothesized to contribute to the disproportionate success of estuarine reared fish include higher growth rates resulting from abundant invertebrate food and favorable water temperatures, suppressed predation resulting from high turbidity and deeper channels, and a favorable transition area for smoltification.

The amount and quality of fish habitat in PA 1 has been significantly reduced by conversion of former tidelands to agricultural land uses. Much of the historically extensive tidal marshlands in lower Elk River are currently used for cattle and dairy ranching. Remaining habitat is impaired by sediment aggradation, flood control levees, and tide gates that reduce the tidal prism and impair fish movement into and out of sloughs and other off-channel areas. Elk River east of US Highway 101 is constricted by levees and the Northwestern Pacific railroad grade and lacks access to off-channel rearing habitats due to floodplain disconnection. Habitat in the stream-estuary ecotone has been further simplified by removal or modification of streamside riparian vegetation. The impairment and loss of productive tidal marsh and estuarine rearing habitat has likely contributed to the acute decline of salmonid population abundance in the Elk River watershed (HBWAC 2005; NMFS 2014, 2016).

For this reason, restoring fish habitats in PA 1 (the stream-estuary ecotone) is a key component of the overall strategy for recovering fish populations in the Elk River watershed. In this section, the known seasonal distribution and life history characteristics of focal fish species are summarized (Section 2.3.1) and characterize existing fish habitat conditions in PA 1 (Section 2.3.2).

[8] An ecotone is a region of transition between two biological communities; ecotones between two habitats are often richer in species than surrounding communities. The "stream-estuary ecotone" is the zone from the margin of Humboldt Bay where channels become surrounded by mudflats, upstream to the upper limit of tidal influence, at approximately the upper boundary of MSR 2.

Focal Fish Species

To support interpretation of the fish habitat assessment, a summary of observed seasonal utilization in lower Elk River, general estuarine life history, and preferred habitat characteristics are provided for each focal species in the sections that follow. The focus of the habitat assessment is on juvenile salmonids, but other special status species are also included. Focal species include Coho Salmon *Oncorhynchus kisutch*), Chinook Salmon (*Oncorhynchus tshawytscha*), steelhead *Oncorhynchus mykiss*), Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*), Tidewater Goby (*Eucyclogobius newberryi*), and Longfin Smelt (*Spirinchus thaleichthys*).

In addition to these focal species, the Elk River tidal estuary provides habitat for numerous other species of native fish, amphibians, and invertebrates whose habitats have been diminished in the Elk River, and which could benefit from habitat restoration and enhancement. Over 30 species of fish have been documented in brackish portions of lower Elk River (M. Wallace, CDFW, unpub. data, 2005–2009).

Salmonids

Seasonal utilization of the lower (MSR1) and upper (MSR2) portions of the mainstem Elk River by juvenile salmonids is summarized in Table C-1 based on monthly sampling conducted by Wallace and Allen (2009) during 2007 and 2008.

Table C-1. Observed seasonal presence of juvenile salmonids in lower and upper portions of PA 1. Based on seining and minnow trapping conducted by Wallace and Allen (2009).

Reach[1]	Species life stage[2]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Lower (MSR1)	Chinook Age-0												
	Coho Age-0												
	Coho Age-1												
	Steelhead Age-1+												
	Cutthroat Age-1+												
Upper (MSR2)	Chinook Age-0												
	Coho Age-0												
	Coho Age-1												
	Steelhead Age-1+												
	Cutthroat Age-1+												

[1] The "Lower" and "Upper" reaches sampled by Wallace and Allen (2009) loosely coincide with MSR1 and MSR2, respectively.

[2] Age class designations are based on fish length data provided by Wallace and Allen (2009).

Coho Salmon

Based on multi-year sampling of Humboldt Bay tributaries, including lower Elk River, Wallace et al. (2015) described three life history strategies employed by juvenile Coho Salmon in the stream-estuary ecotone, including (1) young-of-year (age-0) fish that arrive in the spring soon after emergence and reside primarily in the upper portion of the stream-estuary ecotone during the summer and early fall; (2) age-0 juvenile coho that migrate to the stream-estuary ecotone in the fall as stream flows rise and rear in adjacent off-channel and tributary habitats during the winter and following spring; and (3) age-1 smolt that emigrate through the stream-estuary ecotone in spring after rearing primarily in upstream riverine reaches. These findings are consistent with timing of Coho Salmon utilization observed during intensive monthly sampling conducted in lower Elk River (Wallace and Allen 2009; Table 1-1). Variations of these life history strategies, including overwintering in adjacent non-natal streams or moving upstream out of the lower mainstem reaches to overwinter, may also occur (Miller and Sadro 2003, Koski 2009, Jones et al. 2014).

Recent monitoring in Martin Slough—where no Coho Salmon spawning habitat is thought to exist—indicates significant numbers of juvenile Coho Salmon from Elk River pass through lower Elk River and Swain Slough before rearing in Martin Slough during winter rearing and spring (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022). Juvenile Coho Salmon were documented in these habitats during every month of monitoring, which was conducted from November through May, but were most abundant from February through April (Natural Resources Services 2022). Notably, some juvenile Coho Salmon from other Humboldt Bay tributaries move into lower Elk River on their way to the ocean. In late-May 2008, Wallace and Allen (2009) captured two age-1 Coho Salmon that were tagged in Freshwater Creek, one in early April and one in early May. Restoration of more diverse and connected tidal wetlands and off-channel habitats in the stream-estuary ecotone may also promote additional life history diversity, as has been observed following large scale estuarine restoration (Flitcroft et al. 2016).

The physical habitat characteristics preferred by Coho Salmon in the stream-estuary ecotone are generally the same as in upstream fluvial reaches, with most individuals inhabiting areas with low-velocity habitats with escape cover. For example, in an intensive study of coho salmon estuarine habitat use, Tschaplinski (1987) found that at low tide the largest number of age-0 coho in locations with water velocity <1 ft/s (but on average 0.3 ft/s), pools with depths ranging from about 1.5–7 ft, and escape cover provided by large logs and rootwads or undercut banks, often containing overhanging vegetation.

Salinity is also expected to be a primary factor driving seasonal utilization and distribution patterns of Coho Salmon and other fish in PA 1 and other stream-estuary ecotones (Otto 1971, Wallace and Allen 2009, Koski 2009, Flitcroft et al. 2016). Pre-smolt juvenile Coho Salmon in the lower reaches of Humboldt Bay tributaries have primarily been documented rearing in habitats <5 ppt (Wallace and Allen 2009). However, laboratory studies of Coho Salmon indicate salinity tolerance increases substantially after being acclimated to dilute salinities and increases with size, with juvenile coho surviving (near 100% survival) salinities of approximately 20 ppt during the spring through fall and 25 ppt in the winter (Otto 1971). Despite the ability to tolerate these higher salinities, in these lab studies, growth was inhibited at values greater than about 10 ppt (Otto 1971). Various other studies indicate that Coho Salmon can survive and grow rapidly in estuarine areas prior to undergoing transformation to the smolt stage (Tschaplinski 1987, Koski 2009).

Chinook Salmon

As with Coho Salmon, Chinook Salmon have been shown to display a wide range of juvenile life history strategies (Bouret et al. 2016), but most fall Chinook Salmon rearing in coastal California streams primarily display the ocean-type life history where juveniles migrate to the estuary within weeks or months of emergence from redd gravels (Reimers 1971, Healey 1991). Fall Chinook Salmon fry generally emerge from redd gravels from March to May and spend several weeks or months in freshwater before outmigrating to the estuary (Reimers 1971, Healey 1991). The species is largely dependent on estuarine and tidal marsh habitats, where they typically feed and grow for extended periods before migrating to sea (Reimers 1971, Healey 1991, NMFS 2016). In the Elk River, Wallace and Allen (2009) documented juvenile Chinook Salmon in the stream-estuary ecotone from May–September, with August and September observations occurring only in MSR1 (Table 1-1). A small number of juvenile Chinook Salmon were documented in Martin Slough in May 2017 during regular monthly sampling (Wallace et al. 2018); however, no individuals were captured during similar sampling conducted from 2014–2016 (Allen et al. 2016 and Wallace et al. 2018) and 2020–2021 (Natural Resources Services 2022). No Chinook Salmon spawning habitat exists in Martin Slough, which means any individuals rearing there originated in Elk River and passed through lower Elk River and Swain Slough to reach Martin Slough.

In the Salmon River estuary of Oregon, Bottom et al. (2005) identified a range of juvenile Chinook Salmon migration strategies, including (1) individuals that entered the estuary and tidal marsh habitats in the early spring, soon after emergence; (2) juveniles that reside in fresh water for several months, enter the estuary in June or July and remain for several weeks to several months before entering the ocean; and (3) juveniles that enter the estuary in the fall after and reading primarily in upstream freshwater reaches. This long-term study found that estuarine wetland restoration increased variation in estuarine rearing strategies, enhancing overall life history diversity and resilience of Chinook Salmon in the watershed (Bottom et al. 2005).

Characteristics of preferred estuarine rearing habitats for Chinook Salmon have not been well described, but the species appears to utilize salt marshes, tidal sloughs, and mainstem portions of the estuary (Reimers 1971, Bottom et al 2005, Hering et al. 2010). Reimers (1971) found that in early spring most juvenile Chinook Salmon in the Sixes River estuary in Oregon were near shore and associated with logs and debris, but by June, they were more widespread throughout the estuary (not just near shore). Levy et al. (1979, as cited in Healy 1991) found that in that juvenile Chinook Salmon were more abundant in tidal channels that had lower banks and provided cover during low tide. Hering et al. (2010) documented extensive movement of juvenile Chinook Salmon between large tidal slough and a smaller tidal channel leading to tidally flooded salt marsh habitat. Movement into the smaller channel generally peaked during mid- to late flood tides (i.e., 1–2 h before high tide) and movement out of the channel peaked late during ebb tides (i.e., 3–4 h after high tide). Little movement occurred when water depth was less than approximately 1.3 ft. This study indicates that juvenile Chinook Salmon in the estuary move frequently in response to tidally driven habitat conditions. In general, Chinook Salmon fry can initially tolerate salinities less than 20 ppt and osmoregulatory capabilities increase rapidly as individuals are exposed to brackish water (Healey 1991).

Steelhead

Like Coho and Chinook salmon, steelhead display diverse juvenile life history strategies and have been shown to extensively utilize habitats in stream-estuary ecotone (Shapovalov and Taft 1954, Barnhart 1991, Bond et al. 2008, Hayes et al. 2008). Steelhead can grow rapidly in the estuary, and the component of the population rearing in these habitats can contribute disproportionately to

the returning adult population (Bond et al. 2008, Hayes et al. 2008). Depending partly on growing conditions, steelhead may migrate downstream to estuaries as age 0+ juveniles or may rear in streams for two or more years before outmigrating to the estuary and ocean (Shapovalov and Taft 1954). Steelhead migrating downstream as juveniles may rear for one month to a year in the estuary before entering the ocean (Shapovalov and Taft 1954, Barnhart 1991). In lower Elk River Wallace and Allen (2009) documented age 1+ juvenile steelhead in all months except November but captures in MSR1 were concentrated in the spring (Table C-1). Small numbers of juvenile steelhead have been documented in Martin Slough during recent intensive sampling, but only in 2 of 6 years sampled (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022). These individuals were captured in April and May. Due to the lack of steelhead spawning habitat in Martin Slough, these individuals likely originated in Elk River and had to pass through Swain Slough to reach Martin Slough.

Characteristics of preferred estuarine rearing habitats for steelhead have not been well described, but are presumably similar to other salmonids in that they require sufficient escape cover and velocity refugia during higher flows. Recent research shows that juvenile steelhead can exhibit diel movements within estuaries in response to temperature and dissolved oxygen patterns, with movement to upper estuary habitats at dawn and movement to lower estuary habitats at dusk (Bond et al. 2021).

