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



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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

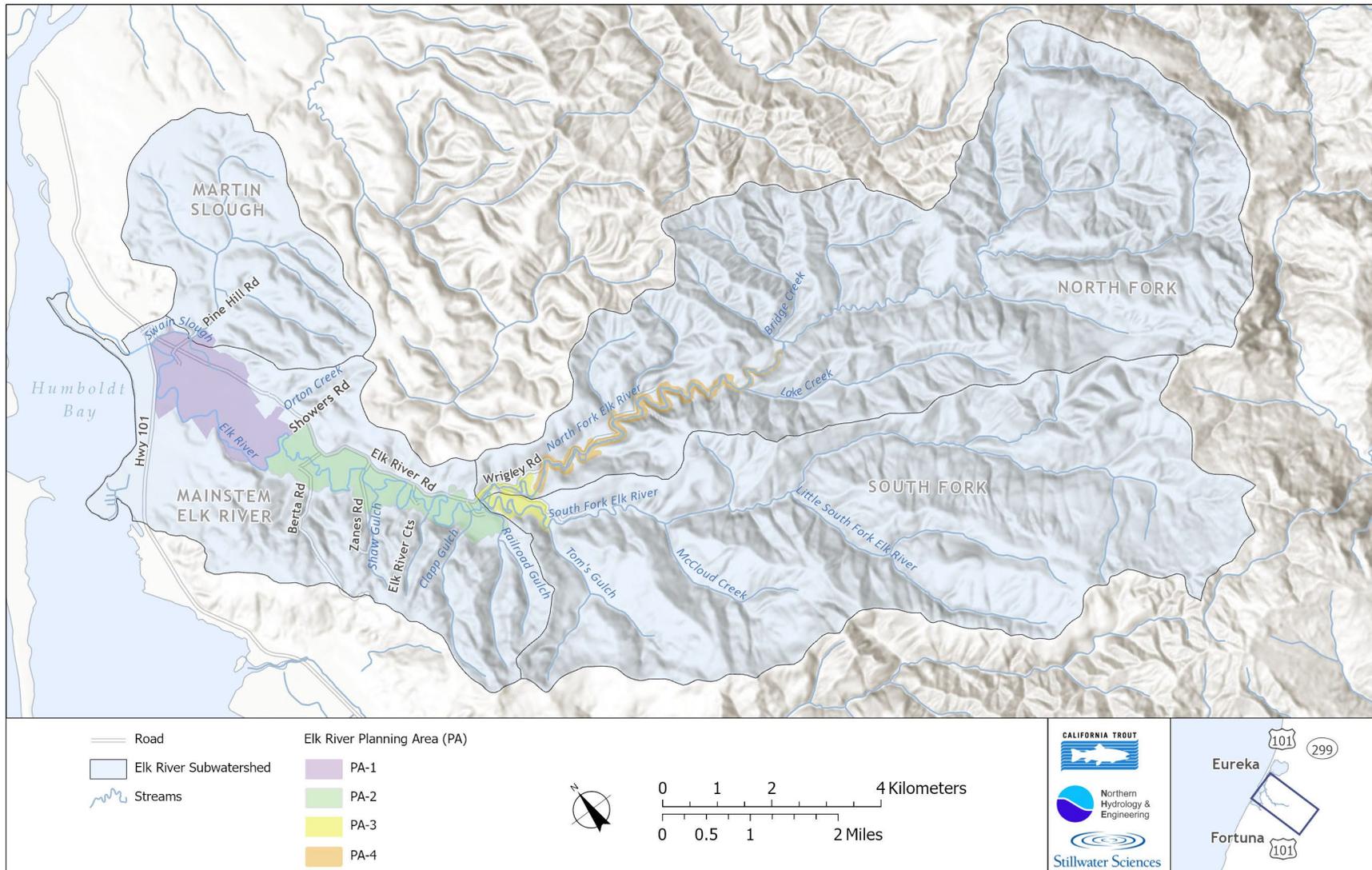


Figure 1-1. Vicinity map of Elk River PA1.