Coastal Cutthroat Trout

Coastal Cutthroat Trout display a wide array of life history strategies, with significant variation in migratory behavior between and among populations (Moyle et al. 2015). In rivers, this life history diversity can loosely be divided into three main groups: (1) anadromous (sea-run) life history, (3) potadromous (migratory within freshwater portions of the river system), and (4) stream-resident. The various life history forms require a wide diversity of marine, estuarine and freshwater habitats to exploit food and survive. Sea-run cutthroat trout migrate upstream to spawn in freshwater, but they are not strictly anadromous because they can make numerous movements back and forth between fresh and salt water to feed. For this reason, they are heavily reliant on estuaries and can spend prolonged periods (months) there, often moving in and out of fresh water, likely in response to feeding opportunities and rearing habitats (Moyle et al. 2015). Coastal Cutthroat trout have similar habitat requirements to those of resident Rainbow Trout and steelhead.

Because of their diverse life histories and frequent movements, Coastal Cutthroat Trout can be found in the in estuaries and the lower reaches of streams throughout the year. In Elk River, Wallace and Allen (2009) captured the species in MSR2 in all months except February and March, but in MSR1 they only captured them from May through July (Table C-1). All individuals captured ranged in length from about 130 millimeter (mm) (5 in) to >300 mm (12 in), indicating that they were age 1 or older. Small numbers of Coastal Cutthroat Trout have also been captured during all seasons of sampling of Martin Slough (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022).

Non-salmonid focal species

Tidewater Goby

Tidewater Goby are a small, short-lived (generally 1 year), estuarine-adapted fish that can tolerate large temperature and salinity ranges (Swift et al. 1989, Tetra Tech, Inc. 2000). The species generally requires stable lagoon or off-channel habitats, particularly during their relatively short

larval stage (Lafferty et al. 1999a, Chamberlain 2006). Tidewater Goby are highly susceptible to predation by piscivorous fish and amphibians, especially introduced species (Stillwater Sciences 2006).

Tidewater Goby utilize the stream-estuary ecotone throughout their life cycle. During the juvenile and adult life stages, preferred habitat consists of low-velocity (but not stagnant), shallow water in seasonally disconnected or tidally muted lagoons, estuaries, and sloughs. Juveniles and adults can be found year-round, although they are most abundant in summer and fall. Tidewater Goby can be flushed downstream during high flow events, but can persist in low-velocity refugia habitat, which generally consists of off-channel sloughs and wetlands (Lafferty et al. 1999b). Substrate preference for juvenile and adult rearing is sand, mud, gravel, and silt, particularly associated with submerged vegetation. Which is likely used for cover (Stillwater Sciences 2006). Juvenile and adult Tidewater Goby are reported to prefer water temperatures of 12–24ºC (54–75°F) within a range of 6–25ºC (42–77°F) (Stillwater Sciences 2006). Juveniles and adults generally prefer salinities <15 ppt, but have been documented in waters ranging from 0–51 ppt (Stillwater Sciences 2006). Juvenile and adult Tidewater Goby appear to prefer shallow depths (< 1 m [3 ft]) near emergent vegetation, possibly to avoid predation by wading birds and piscivorous fish (Moyle 2002).

Reproduction and spawning typically occur during spring and summer in shallow, slack waters of seasonally disconnected or tidally muted lagoons, estuaries, and sloughs. Males dig burrows and guard eggs, most commonly in early spring and late summer in some areas (Stillwater Sciences 2006). Larvae, eggs, and males in burrows are likely less tolerant of floods, lagoon breaching, or strong tidal exchange. Preferred water temperatures during reproduction are 15–24°C (59–75°F), with a range of 2–27°C (36–81°F) (Stillwater Sciences 2006). Preferred salinities during spawning are generally <15 ppt, but range from 5–25 ppt (Stillwater Sciences 2006). Preferred depths for reproduction range from approximately 0.2 m to 1 m (0.7–3.3 ft) and preferred substrates appear to be sand, coarse sand, and sand/silt (Stillwater Sciences 2006).

Although Tidewater Goby are tolerant of a wide range of habitat conditions, they are generally most abundant and persist in habitats with a narrower range in habitat parameters during specific life stages (Stillwater Sciences 2006). Physical structure and location of Tidewater Goby habitat may be more important to their survival and persistence than specific water quality parameters (Chamberlain 2006). Persistence of Tidewater Goby populations is greatest in large wetlands and distance between extirpated habitats and larger wetland source populations affects dispersal and potential for recolonization (Lafferty et al. 1999a,b). Flood and breaching events can result in dispersal between disconnected estuarine habitats, although low survival likely limits dispersal (Stillwater Sciences 2006).

Seasonal distribution and relative abundance of Tidewater Goby in lower Elk River and Swain Slough is not well described. No Tidewater Goby were captured, during multiple years of seining at several sites in MSR1 and the lower portion of MSR2 (M. Wallace, CDFW, unpubl. data, 2005–2009). However, large numbers of Tidewater Goby were captured during in restored habitats in Martin Slough during monthly sampling conducted in fall, winter, and spring (Natural Resources Services 2022).

Longfin Smelt

Longfin Smelt (LFS) were listed as threatened under the California Endangered Species Act in 2009 (CDFG 2009). This euryhaline, anadromous species exhibits complex life history patterns, using a variety of habitats during its approximately 2-year life cycle, from nearshore waters to

estuaries and the stream-estuary ecotone (Rosenfield 2010, Garwood 2017). LFS live along the Pacific Coast of North America from Prince William Sound, Alaska to the San Francisco Estuary (Rosenfield 2010). In Humboldt Bay, LFS have been documented in all the major tributaries including Mad River Slough, Jacoby Creek, Freshwater Slough, Elk River, and Salmon Creek (Garwood 2017). In lower Elk River, the species was documented in MSR1 from January–March 2016 (M. Wallace, CDFW, unpubl. data, 2006; Garwood 2017). The life stage of these individuals was not reported. LFS were not reported from other recent monitoring efforts in lower Elk River and Martin Slough (Wallace and Allen 2009, Allen et. al 2016, Wallace et al. 2018), but juvenile smelt of unknown species were reported in Martin Slough from late fall through spring (Natural Resources Services 2022).

Except for an unpublished larval LFS study conducted by CDFW between 2016–2018, information on the life history of the species in the Humboldt Bay region is limited relative to the San Francisco Estuary where it has been well studied (Rosenfield 2010, Garwood 2017). For this reason, the life history description presented draws heavily on information from the San Francisco Estuary (including the Sacramento-San Joaquin Delta) synthesized by Moyle (2002) and Rosenfield (2010).

LFS, which are semelparous, are thought to spawn in or near the mixing zone between fresh and brackish water in the upper portions of the estuary. Evidence from the Sacramento-San Joaquin Delta suggests spawning locations likely shift depending on freshwater inflow entering the stream-estuary ecotone (Rosenfield 2010). LFS eggs are adhesive and are thought to be deposited on sandy and gravel substrates. Eggs are deposited from late-fall to early spring, and generally incubate at water temperatures of about 7–15°C (Moyle 2002). LFS were not captured in Elk River during 2016–2018 sampling of Humboldt Bay tributaries, but based on capture of larvae in nearby Freshwater Creek, spawning likely occurred from late December through February or early March in those years (J. Ray, CDFW, pers. comm., 10 August 2022). In Freshwater Creek, based on larval capture locations, spawning likely occurred in fresh water near the upper extent of tidal influence (J. Ray, CDFW, pers. comm., 10 August 2022).

The embryo incubation period for LFS is thought to be from about 4–6 weeks, depending on water temperature (Moyle 2002). Salinity requirements for developing eggs are not well described, but the distribution of sexually mature adults in or close to fresh water suggests lower salinities are required for egg development (Moyle 2002, Rosenfield 2010). After hatching from eggs, the small (5–8 mm) larvae are buoyant and generally distributed near the surface of the water column in fresh and brackish waters (Moyle 2002, Rosenfield 2010). Larval LFS have a relatively low salinity tolerance and are most closely associated with salinities of 2 ppt. Upper salinity tolerance is not well described, but larval abundance rapidly declines with increasing salinities up to 15 ppt (Moyle 2002, Rosenfield 2010). Larvae can be detected over a protracted period, but they are most common in the winter and spring. In lower mainstem Freshwater Creek, in 2016 and 2017, recently hatched (6–7 mm) larval LFS were captured from mid-January through mid- to late March, with peak capture in late January and early February (J. Ray, CDFW, pers. comm., 10 August 2022). Larvae are weak swimmers and susceptible to transport to locations with unsuitable environmental conditions (e.g., high salinities) by stream flows and tidal currents (Moyle 2002, Rosenfield 2010).

Metamorphosis from the larval to juvenile form, which is strongly influenced by water temperature, may begin as quickly as 15 days post-hatch but more commonly requires 3 months. Juvenile and pre-spawning adult LFS are widely distributed throughout the year in brackish and marine environments. Juveniles and pre-spawning adults can be found across a wide range of salinities, from fresh water to pure sea water, but they generally prefer salinities from 15–30 ppt.

During the summer, they can inhabit water as warm as 20°C (68°F), but generally select 16–18°C (60.8–64.4°F). In the Sacramento-San Joaquin Delta, both juveniles and adults are typically found at greater densities in deeper habitats (>7 m) relative to shallower habitats. Juveniles and adults appear to migrate seasonally, downstream during summer months and upstream in the late-fall and winter. Adults are thought to become sexually mature as they migrate towards spawning locations.

Fish Habitat Characterization

This section describes existing fish habitat conditions in PA 1 , with an emphasis on characterizing juvenile salmonid rearing habitat. The assessment focuses on juvenile summer and winter salmonid rearing habitats since spawning habitat is not present in the low gradient and fine sediment dominated channels of the stream-estuary ecotone. Field assessments of physical habitat conditions for salmonids were conducted during both the dry (summer habitat) and wet (winter habitat) seasons to help understand habitat factors limiting salmonid population productivity and identify opportunities for and constraints to restoring fish habitat. Results from salinity and water temperature monitoring (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023) are also summarized as they relate to water quality constraints on fish utilization in PA 1.

In most of PA 1, clear geomorphic habitat units could not be identified due to the channelized, tidally influenced, and relatively homogeneous nature of the channel (uniform width, depth, and substrate). For this reason, traditional mesohabitat typing (e.g., pool, riffle, flatwater) was not feasible. Thus, for the purposes of characterizing and describing fish habitat conditions, the main channels of lower Elk River (MSR1 and MSR2) and Swain Slough (SS) were delineated into channel segments based on tributary and off-channel habitat junctures, unique geomorphic or riparian characteristics, or other notable changes in channel conditions (Figure 1-1). These segments ranged in length from approximately 400 ft to 2,500 ft. Primary off-channel features connected to the main channels of Elk River and Swain Slough were also identified and characterized and are shown in Figure C-1.

Figure C-1. Channel segment used to characterize fish habitat within Planning Area 1.

Summer rearing habitat for salmonids was assessed from September 28 through October 1, 2021, when stream flow was representative of typical late-summer and early fall habitat conditions. A mix of boat and bank surveys were used to access channels in PA 1 in both summer and winter. The summer habitat assessment focused on describing relative quantity of escape cover for juvenile salmonids and other fish in each channel segment provided by water depth, overhanging terrestrial vegetation, aquatic vegetation, large wood, small woody debris, and other cover elements. Observations and notes on relative level of canopy cover, presence and relative quantity of large wood, water velocity, tidal influence, and other fish habitat characteristics were also collected. Notes on anthropogenic disturbances and restoration opportunities and constraints were also recorded. GPS coordinates were collected at the downstream boundary of each channel segment and representative photographs of channel characteristics and physical habitat conditions were taken.

Salmonid winter rearing habitat was assessed from January 12–14, 2022, during a relatively dry period with a relatively low winter base flow (Section 2.2.2.1 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). The winter assessment focused on characterizing relative quantity and quality of low-velocity winter rearing habitat for juvenile Coho Salmon and other salmonids, including: (1) availability of in-channel low-velocity habitat; and (2) level of connectivity with off-channel features such as alcoves, side channels, and adjacent tidal marshes and floodplains. The degree of off-channel habitat connectivity was qualitatively characterized at representative locations by observing inundation of off-channel features at the surveyed flow and tidal stage and by assessing potential for inundation at higher streamflows and tides. Information from geomorphic and surface water assessments were also used to help characterize off-channel winter habitat conditions in the planning reach and ascertain restoration potential.

For summarizing fish habitat conditions herein, river and slough channels and adjacent off-channel habitats within PA 1 were subdivided into the following areas, each of which is characterized in the sections that follow:

- MSR1 – the lowest reach of mainstem Elk River that is dominated by saline or brackish water. The assessed portion of MSR1 includes main channel segments ER1–ER9.
- MSR2 – the reach of mainstem Elk River upstream of MSR1 that is tidally influenced but dominated by fresh water and includes main channel segments ER10–ER13.
- Swain Slough – the primary slough channel that enters the Elk River estuary at the HWY 101 bridge and includes main channel segments SS1–SS6 and other ditches or off-channel features draining into Swain Slough.
- Other – other assessed off-channel features and tributaries.

MSR1

Approximately 2 miles of mainstem Elk River were assessed within MSR1, from the HWY 101 bridge upstream to the MSR2 boundary (Figure 2-24). In general, MSR1 is characterized by a broad, homogenous tidal slough channel with a high width-to-depth ratio, silt-dominated bed substrate, and near vertical banks associated with constructed levees along significant portions of the reach (Section 2.6, Appendix A of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Throughout much of MSR1, the channel is confined by these levees, limiting natural channel processes and connectivity with relic slough channels, tidal marshes, and other off-channel habitats. Wetted borrow ditches run along most of the levees on the side opposite from the main channel. These ditches are channelized and have infrequent connections with the main channel, but in some places may function like tidal slough channels (e.g., ER1.1). Channel width

in MSR1 gradually decreases in the upstream direction, ranging from approximately 150 ft in ER1 to 40 ft in ER9. MSR1 can experience daily tidal fluctuations of 4–8 ft (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023), which has significant bearing on habitat conditions and fish utilization patterns in the reach. For example, many of the higher quality rearing habitats that provide low velocities, escape cover, and feeding opportunities are associated with channel margins, alcoves, inset benches, and tidal sloughs, and these habitats may become dewatered or too shallow to support salmonid rearing during lower tidal stages. Because of tide-driven temporal shifts in habitat characteristics, fish are likely to move to find suitable rearing habitats at different tidal stages. The area of suitable salmonid rearing habitat in MSR1 is generally expected to be greatest at higher tidal stages and diminish at lower stages. Studies in other estuaries indicate that available habitat during low tides likely limits fish carrying capacity (Tschaplnski 1987). For this reason, providing rearing habitat and cover at lower tides is an important consideration for habitat restoration in MSR1.

Summer habitat

In channel segments ER1–ER4 (the lower 4,720 ft of the assessed portion of MSR1), quality of physical summer rearing habitat for salmonids, Tidewater Goby, and other fish is, in general, relatively poor due to the homogenous and straight channel, steep banks, limited hydraulic and depth complexity, and lack of in-channel and riparian cover (Figure C-2). In ER1–ER4, other than some shallow, grassy margins and small bank indentations along the main channel that are wetted during higher tides, the primary habitats with escape cover and lower velocities are associated with the ER.1 ditch network, alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1), and a single, small island at the upstream end of ER3. A network of partially wetted drainage ditches, relic slough channels, and depressions occurs throughout the ERWA adjacent to MSR1. These channels connect to the Elk River via tide gates at ER2.1, ER2.2, and ER3.1, but tidal exchange and fish access to these features are limited by dilapidated tide gates and low habitat complexity along with high salinities would limit juvenile salmonid rearing in these ditches during the summer (Section 2.2.2; Table 2-12 and Table 2-13 in the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). It was not possible to view the entire channel at the surveyed tide due to depth and turbidity, but except for a few pieces of submerged large wood observed in ER4, very little in-channel cover was observed in channel segments ER1–ER4. Additionally, no canopy cover or significant escape cover from riparian trees was observed. Because of the simplified channel and minimal off-channel habitat connectivity, high water velocities during higher ebb and flood tides may limit overall capacity of the channel to support juvenile Coho Salmon and other fish during the summer.

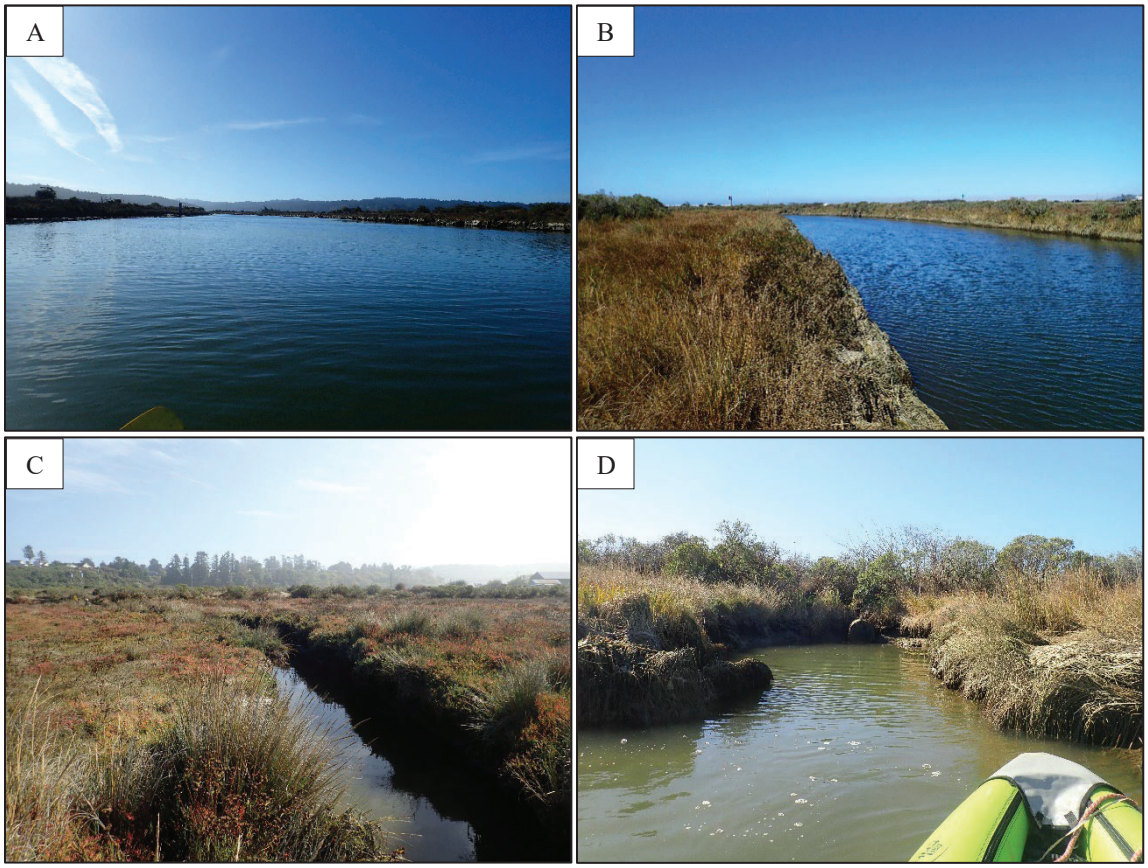


Figure C-2. Photos from September 2021 showing representative main-channel summer fish habitat conditions in ER1 (A) and ER4 (B) and examples of accessible off-channel habitat features in ER1.1 (C) and ER3.1(D). Note: tidal stage was relatively high when these photos were taken.

In channel segments ER5–ER7, overall fish habitat quantity and quality continues to be limited by the simplified, straight channel bordered by relatively steep banks and limited off-channel habitat. Main-channel salmonid summer rearing habitat quality improves somewhat relative to ER1–ER4 due to long patches of continuous riparian trees with overhanging branches on the right bank of ER5 and ER6 and on the left bank of ER7. These branches provide both overhead and in-channel escape cover for juvenile fish (Figure C-3). Based on observations during the winter survey, which was conducted at a lower tidal stage than the summer survey, the area of suitable salmonid rearing habitat provided by these overhanging branches is expected to be greatest at higher tidal stages, when they and the few gradually sloping banks become more inundated. It was difficult to fully assess in-channel cover at the surveyed tide due to depth and turbidity, but other than several pieces of submerged large wood in ER7, most cover was associated with channel margins (branches from live trees and grasses).

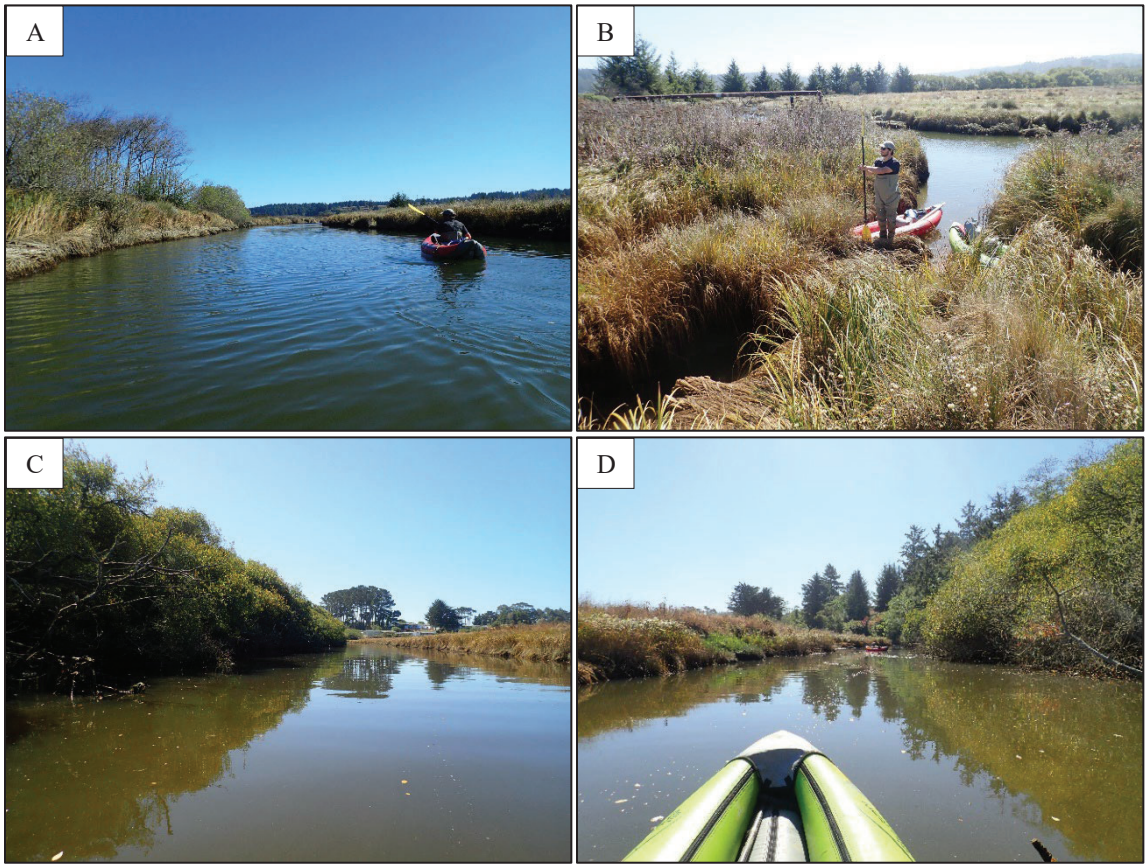


Figure C-3. Photos from September 2021 showing representative main-channel summer fish habitat conditions in ER5 (A), an alcove habitat associated with a tide gate at ER5.1 (B), and examples of overhanging riparian cover in ER6 (C) and ER7 (D). Note: tidal stage was relatively high when these photos were taken.

In channel segments ER8–ER9 (the upper 2,260 ft of MSR1), overall quality of summer rearing habitat for salmonids increases substantially due the presence of thick riparian trees with complex overhanging and in-channel branches on one or both banks (Figure C-4). Additionally, several pieces of in-channel large wood that provide high quality habitat were observed in both ER8 and ER9. The channel in these segments is still relatively homogeneous, with steep banks on both sides and is narrower and deeper relative to downstream segments. In many places, overhanging branches provide shade and escape cover for fish across much of the narrow channel. However, in several sections of the right bank of both ER8 and ER9, the riparian zone is interrupted by several long areas of grassy bank with few trees and little fish cover. No connected alcoves, tidal sloughs, or other features that provide flow refugia or off-channel rearing opportunities were documented in ER8 or ER9. A seasonally wetted drainage ditch, ER9.1, enters Elk River at the ER8/ER9 boundary via a tide gate, but is not currently accessible to fish. This location, which historically had a connected tidal slough channel, is fed by springs/seeps draining the hillslope. As described below, if restored, it has potential to provide high quality off-channel rearing habitat.