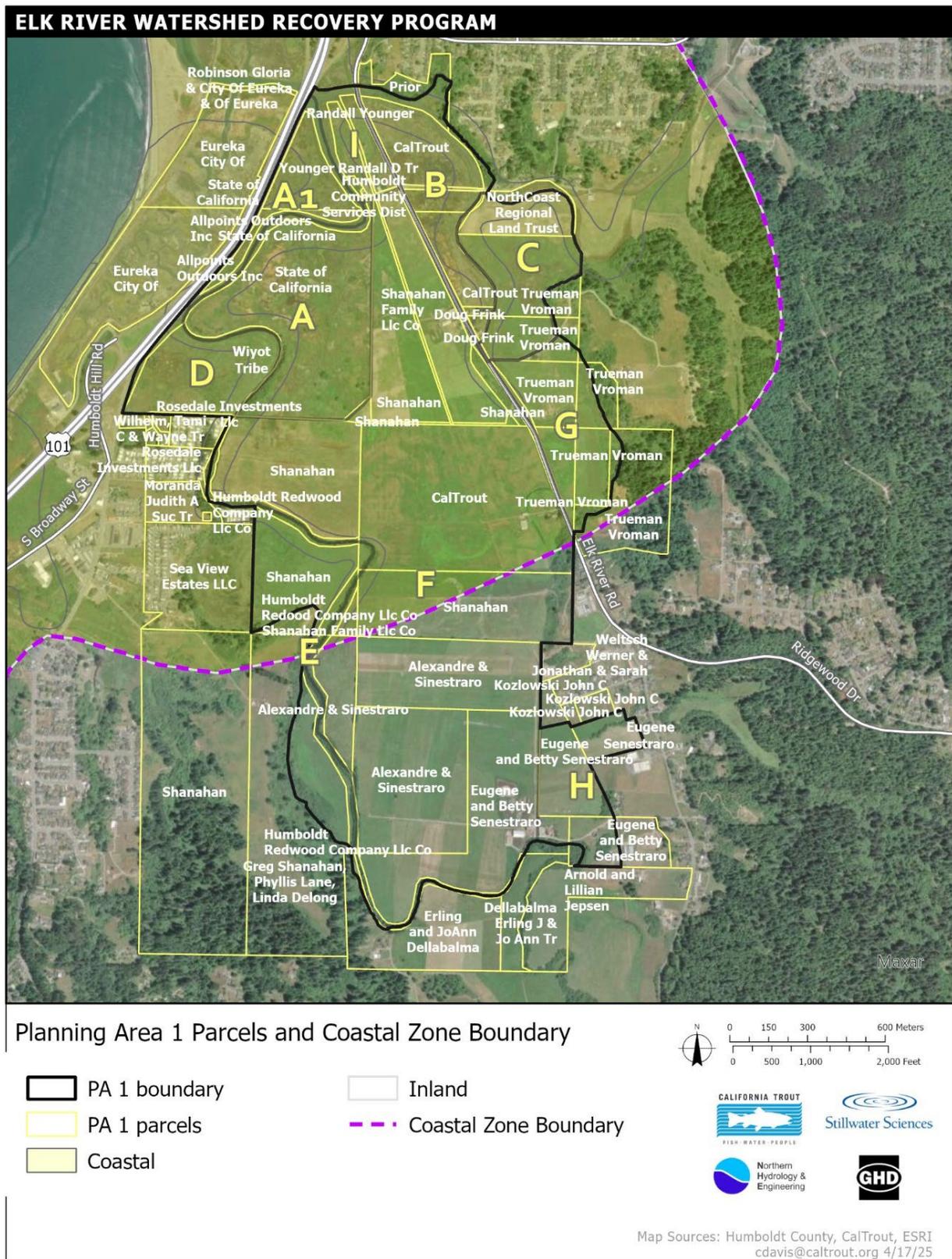


Figure 1-2. PA1 coastal zone boundary and land ownership

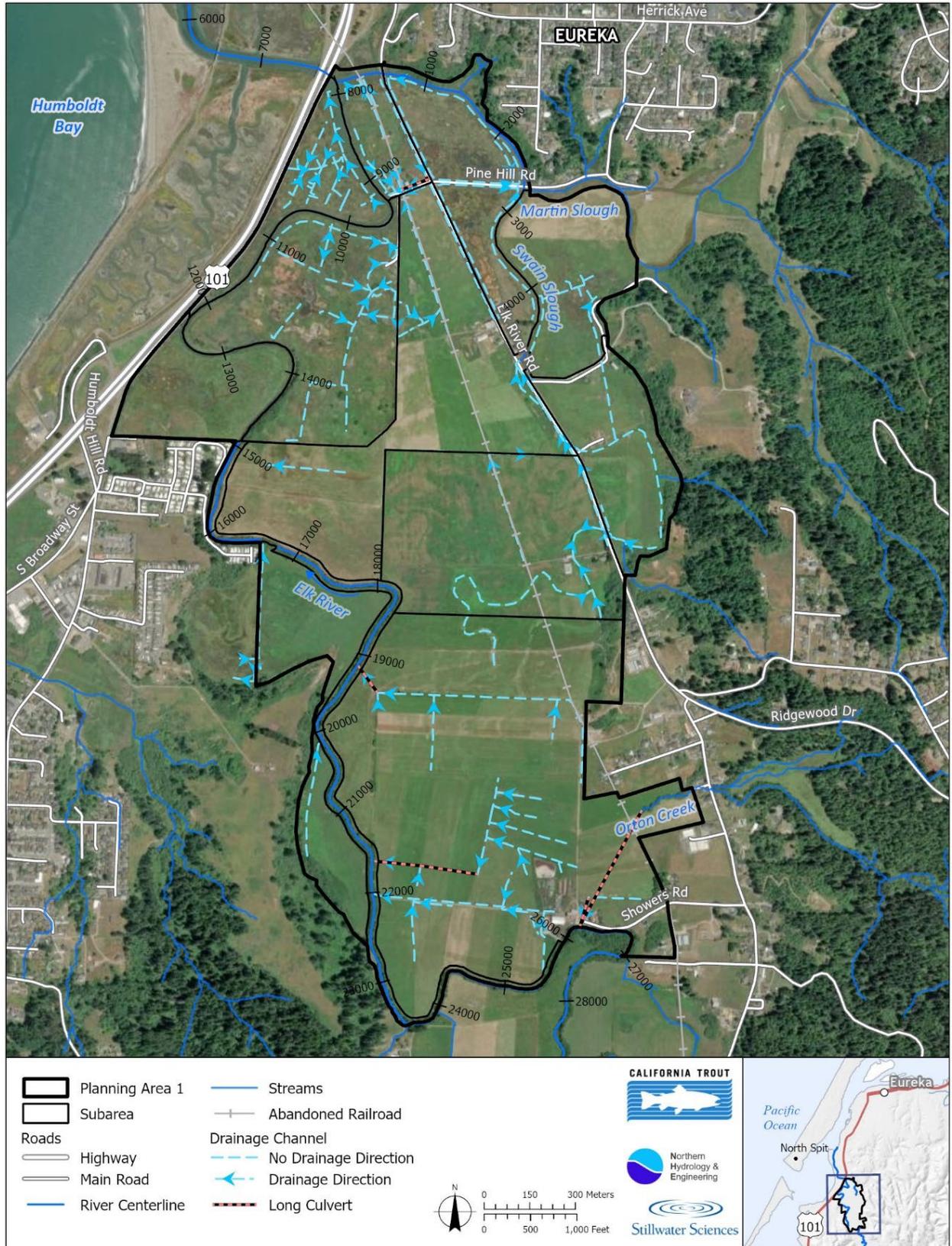


Figure 1-3. Map of Elk River PA1 showing existing drainage. River stationing represents the distance (ft) upstream from the Humboldt Bay confluence.