Overall, suitable habitat for Tidewater Goby is limited in MSR1 because the species requires relatively stable and shallow low-velocity habitats in connected off-channel sloughs and wetlands. The primary habitats with potential to support Tidewater Goby under existing

conditions are associated with the ER.1 ditch network and alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1, ER5.1, ER6.1). Additionally, many existing, but largely disconnected, ditches and relic slough channels in the ERWA have potential to provide high quality goby habitat if restored. The drainage ditch and relic slough associated with ER9.1 also has potential to provide goby habitat if reconnected.

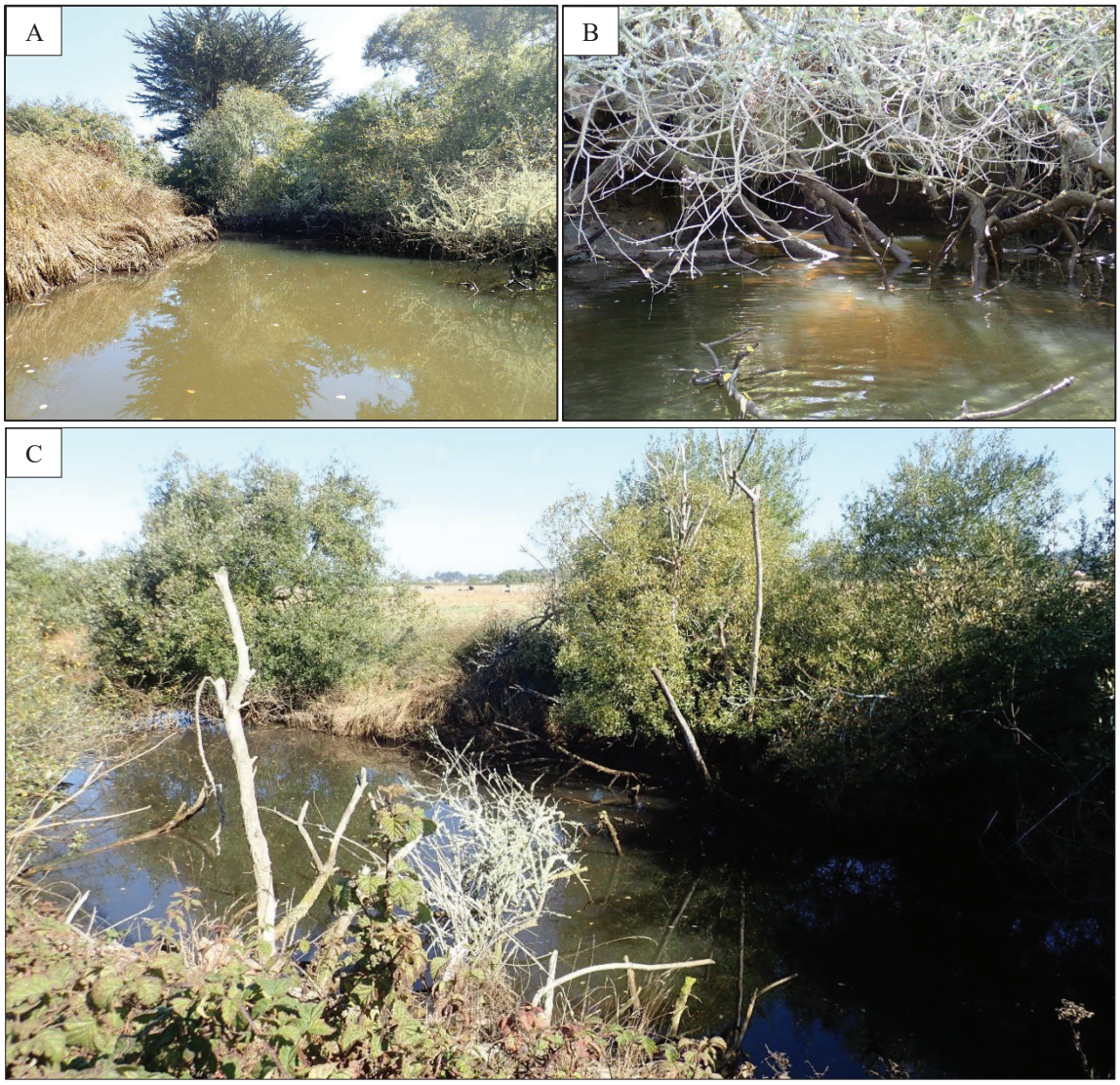


Figure C-4. Photos from September 2021 showing a steep, grassy bank on the right bank of ER8 and overhanging riparian branches on the left bank (A) complex overhanging and in-channel tree branches on a near-vertical bank in ER8 (B), and section of ER9 with patchy riparian on both banks (C).

Winter habitat

The same channel characteristics that limit summer rearing habitat quality for salmonids and other fish in much of MSR1 (homogenous and straight channel, steep banks, limited hydraulic and depth complexity, lack of in-channel cover) also limit winter rearing habitat quality. MSR1

has minimal in-channel velocity refugia, limited escape cover, and lack of connected off-channel rearing habitat.

At the relatively low stream flow and moderate tidal currents surveyed, small areas of relatively low-velocity habitat (<1.0 ft per second) were observed along the channel margins and the few alcove-like habitats present in MSR1. However, because of the straight channel, with relatively steep banks, and very little large wood, even moderate winter and spring high-flow events are expected to produce in-channel water velocities that exceed values needed by Coho Salmon for rearing (<0.6 ft per second ft/s; Beecher et al. 2002). Lack of in-channel cover and velocity refugia is also expected to restrict suitable habitat area for other fish species in the reach during higher flows.

The primary areas with potential to provide velocity refugia during higher stream flows include (1) the ER.1 ditch network, the alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1, ER5.1, and ER6.1 (2) small areas in ER6, ER7, ER8, and ER9 that have both relatively gradual slopes and complex, overhanging, in-channel riparian branches or large wood along the bank, and (3) the few pieces of in-channel large wood big enough to potentially provide small areas of low velocity habitat (Figure C-3). A series of 20–40 ft wide "inset benches" (bounded by levees) located along the right bank in ER3 and ER5 have gradual bank slopes (after an initial step up from the active channel). These sites may also provide velocity refugia when they are flooded during higher flows (Figure C-5).

The network of drainage ditches, relic slough channels, and depressions in the ERWA have potential to provide large areas of high-quality winter refugia and rearing habitat depending on flow and tidal stage, but the current habitat is generally in poor condition. Additionally, as described above, ER9.1 is not currently accessible to fish, but if restored, has potential to provide a large area of high-quality, off-channel salmonid winter rearing habitat. During the relatively dry winter period, a significant amount of fresh water was observed entering the ditch via the adjacent hillslope, which would help maintain water quality at the site if it were made accessible to fish (Figure C-6).

Figure C-5. Examples of locations in MSR1 that have potential to provide high flow refugia for fish in MSR1, including connected borrow ditch at ER1.1 (A), large alcove associated with ER2.2 (B), large wood along both channel margins in ER7 (C), relatively gradually sloped bank with in-channel willow branches in ER9 (D), and inset bench on right bank in ER5 (E).

Figure C-6. Photo from January 2022 showing the lower portion of the drainage ditch at ER9.1.

Water quality

Despite the presence of suitable physical habitat for juvenile salmonid rearing in MSR1, utilization of this reach is likely seasonally limited by high salinities and water temperatures. Continuous water temperature and salinity data collected in MSR1 in 2021 and 2022 (Section 2.2.2) provide an indication of seasonal suitability for salmonids and other fish species. MSR1 is characterized by brackish water, with channel bottom salinities varying from about 20–30 ppt during the dry season and ranging from about 0–26 ppt during wetter periods, with lower values associated with higher flows during lower tides. In general, high salinities are expected to inhibit most rearing by non-smolt juvenile salmonids during much of the dry season. Results of fish monitoring conducted in the reach confirm that few rearing juvenile salmonids use MSR1 during the summer and early fall, except for Chinook and Coho smolt, which have higher salinity tolerances than fry and parr (Wallace and Allen 2009; Table C-1).

During wetter periods in the winter and spring, salinities in MSR1 can be low enough to support juvenile salmon rearing and it is likely that some individuals move in and out of this reach in response to fluctuating salinities resulting from variable flows and tides. Additionally, during both wet and dry seasons, significant salinity stratification can occur, with the surface layer having considerably lower salinities relative to the channel bottom (where the continuous data were collected). For example, at the water quality monitoring site ER-2 (channel segment ER6), spot-measured salinity in September 2021 was 13.7 ppt near the surface and 27 ppt near the

bottom. At the same site, in both February and late-May 2022, salinity was about 3 ppt near the surface and 27 ppt near the bottom. It is likely that the presence of less saline surface layers allows juvenile salmonids to acclimate to higher salinities and rear in or move through the reach prior to undergoing smoltification.

Water temperatures in MSR1 generally remain below levels tolerated by juvenile Coho Salmon and other salmonids (approximately 18°C), but in 2021, daily mean temperatures exceeded 20°C and daily maximums exceeded 22–24°C at monitoring sites ER-1 and ER-2 during June and July. Additional temperature monitoring in the reach would be valuable to understand whether these higher values occur in other water years. Limited depth stratified spot measurements indicate thermal stratification can occur in MSR1 during some periods, with surface values from 2–4°C cooler than bottom values during some (but not all) measurements.

MSR2

Approximately 1 mile of mainstem Elk River and adjacent off-channel features were assessed for fish habitat in MSR2 (Figure 2-21 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). In general, MSR2 is considered the upper part of the stream-estuary ecotone and is tidally influenced at stages greater than about 4 ft but dominated by fresh water. Similar to upstream reaches, MSR2, which is dominated by homogeneous silt-sand substrates, has been impacted by channel and habitat simplification resulting from agricultural land uses, large wood removal, and sediment aggradation. The channel is relatively narrow (20–50 ft) with steep banks and is entrenched by 6–8 ft relative to the adjacent pastures throughout much of MSR2, limiting floodplain connectivity. The riparian corridor is constrained to a narrow strip, primarily composed of willow and alder on the stream bank and, in many places encroaching on the channel. Stream banks are degraded by cattle grazing in places. In general, salinities and water temperatures remain sufficiently low to support year-round rearing by juvenile salmonids. More detailed observations of summer and winter habitat for juvenile salmonids are provided in the sections that follow.

Summer habitat

Despite the anthropogenically impacted and simplified channel, suitable summer rearing habitat for juvenile salmonids is abundant and widespread in MSR2 relative to MSR1. Large areas of summer rearing habitat with sufficient depth and extensive escape cover are present and ample riparian shading was observed throughout the reach (Figure C-7). A comprehensive large wood survey could not be conducted due to the extremely dense riparian that choked the channel in much of the reach, but very few pieces of functional large wood and no channel spanning wood jams were observed.

Channel segment ER10 is characterized by a straight, homogenous channel bounded by cattle pasture on both sides and contains an extremely dense willow-dominated riparian zone that overhangs the entire wetted channel in most areas. In many places, thick willow branches interacted with the low-flow channel. These branches provide a high amount of overhead and in-channel escape cover for rearing juvenile salmonids. While very few pieces of large wood were observed, some larger willows growing along the bank may function like large wood. At the outgoing tidal stage of about 4 ft when ER10 was assessed, some short riffle-like features and shallow, hydraulic control points separating habitats were observed, suggesting minimal tidal influence at that stage.

In channel segment ER11 the hillslope impinges along the left bank of the channel. The riparian zone is still relatively dense and contiguous in ER11 but has more diversity and the understory and channel are more open relative to ER10. Several pieces of functional large wood were observed, creating some local scour and fish cover. Significant erosion resulting from cattle was observed in portions of ER11, from the left bank hillslope, extending into the channel, creating local silt inputs, and potentially impairing water quality.

The dense riparian vegetation in channel segment ER12 is similar to that observed in ER10: the channel is choked with live willow that interacts with the fine-sediment dominated channel. Overall, summer rearing habitat for salmonids in ER12 is abundant and relatively high quality, except for several relatively long (50–100 ft) and homogeneous sections of shallow (<0.5 ft) and flowing flatwater habitat. ER12.1 is a significant off-channel drainage fed by springs draining the adjacent hillslopes that enters ER12 via a culvert and tide gate that excludes fish. As detailed below, this site has significant potential for fish habitat restoration, particularly for winter off-channel habitat. A ditch draining the adjacent cattle pasture enters ER12 through a long culvert (without a tide gate) on the right bank at ER12.2.

Channel segment ER13 runs along the base of the hillslope on the left bank, with continued flat cattle pasture on the right bank. Portions of the segment have extensive escape cover and sufficient water depth to support summer rearing habitat for salmonids, however, several very shallow and apparently stagnant sections with unsuitable salmonid habitat were observed in ER13. Several shallow locations had thick aquatic vegetation, which in one place spanned the channel and appeared to obstruct fish movement. In general, the channel in ER13 is more open with larger and less dense riparian trees relative to downstream segments. The channel is still entrenched, but portions of the bank have failed, creating small inset benches and increasing channel complexity in places. While the bed substrate is still silt-dominated, patches of sand and small gravel were observed in the upper portion of ER13. A significant spring/drainage was observed flowing off the left bank hillslope and entering the channel at the downstream end of ER13.

Despite the generally abundant and high-quality summer rearing habitat observed for salmonids, restoration actions that increase the depth and complexity of pools and mitigate for in-channel cattle impacts would be valuable in portions of MSR2. Implementing restoration actions that improve winter rearing habitat—such as through the addition of large wood—will also improve summer habitat.

Overall, suitable habitat for Tidewater Goby is limited in MSR2 because the species requires relatively stable and shallow low-velocity habitats in off-channel sloughs and connected wetlands, which are rare in the reach. The drainage ditch and relic channel associated with ER12.1 has potential to provide goby habitat if restored.

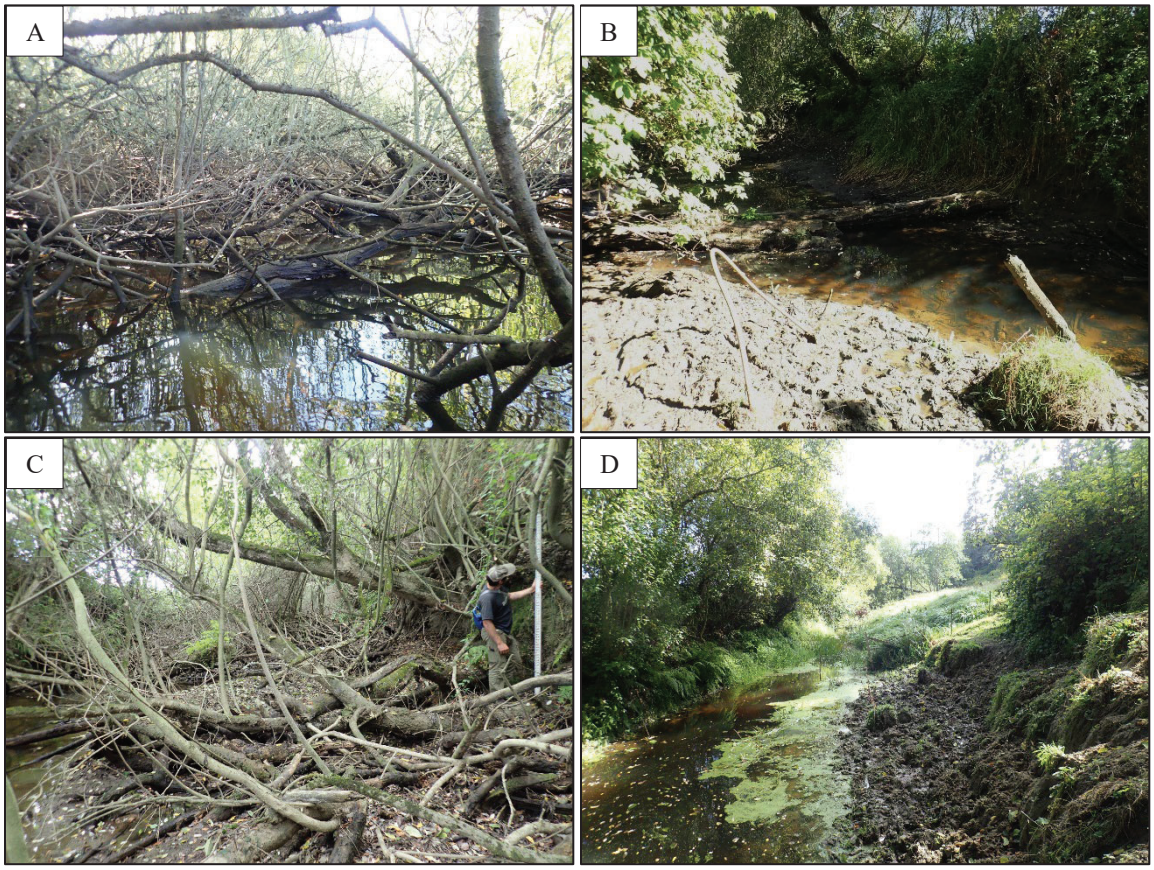


Figure C-7. Representative summer rearing habitat in MSR2. Dense willow branches and small woody debris covering much of the channel in ER10 (A), a more open section in ER11 with some functional large wood and cattle impacts in the channel (B), dense in-channel branches and entrenched channel in ER12 (C), and shallow, stagnant section of ER13 with in cattle impacts (D).

Winter habitat

Overall, quality of winter habitat in MSR2 is relatively poor, with minimal in-channel flow refugia due to low large wood densities, essentially no connected off-channel habitat features, and severely restricted connectivity with adjacent floodplains. During the winter habitat assessment conducted in January 2022 at a moderate winter baseflow, small areas of relatively low-velocity habitat (<1.0 ft per second) were observed along the channel margins in a few locations where banks were more gradually sloped and dense willow branches or large wood were present (Figure C-8). However, because of the entrenched channel and limited functional large wood, even moderate high-flow events are expected to produce water velocities that exceed values preferred by Coho Salmon for rearing (approximately 0.6 ft per second ft/s; Beecher et al. 2002) throughout much of the reach. In some locations, it is possible that the extremely dense in-channel willow trunks and instream branches create low-velocity refugia along the channel margins or slow upstream water velocities through backwatering. Several groups of large wood pieces that were observed also likely create some in-channel flow refugia at higher flows.

Figure C-8. Examples of low-velocity in-channel habitat in MSR2 observed during the January 2022 survey conducted at a moderate winter base flow. Dense in-channel branches and small wood pieces in ER10 (A) and a piece of large wood creating alcove-like habitat at the observed flow in ER11 (B).

No alcoves, side channels, or other off-channel winter habitat features accessible to fish were observed in MSR2. The primary opportunity to restore off-channel fish habitat in MSR2 involves re-connecting the existing low-elevation drainage present at ER12.1, which runs along the hillslope west of ER12 for approximately 1,300 ft before entering the channel via a culvert and tide gate (Figure C-9). During the January 2022 assessment, during a relatively dry winter period, the entire length of this drainage was wetted and significant flow was observed at both at the upstream/south end of the feature and where it entered the culvert through a shallow riffle at the south end. Additionally, a large (~30 x 200 ft) and relatively deep (max depth = 1.5 ft) ponded area was documented at the south end of the feature. Simply removing or modifying the existing tide gate to allow fish access to the existing low elevation feature fed by freshwater would provide a large area of high-quality off-channel winter rearing habitat in a reach where little is present.

Figure C-9. Large area of existing off-channel habitat at ER12.1 that is inaccessible to fish due to a tide gate.

Water quality

Continuous water temperature and salinity data collected at site ER-3 near the ER11/ER12 boundary in MSR2 (Section 2.2.2) indicate that, although water levels rise and fall with the tide, the site is freshwater dominated in the winter and spring when stream flows limit the upstream extent of saltwater influence. However, during summer and fall low flow conditions, the site becomes brackish during higher tidal stages (typically greater than about 6.5 ft). In 2021, daily

maximum bottom salinities ranged from near 0 ppt during days with lower high tides to 21 ppt at higher tides (Figure 2-18, Figure 2-19 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). High densities of age-0 Coho Salmon documented in MSR2, suggests salinity does not prevent fish utilization of the reach during the low flow period (Wallace and Allen 2009; Table C-1). While salinity stratification was not documented by limited spot measurements in 2021 and 2022 (Table 2-8 in CalTrout et al. 2023; note measurements only conducted during lower tides or higher flows), it is likely that a significant freshwater surface layer is present in much of MSR2 during high tides, allow juvenile salmonids to persist. Fish may also move upstream during high tides to avoid high salinities. Water temperatures in MSR2 remain below levels that can be stressful to salmonids and are substantially cooler than measured in MSR1, with daily mean temperatures at the ER-3 monitoring site never exceeding 16°C during 2021 and 2021.

Although water quality information is limited in these reaches, winter water quality is known to be significantly impaired by high suspended sediment concentration and turbidity (CalTrout et al. 2019).

Swain Slough downstream of Elk River Road tide gate

Approximately 0.9 miles of mainstem Swain Slough and adjacent off-channel habitats within PA 1 were assessed for fish habitat, from its confluence with Elk River upstream to the tide gate at Elk River Road (SS1–SS6; Figure C-1).

In general, mainstem Swain Slough is characterized by a relatively broad, homogenous tidal slough channel with steep banks confined by constructed levees along significant portions of the reach (Figure 2-40 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). As with lower Elk River, the channel is confined by these levees, limiting natural channel processes and connectivity with relic slough channels, tidal marshes, and other off-channel habitats. Wetted borrow ditches run along most of the levees. These features are channelized and have infrequent connections with the main channel (either thorough small gaps in the levees or during high tide), Channel width in Swain Slough gradually decreases in the upstream direction, ranging from approximately 60 ft in SS1 to 20 ft in SS6. Swain Slough tidal patterns and water levels closely tracks those recorded at the ER-1 monitoring site, except during high flow events with significant freshwater inflows from Martin Slough (Section 2.2.2). Daily tidal fluctuations of 4–8 ft are expected to have significant influence on habitat conditions in Swain Slough, with a greater area of habitat with high-quality cover on the channel margins available at higher tidal stages. As with MSR1, available habitat during low tides is expected to limit overall fish carrying capacity. Observations of summer and winter fish habitat, focused on juvenile salmonid rearing, and the likely influence of salinity and water temperature on fish utilization in Swain Slough are summarized below.

Summer habitat

As with MSR1, because of high salinities, utilization of Swain Slough habitats by salmonids during the summer is expected to be primarily limited to the smolt life stage as they transition to Humboldt Bay and the ocean. At relatively high tidal stages, including during the September 2021 survey, there is a significant amount of juvenile fish escape cover and low velocity habitat along much of the margins Swain Slough. High quality fish cover is provided by extensive overhanging and in-channel riparian tree branches present along much of the right bank in SS2 and SS3 (Figure C-10). Additional cover is provided by flood grasses and other vegetation that occur along much of the channel, including some relatively large inset benches with gradual slopes and small alcove-like features in SS4, SS5, and SS6 that provide large areas of 1–2 ft deep,

lower velocity habitats with cover during higher tides. Little connected off-channel habitat is currently present in Swain Slough due to the levees that run along the channel. A relatively large salt marsh that contains an off-channel pond is present at SS3.1. Tidal connectivity and fish access to this site appears to be severely limited by an old tide gate and drainage ditch running through the marsh. As detailed under winter habitat below, this site has potential to provide a large area of high-quality fish rearing habitat. The borrow ditches that run along much of Swain Slough appear to be connected to the main channel only at high tidal stages, but there are a few locations, such the left bank of SS4 where the levees have partially failed, allowing more frequent tidal inundation and potentially providing fish off-channel fish habitat at more moderate tidal stages.

At lower tidal stages, many of these margin habitats become dewatered and fish would need to move to find cover provided by in-channel features. Observations from a relatively low tidal stage during the January 2022 winter habitat survey indicate that the low-flow channel in much of Swain Slough is relatively shallow during low tides and contains very little in-channel escape cover or hydraulic diversity. In SS1 and SS2, some fish cover is provided by mid-channel patches of eelgrass (Section 2.4). Except for two large logs in SS3 that create some scour and fish cover, no large wood was observed in the low-flow channel.