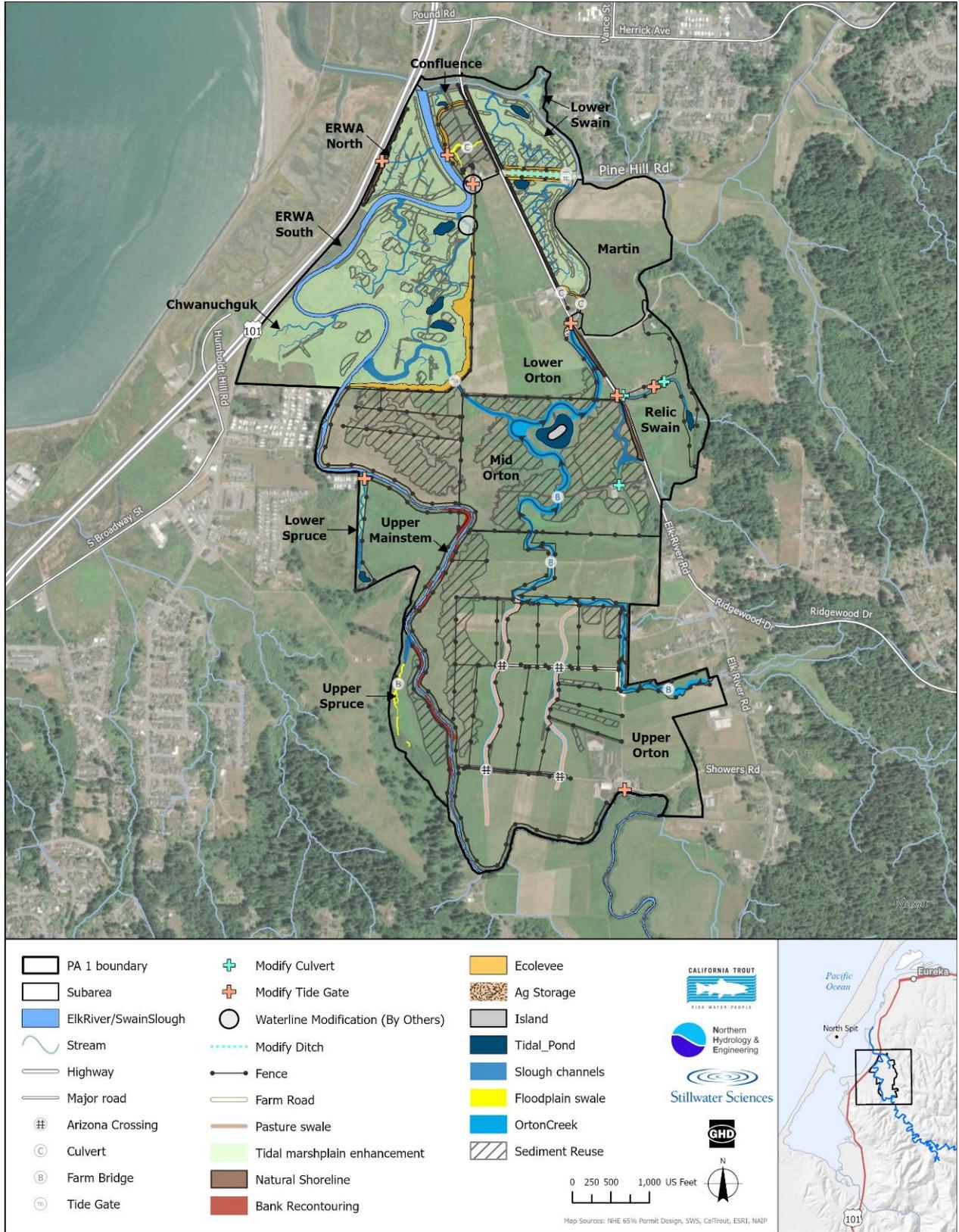


Figure 1-4. Overview of enhancement actions

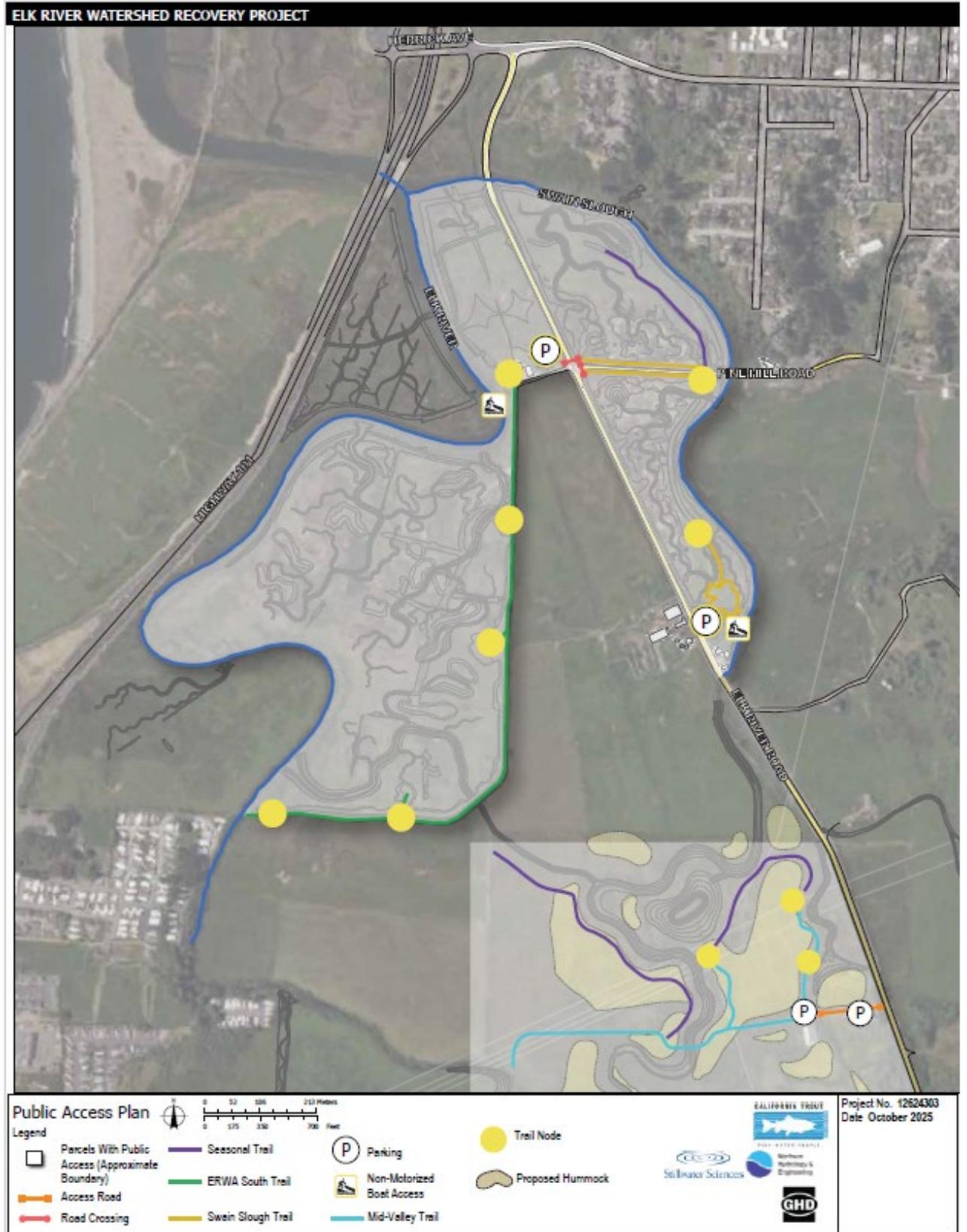


Figure 1-5. Public access overview.

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.