Overall, suitable habitat for Tidewater Goby is currently limited in Swain Slough because the species requires relatively stable and shallow low-velocity habitats in connected off-channel sloughs and wetlands. The primary habitats with potential to support Tidewater Goby under existing conditions include the large alcove at SS4.1 and locations with levee failures where borrow ditches are connected. Some of the smaller alcove life features that occur along the margins SS4 and SS5 may also provide some habitat, but most of these features likely go dry during low tides.

Figure C-10. Photos from September 2021 showing representative main-channel summer fish habitat conditions in Swain Slough. Looking upstream at straight channel in SS2 confined by a levees on the left bank and more gradual bank with riparian cover on the right bank (A), looking downstream at overhanging riparian cover along both banks in SS3 (B), looking upstream at flooded vegetation along the margins of SS5 during a relatively high tidal stage (C), and looking downstream from the tide gate at the end of SS6 (D).

Winter habitat

During wetter periods of winter and spring with more freshwater influence, like MSR1, Swain Slough has potential to support rearing age-0 juvenile salmonids and other freshwater-dependent or brackish species (Table C-1). Winter habitat complexity and fish escape cover in the Swain Slough channel during moderate winter flows is similar to that described for summer habitat: relatively large areas of high-quality habitat are accessible along the channel margins during higher tidal stages and minimal in-channel habitat is available during lower tides (Figure C-10 and Figure C-11). During high winter flows, when significant freshwater enters Swain Slough via Martin Slough and upstream drainages, water velocities in much of the channel may become too high to support juvenile salmonid rearing. As described above, access to off-channel and floodplain habitats that provide velocity refugia is limited by the levees that run along much of Swain Slough. During high flow conditions, some high-flow refugia habitat appears to be present along the more natural bank margins that occur along the right bank of SS2 and SS3, which has sections with relatively gradual slopes (up to the base of the adjacent hillslope) with thick overhanging tree branches and some bankside large wood (Figure C-11). Fish may also find

velocity refugia where the levees have failed, and they can access the network of borrow ditches and adjacent lower elevation floodplains. However, fish stranding could be an issue when flows recede and the ditches become disconnected.

Figure C-11. Photos of from the January 2022 fish habitat assessment of Swain Slough. Examples of potential high flow refugia habitat, including large wood located on the relatively gradually sloping right bank of SS3 (A) and an alcove at SS4.1 (B) and representative area with shallow water and low in-channel habitat complexity that occurs during lower tidal stages in SS4 (C).

The salt marsh that occurs east of the SS2/SS3 boundary (SS3.1), is currently largely disconnected; however, it has high potential to provide a large area of high-quality fish habitat adjacent to lower Swain Slough (Figure C-12). The approximately 1-ac marsh is fed by a small drainage originating in the adjacent wooded hillslopes that provide significant freshwater inputs to the site during the wet season. Most of this water appears to drain into a narrow (2 ft) and very entrenched (3–5 ft deep) drainage ditch that runs across the meadow before terminating in Swain Slough through a small tide gate at the base of a channel-side levee. An existing, small (40x40 ft) brackish pond is present on the eastern edge of the marsh. It does not have an obvious inlet or outlet channels but appears to be tidally connected at some tidal stages (was brackish during September site visit) and likely receives some freshwater from the adjacent hillslopes. The site appears to become inundated at the highest tidal stages that flood the berm that runs along this channel/marsh margin (Figure 2-1 of the *Elk River PA 1 10% Design Report*; CalTrout et al.

2023). However, field observations suggest the marsh is inaccessible to fish at most tidal stages. It is unclear how frequently the site floods during winter flow events but appears to be disconnected by the relatively high elevation berm at most flows. This site has significant potential for restoration of high quality and valuable fish habitat since it is an undeveloped low-elevation salt marsh habitat with an off-channel pond in the lower estuary that could be fed by significant freshwater. If restored, this site could provide high flow refugia habitat during flood events and persistent off-channel rearing habitat for salmonids and other fish during the winter and spring.

Figure C-12. Photos of disconnected off-channel salt marsh (A), associated pond (B), small tributary flowing into marsh (C), and old tide gate that enters Swain Slough (D).

Water quality

As with MSR1, during the summer and early fall, high salinities (>20 ppt) in Swain Slough are expected to limit fish use to species and life stages (i.e., smolt) than can tolerate salt water (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). During wetter periods in the winter and spring, salinities in Swain Slough can be significantly lower especially at the SS-2 monitoring station (channel segment SS6), where daily values fluctuating between a low of near zero and a high of 6–10 ppt during periods with higher flows during lower tides. During these periods, Swain Slough may support age-0 and pre-smolt juvenile salmon rearing; though it is likely that some individuals move in and out of this reach in response to fluctuating salinities resulting from variable flows and tides. Additionally, the duration that Swain Slough provides suitable salinities is expected to be significantly longer during wet winters relative to the dry winter of 2021–2022 when water quality monitoring was conducted. Restoration efforts that reconnect freshwater sources to Swain Slough and provide fish access to nearby freshwater dominated habitats are expected to extend the duration of salmonid rearing. Additionally, significant salinity stratification may also allow salmonids to persist in the reach during some periods when bottom salinities are high. However, in contrast to MSR1, limited depth-stratified sampling in 2021 and 2022 suggests minimal thermal stratification in Swain Slough (Section 2.2.2.1 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023).

Water temperatures recorded at Swain Slough monitoring sites (SS-1 and SS-2) were similar to those recorded at MSR1 monitoring sites (ER-1 and ER-2). Daily mean water temperatures at both sites remained above 18°C for much of the summer 2021, with temperatures at SS-2 being higher than at SS-1 (Section 2.2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Limited depth-stratified measurements showed essentially no thermal stratification at the Swain Slough monitoring sites.

Other locations assessed

Eastern off-channel habitat

A disconnected relic slough feature that is fed by two small tributaries (T1 and T2) and borders cattle pasture on the east side of Elk River Road, was also assessed due to its potential for fish habitat restoration (Figure C-1; Figure C-13). This site consists of two channel-like depressions that are mostly dry in the summer but appear to remain wetted for much of the winter and spring. The northern channel, T1, is fed by a seasonal drainage from the north, a small tributary, and at least one spring entering from hillslope to the east of the channel. The T1 channel is approximately 1,900 ft long and flows north and west before passing through a culvert under Elk River Road and entering a drainage ditch (SS7) that flows into Swain Slough Figure C-1, Section 2.6, Appendix A). The southern channel, T2, is fed primarily by a tributary flowing from the southeast hillslope that enters a depression along the southern edge of the cattle pasture before passing through a culvert under Elk River Road and eventually flowing into Swain Slough via a drainage ditch that follows the west side of Elk River Road Figure C-1, Section 2.6, Appendix A of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). This feature includes about 400 ft of ponded habitat on the edge of the cattle field, including a relatively deep (1 ft) section partially within the adjacent riparian forest (Figure C-13). Neither of these relic channels are currently accessible to fish but contribute valuable freshwater to Swain Slough and have potential to provide high quality winter rearing habitat for salmonids if reconnected.

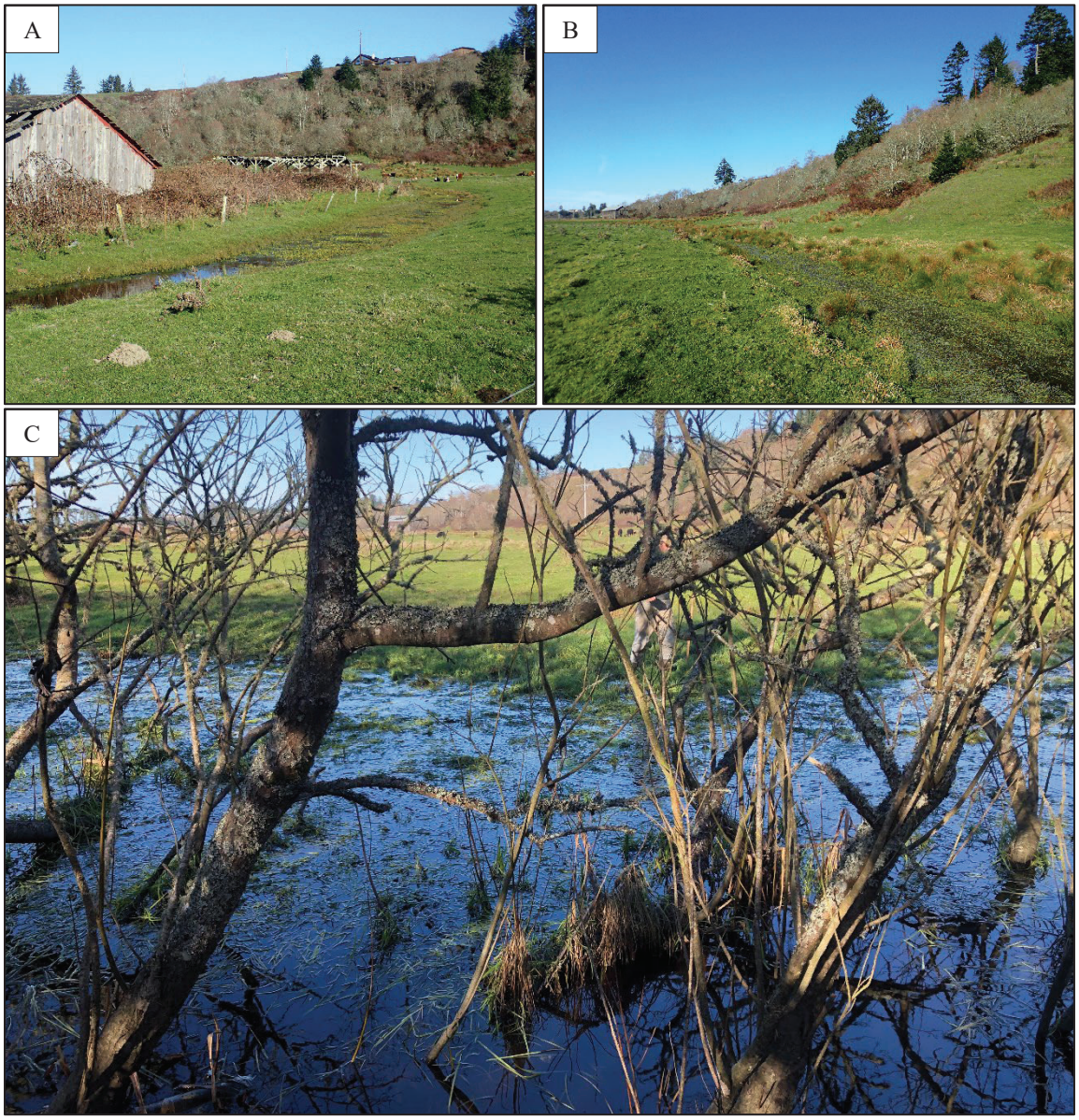


Figure C-13. Relic Swain Slough channel complex east of Elk River Road. T1 channel near Elk River Road(A) and along hillslope (B) and deep depression along riparian forest associated with T2.

Orton Creek

Orton Creek is a small perennial tributary draining an area of approximately 1.5 square kilometers (km^2) (0.6 square miles [mi^2]) (Figure C-1) east of Elk River Road. After crossing Elk River Road through a culvert that is a barrier to fish movement just east of PA 1, the stream flows west for approximately 900 ft before entering a culvert that routes it southwest for approximately 1,400 ft to Elk River near the end of Showers Road. Historical aerial photographs and terrain analyses indicate that the stream likely flowed into Swain Slough before being re-routed (Figure 2-3 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Although the contributing drainage area and stream channel are relatively small (approximately 3–4 ft wetted width in

January), Orton Creek delivers a significant amount of fresh water to PA 1. Notably, the stream was wetted and had detectable flow during a site visit in August 2021, following a historically dry winter. During the winter habitat assessment on January 14, 2022, following a relatively dry period (7 days without rain), stream flow measured near the culvert inlet was near 0.4 cfs. The portion of the channel in PA 1 that is above ground currently has a relatively small area of suitable salmonid rearing habitat due to its small size. The channel is narrow and has limited connectivity with the flood plain since it is generally entrenched by 3–6 ft relative to the adjacent pasture. The channel consists of alternating short riffles and pools with depths generally <1 ft during January. Bed substrate includes a mix of silt, sand, and small gravels. Water temperature in Orton Creek was 12.5°C on at 12:40pm on October 1, 2021, and 8°C at 12:14 pm on January 14, 2022. Despite limited existing physical habitat for fish, reconnecting freshwater flows from Orton Creek to a relic Swain Slough channel would have high value by lowering salinities and helping to maintain water quality in restored channels. Additionally, if the channel were restored, Orton Creek could provide some high-flow refugia for salmonids and provide quality spawning habitat for Coastal Cutthroat trout and potentially other salmonids.

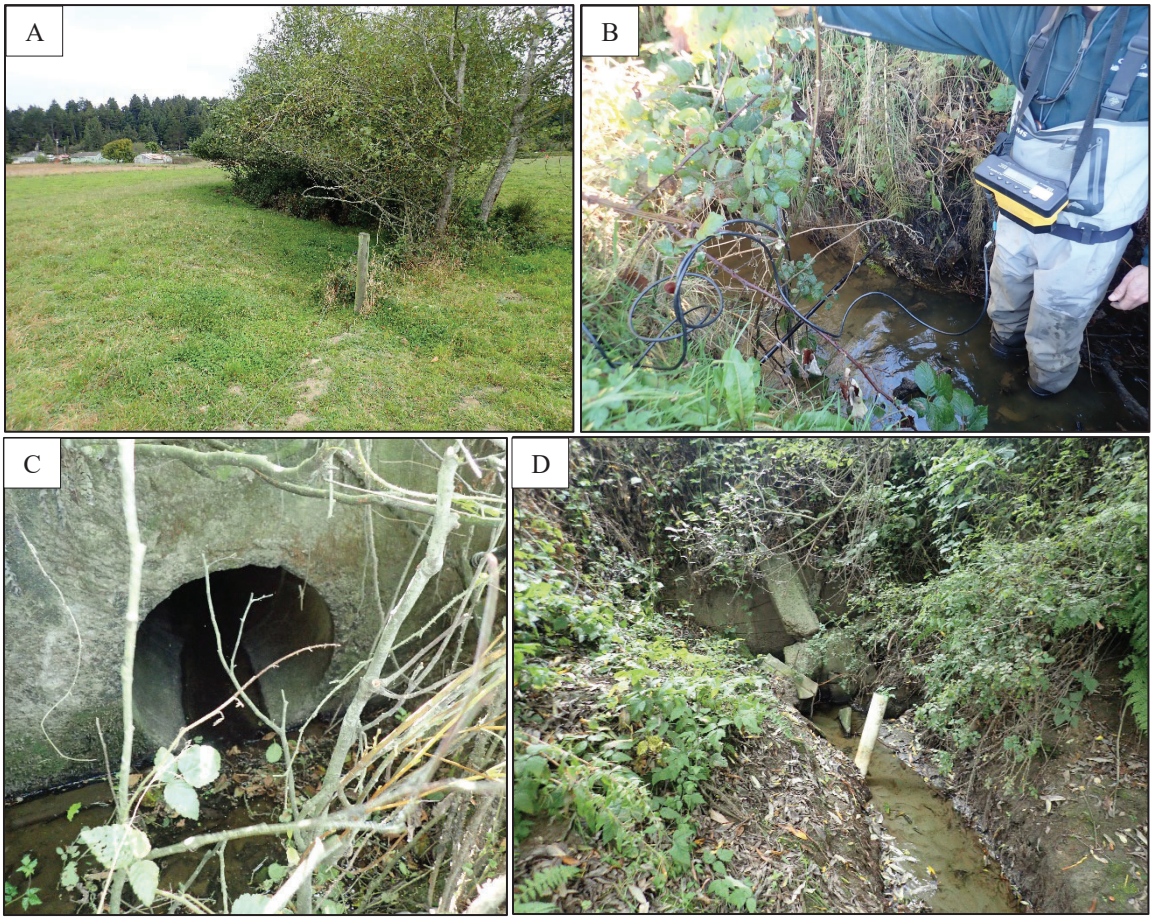


Figure C-14. Photos of Orton Creek and the culvert connecting it with Elk River. Riparian zone near culvert inlet (A), wetted channel during January 2022 flow measurement near culvert inlet (B) culvert inlet during August 2021 site visit (C) and culvert outlet and flow into Elk River during September 2021 habitat assessment.

Appendix D

Bat Habitat Assessment

BAT HABITAT ASSESSMENT

Methods

A bat habitat field assessment was conducted to provide existing information for permitting and design considerations. The bat habitat assessment was conducted on February 25, 2025, by Stillwater biologist Lauren Dusek, with support from Emmalien Craydon. The assessment included Areas 1–4 and involved visual inspection of existing structures and an assessment of mature tree stands that may be modified by the Project (Figure D-1).

A structure survey was conducted at structures that may be removed or possibly considered for modification to benefit bats. The building within Elk River Wildlife Area (ERWA) South that is managed by California Department of Fish and Wildlife was not surveyed (Figure D-1). The survey assessed if the structure had the potential for supporting roosting bats and documented any evidence of a previous roost (e.g., guano or urine staining). While all structures had the potential to support a night roost (used by an individual or smaller number of bats in the evening between feeding bouts), the focus of the survey was to identify the potential for the structure to support a maternity roost. Maternity roosts are locations where pregnant females gather in a warm, safe place to have their young. Structure modification has the potential to disturb maternity roosts and result in injury or mortality to adults and non-volant young (young unable to fly) if timed during the maternity season (May 1 through August 31).

A tree inventory was conducted at Area 4 to inspect the established *Hesperocyparis macrocarpa* (Monterey cypress) stand along Swain Slough in PA 1 to provide recommendations for tree retainment or removal based on each individual tree's potential to support wildlife and its potential impacts on adjacent planting areas (e.g., shade). The following was assessed for each individual:

- current tree condition (health and vigor, visible decomposition condition) and its potential to contribute to long-term structure;
- length of shade generated that could inhibit native plant establishment in adjacent recovery areas;
- trunk surface area with solar exposures ideal for bat use;
- cracks, crevices, and peeling bark to provide roosting habitat for bats;
- perching/nesting habitat for birds; and
- anticipated impacts based on the latest design plans for PA 1 (Figure 1-2).

The tree inventory was guided by a desktop solar assessment that determined the zone within PA 1 with the greatest morning sun in early June (Figure D-1). This parameter covers the period when bats are rearing their pups.

Survey results for Areas 1–4 are provided below.

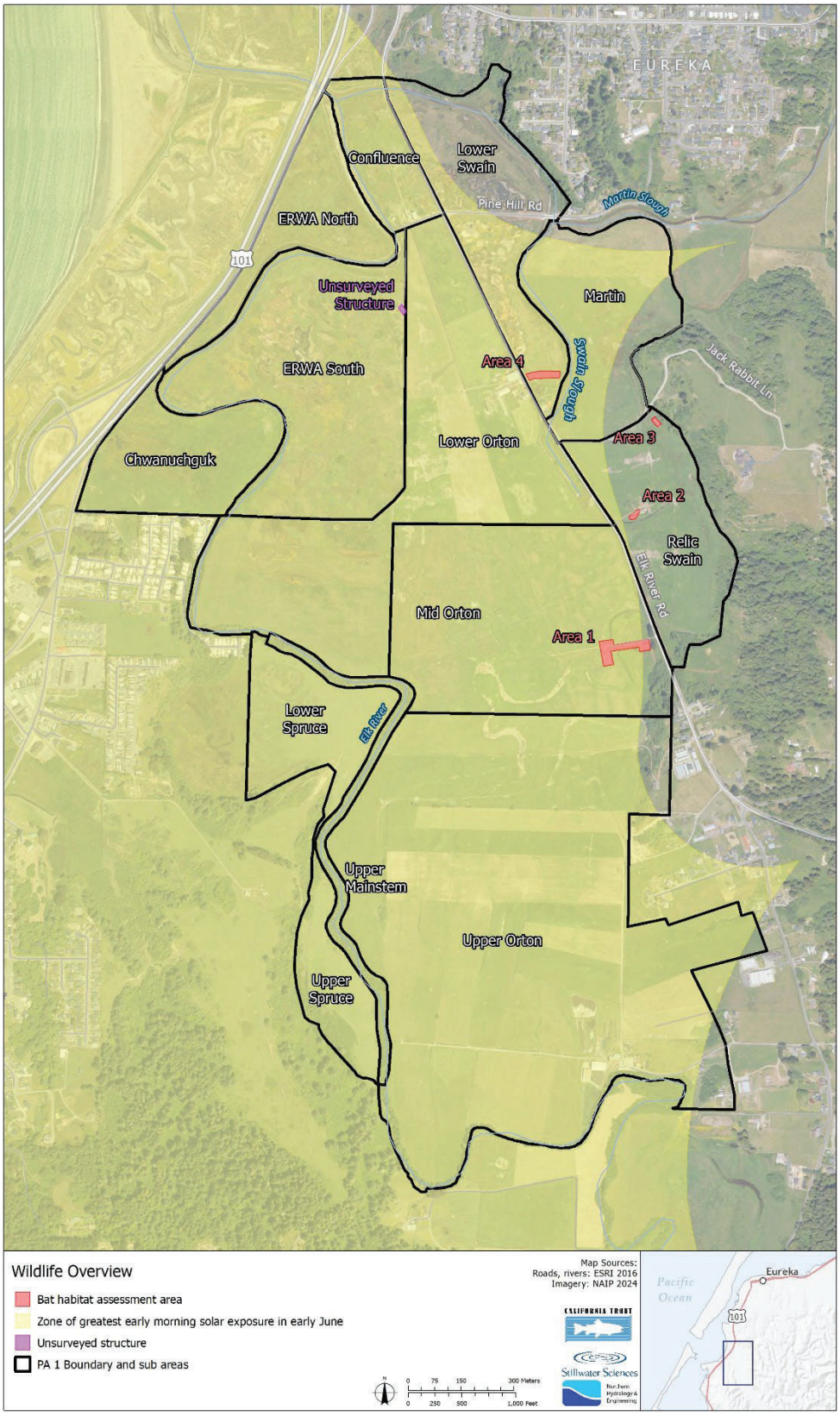


Figure D-1. Bat habitat assessment areas (Areas 1–4) and the zone of greatest early morning solar exposure in early June within Planning Area 1.

Area 1 (Mid Orton)

The bat habitat assessment within Area 1 included the review of six structures (Figure D-2).