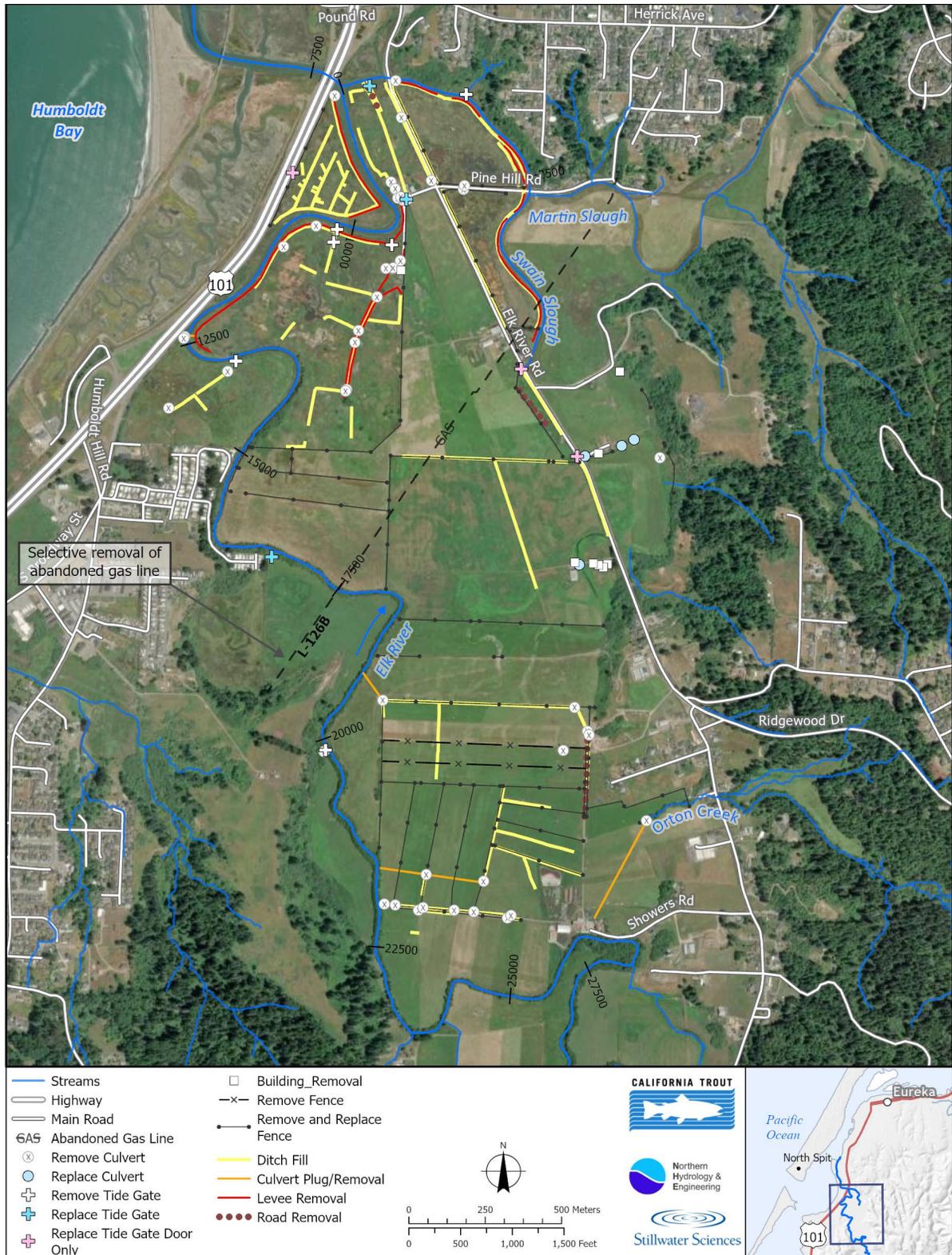


Figure 2-1. Infrastructure to be removed. These actions focus on routing overbank flow down valley, removing cross-valley drainage, retrofitting tide gates with fish friendly flap gates, and removing tide