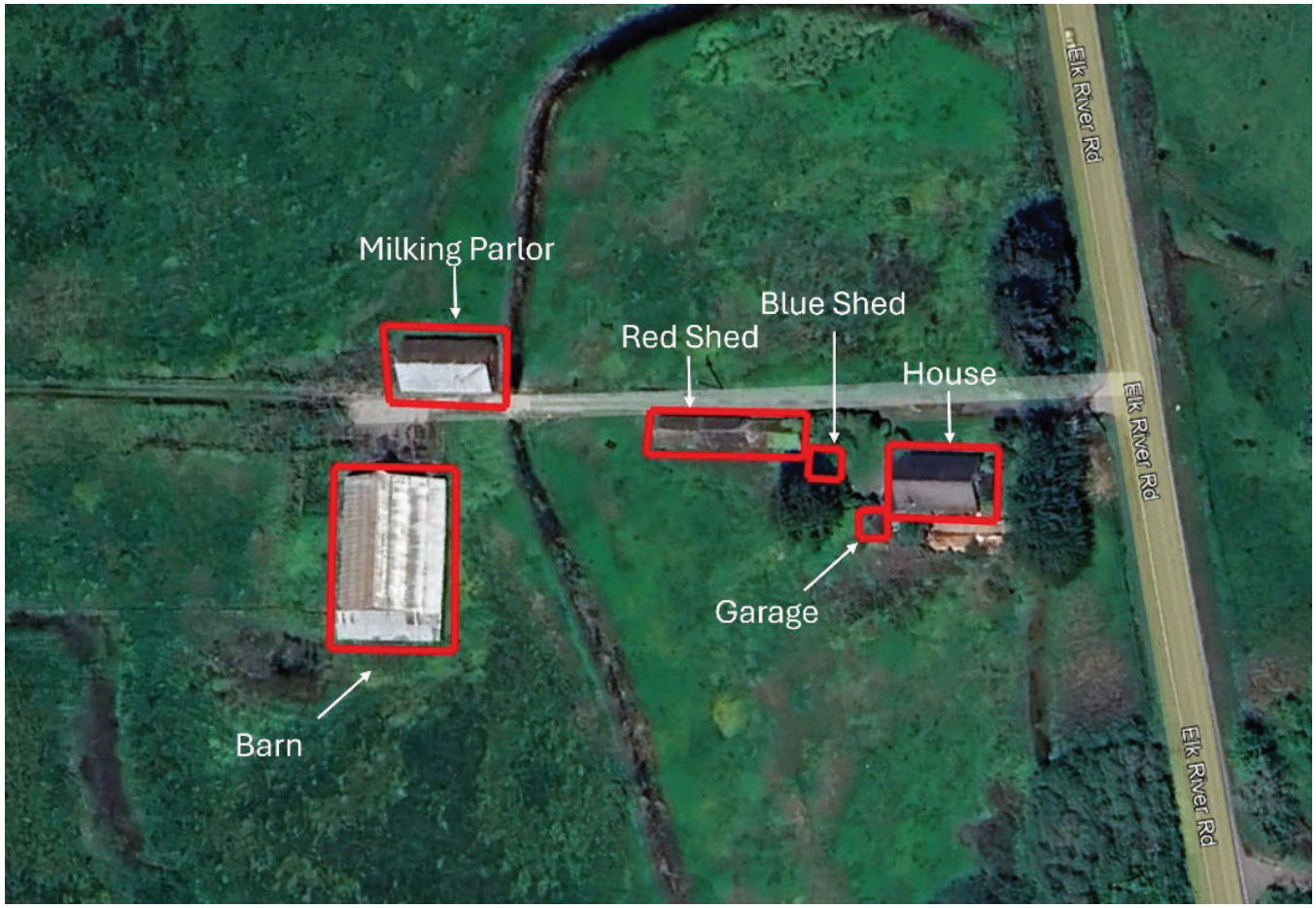


Figure D-2. Area 1 structures assessed for bat habitat.

Milking Parlor

Results:
The current Project design will remove the milking parlor. The structure consists of wood siding and a roof made of either corrugated metal or wood (the latter observed over the attic). It consists of one large room with a few smaller adjoining rooms; all with moderate deteriorated conditions (Figure D-3). The attic was not accessible during the survey.

There was no evidence of bats. About a dozen pre-existing barn swallow nests were observed. While the structure provides bat roosting habitat, there is a **low to moderate likelihood** for this structure (particularly the attic) to support a maternity roost due to the open nature of the building.

Figure D-3. Area 1 milking parlor; photos on the right show attic access locations.

Barn

Results:
The current design will retain the barn structure. The barn is comprised of wood siding and a corrugated metal roof (Figure D-4). The structure is a single open room. There was no evidence of bats, and limited maternity roosting opportunities. Several barn swallow nests from a prior season and one active rat nest were present. While the structure provides bat roosting habitat, there is a **low likelihood** for the barn to support a maternity roost due to the lack of crevices present.

Figure D-4. View of Area 1 barn's southernly exposed exterior (left) and view of the barn interior (right).

Red Shed

Results:
The current design will remove the red shed. The red shed is composed of wood siding and a wooden and composite shingle roof (Figure D-5). While the inside of the red shed was not thoroughly inspected due to safety concerns, portions of the highly degraded structure allowed significant airflow which reduces the suitability of the structure to support maternity roosting habitat. Roosting habitat may be present in the gap between the roof, as shown in Figure D-5. Overall, there is a **moderate likelihood** for this shed to support a maternity roost due to the gap along the roof.

Figure D-5. Area 1 red shed exterior view (top left), view of the interior (right), and potential bat roosting habitat at the roof (bottom left).

Blue Shed

Results:
The current design will remove the blue shed. The blue shed is comprised of wood siding and a composite shingle and wooden roof (Figure D-6). This structure was fully boarded (doors and windows) and the interior was not accessible to survey. While the structure appeared well sealed from the outside, there was one hole on the east side of the attic which may provide access to the attic. There was no evidence of bats. Several barn swallow nests from a prior season were documented on the underside of the overhanging eves. While the blue shed provides access to the roof for roosting habitat, there is a **low likelihood** for this structure to support a maternity roost as the structure was well sealed.

Figure D-6. Area 1 blue shed view from the east side (top left) with access hole to the attic (top right) and prior years barn swallow nests (bottom).

Garage

Results:
The current design will remove the garage. The garage is composed of wood siding and a wooden and composite shingle roof (Figure D-7). The interior and exterior of this structure were thoroughly inspected and there was no indication of bat use. Besides the garage door being open, the garage was well sealed on the outside. While the structure provides bat roosting habitat, there is a **low likelihood** for this structure to support a maternity roost due to the lack of crevices.

Figure D-7. Exterior view of the Area 1 garage structure.

House

Results:

The current design will remove the house. The house is composed of wood siding, a brick chimney, and a wooden and composite shingle roof (Figure D-8). The interior of the house was not accessible. The exterior of the structure looked well sealed except for a hole on the back side of the house, where bird droppings were observed. There was also a gap between the chimney and the side of the house; however, there was no indication of guano. The structure may support roosting habitat, particularly in the attic and gap between chimney and wall, as shown in Figure D-8. Overall, there is a **moderate likelihood** for this structure to support a maternity roost due to the presence of crevices and attic openings.

Figure D-8. Area 1 house view from the exterior with gap between the chimney and the house (top right) and access to the attic (bottom right).

Area 2 (Relic Swain)

The bat habitat assessment within Area 2 included the review of two structures—a barn and a shed. One additional structure was not evaluated as it was not included within PA 1 design enhancement areas (Figure D-1).

Barn

Results:
The current design will remove the barn. The barn is composed of wood siding and wooden roof shingles (Figure D-9). The structure is a single open room. While the inside of the barn was not thoroughly inspected due to safety concerns, portions of the structure (gaps along the degraded roof and siding) allowed airflow which reduces the suitability of the structure to support maternity roosting habitat. While the structure provides bat roosting habitat, there is a **low likelihood** for this barn to support a maternity roost due to the airflow.

Figure D-9. Area 2 barn view from the exterior (top) and interior (bottom left and right).

Shed

Results:
The current design will retain the shed. The shed is composed of cinder block and corrugated metal siding, corrugated metal roof, and a wooden door (Figure D-10). The structure formed a single room. While the interior of the shed was not thoroughly inspected due to safety concerns, the **structure does not provide suitable habitat for bats** as there were no suitable crevices.

Figure D-10. Area 2 shed view from the exterior.

Area 3 (Relic Swain)

The bat habitat assessment within Area 3 included review of a single barn structure (Figure D-1).

Barn

The current design will remove the barn. The barn is composed of wood and was partially collapsed (Figure D-11). While the inside of the barn was not thoroughly inspected due to safety concerns, portions of the highly degraded structure allowed significant airflow which reduces the suitability of the structure to support maternity roosting habitat. While the structure provides bat roosting habitat, there is a **low likelihood** for this structure to support a maternity roost due to the existing airflow.

Figure D-11. Area 3 barn and view from the exterior (left) and interior (right).

Area 4 (Lower Swain)

The bat habitat assessment within Area 4 included the review of the single maintained barn structure and an established stand of Monterey cypress.

Barn

The current design will retain the barn. The barn is composed of wood siding and a corrugated metal roof that overlays a wooden roof (Figure D-12). The interior of the barn was not accessible. From the exterior, the structure appeared well sealed with one hole on the easterly facing second-story. There was no evidence of bats. The structure provides bat roosting habitat, particularly in gaps present along the wooden roof but there is a **low likelihood** for this structure to support a maternity roost

While this structure is in an ideal location to enhance bat roosting habitat as it is located within the zone of greatest morning sun between late May and early June, when bats are rearing their pups (Figure 1), the preferred second story easterly wall does not provide sufficient height (about 9 feet) above a roofline for bats to drop and take flight from a roost.

Figure D-12. Area 1 barn view from the outside and access hole (right)

Monterey Cypress Stand

The Monterey cypress stand near Swain Slough consists of 20 trees and is within the zone of greatest morning sun between late May and early June, when bats are rearing their pups (Figure D-1). Thus, this location is an ideal area to incorporate bat habitat enhancements in intact trees to support roosting bats. Some of these trees have peeling bark, which is suitable for roosting bats. The trees support nesting habitat for birds and the broken tops and vertical limbs provide perch sites while foraging in adjacent grasslands and agricultural fields (Figure D-13). Although these features represent ideal habitat conditions for wildlife, they also represent a decline in tree health. An arborist may be able to assess disease susceptibility and existing lifespan of living trees planned for habitat enhancements.

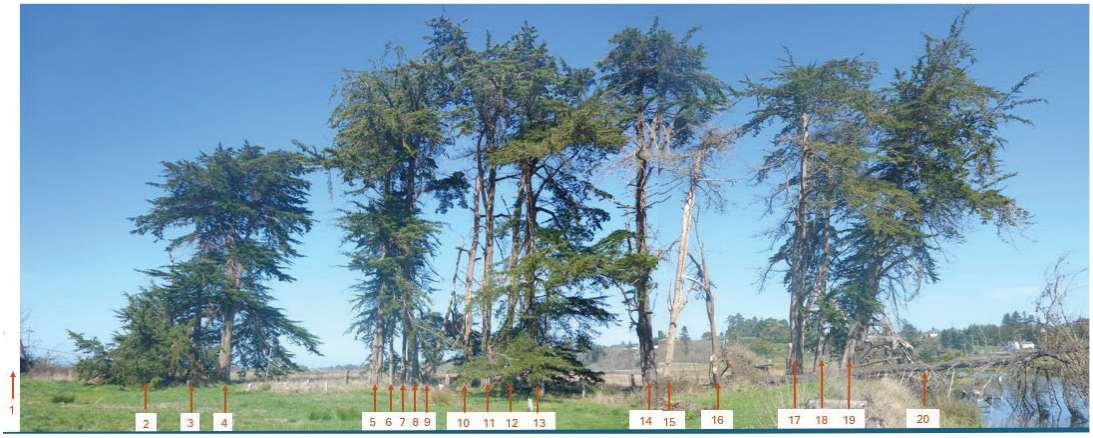


Figure D-13. Area 4 Monterey cypress stand (Trees 1–20).

Results of the tree inventory assessment:

- Tree 1 (down snag, adjacent to barn): Low habitat suitability for nesting birds/roosting bats as existing crevices are shallow and peeled bark is on the underside and would collect water forming undesirable conditions for bats.
- Tree 2 (snag): Moderate habitat suitability for perching birds on a horizontal limb.
- Tree 3 (decadent tree with broken top): Low habitat suitability as this tree has active decay and insect damage and is leaning towards the south-east side of the property, creating shade.
- Tree 4 (living): Moderate habitat suitability and potential for enhancement by adding bat crevices and removing lower branches.
- Tree 5 (living): Moderate habitat suitability and potential for enhancement by removing lower limbs.
- Tree 6 (snag): Low habitat suitability; adjacent trees provide similar habitat.
- Tree 7 (snag): Moderate habitat suitability.
- Tree 8 (live): Moderate habitat suitability and potential for enhancement by removing lower limbs to reduce shade onto adjacent planting area.
- Tree 9 (snag): Low habitat suitability as it is younger and lower limbs currently shade adjacent planting area.
- Tree 10 (snag): Moderate habitat suitability with crown top and horizontal limbs for perching.

- Trees 11 and 12 (living): Moderate habitat suitability and potential for enhancement by adding bat crevices.
- Tree 13 (decadent tree): Low habitat suitability due to active decay and broken lower limbs, which are shading adjacent planting area.
- Tree 14 (decadent tree): Low habitat suitability with a potential for enhancement by adding bat crevices.
- Tree 15 (snag): Moderate habitat suitability due to peeling bark on easterly-side, which may provide natural bat roosting habitat.
- Tree 16 (snag): Moderate habitat suitability for perching birds on limbs.
- Trees 17 through 19 (living): Moderate habitat suitability for bird nesting.
- 20 (down snag): Low habitat suitability.

Attachment 4

65% Design (Attached Separately)