gates and levees at tidal march enhancement.

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.

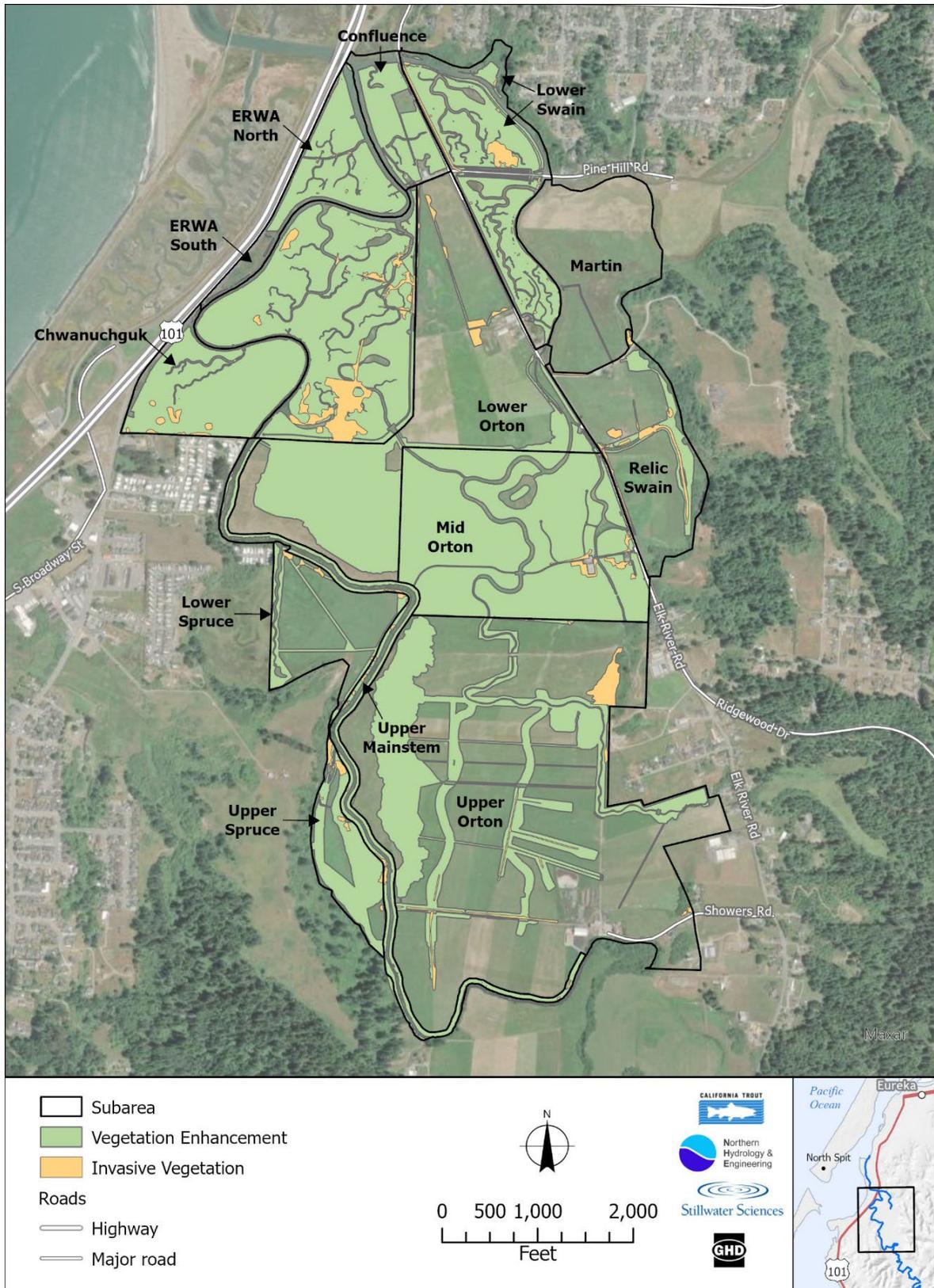


Figure 2-2. Vegetation enhancement actions in PA1, revegetation and invasive plant management areas.

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
<i>Cirsium arvense</i>	Canada thistle	Moderate	Yes
<i>Cirsium vulgare</i>	bull thistle	Moderate	Yes
<i>Conium maculatum</i>	poison hemlock	Moderate	Yes
<i>Cortaderia jubata</i>	purple pampas grass	High	Yes
<i>Cotoneaster</i> spp.	cotoneaster	Moderate	Yes
<i>Cytisus scoparius</i>	Scotch broom	High	Yes
<i>Dipsacus fullonum</i>	wild teasel	Moderate	Yes
<i>Erica lusitanica</i>	heather	Limited	Yes
<i>Foeniculum vulgare</i>	fennel	Moderate	Yes
<i>Genista monspessulana</i>	French broom	High	Yes
<i>Glyceria declinata</i>	low manna grass	Moderate	No
<i>Hedera helix</i>	English ivy	High	Yes
<i>Ilex aquifolium</i>	English holly	Limited	Yes
<i>Phalaris arundinacea</i>	reed canary grass	None³	Yes³
<i>Rubus armeniacus</i>	Himalayan blackberry	High	Yes
<i>Spartina densiflora</i>	dense-flowered cordgrass	High	Yes
<i>Vinca major</i>	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.

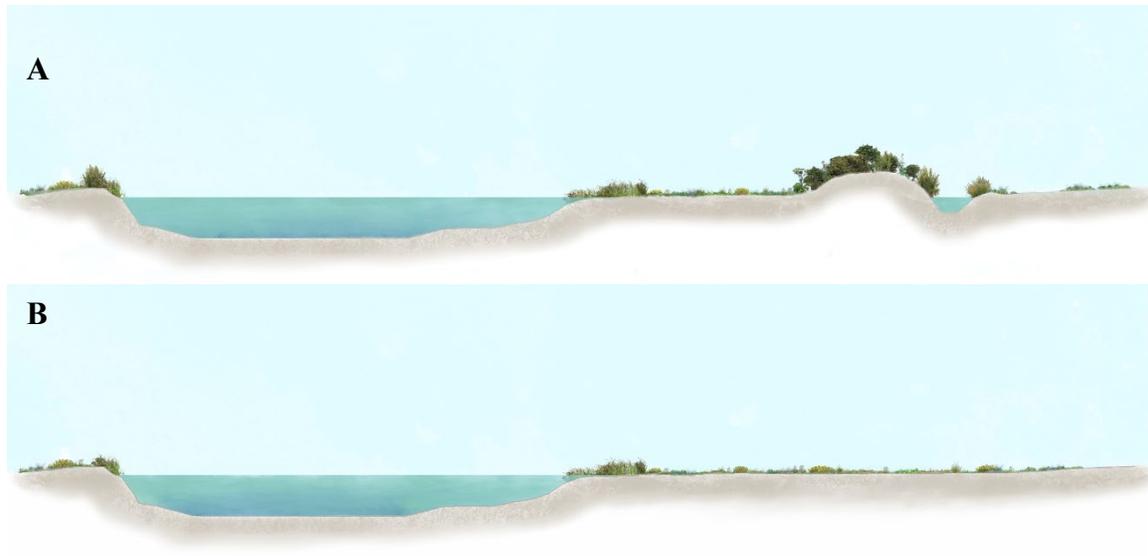


Figure 2-3. Elk River salt and brackish marshes. Existing conditions – with a narrow strip of marsh plain disconnected from larger tidal wetlands by existing levees (A). Proposed conditions resulting from removing and modifying levees to reconnect Elk River to extensive salt and brackish marsh plains 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.

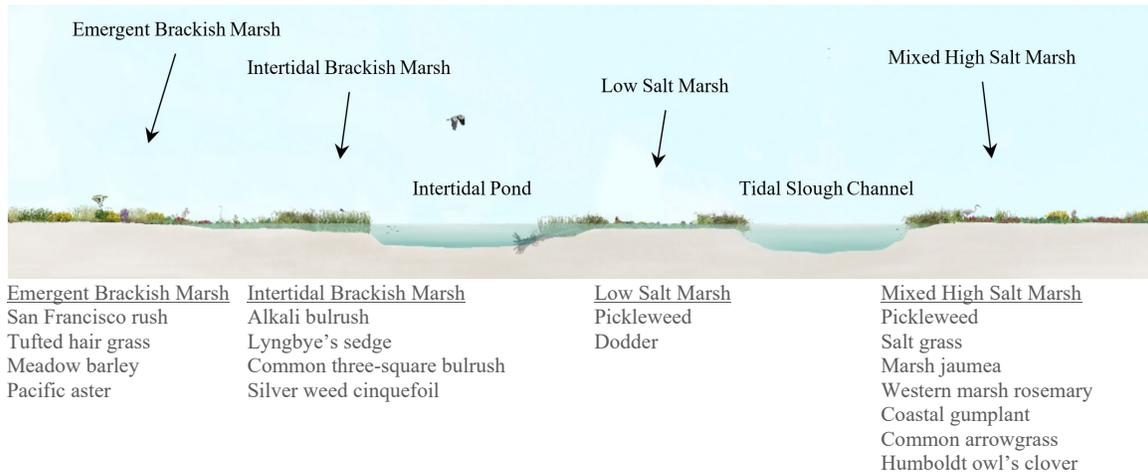


Figure 2-4. Conceptual cross section showing salt marsh enhancement including an enlarged slough channel network, intertidal pools, brackish vegetation along channel edges, and mixed high marsh. Water elevation shown is approximately MHHW. Example is from ERWA-Slough in PA1.



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.

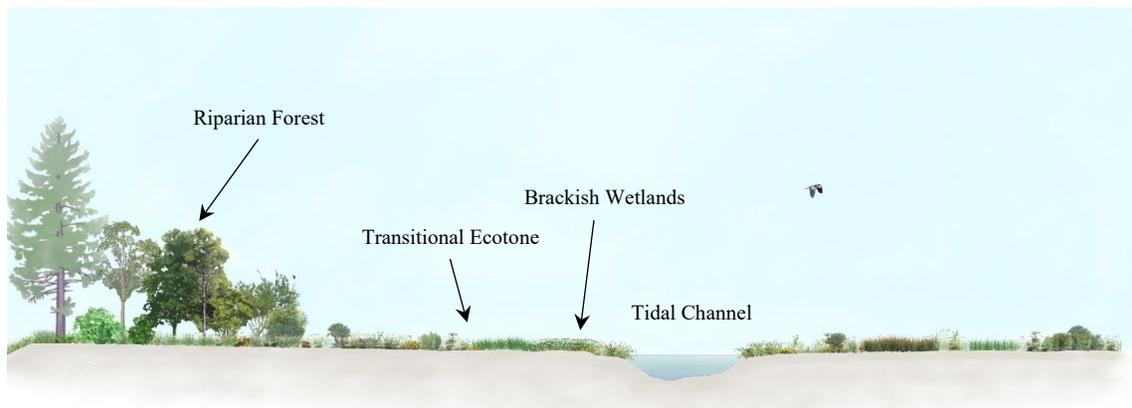


Figure 2-7. Conceptual cross section showing brackish wetlands enhancement including off-channel habitat with tidal channels fringed with brackish marsh vegetation. Brackish wetlands transition through a wetland-to-riparian ecotone, grading to riparian forest and uplands.

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 breach. 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.

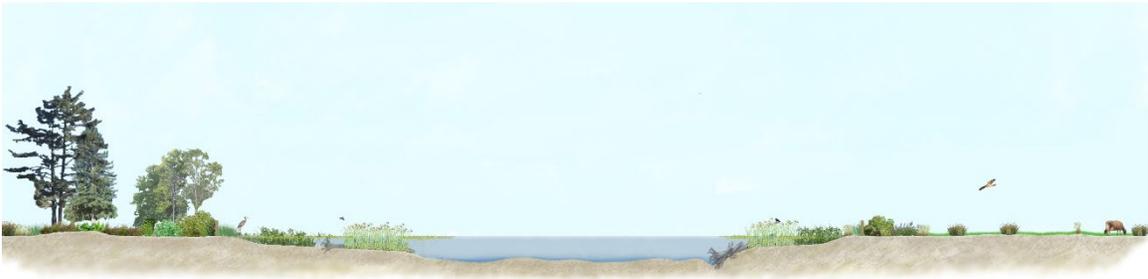


Figure 2-10. Conceptual illustration of perennial wetland off-channel from the Elk River.

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 (MSR1², 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.

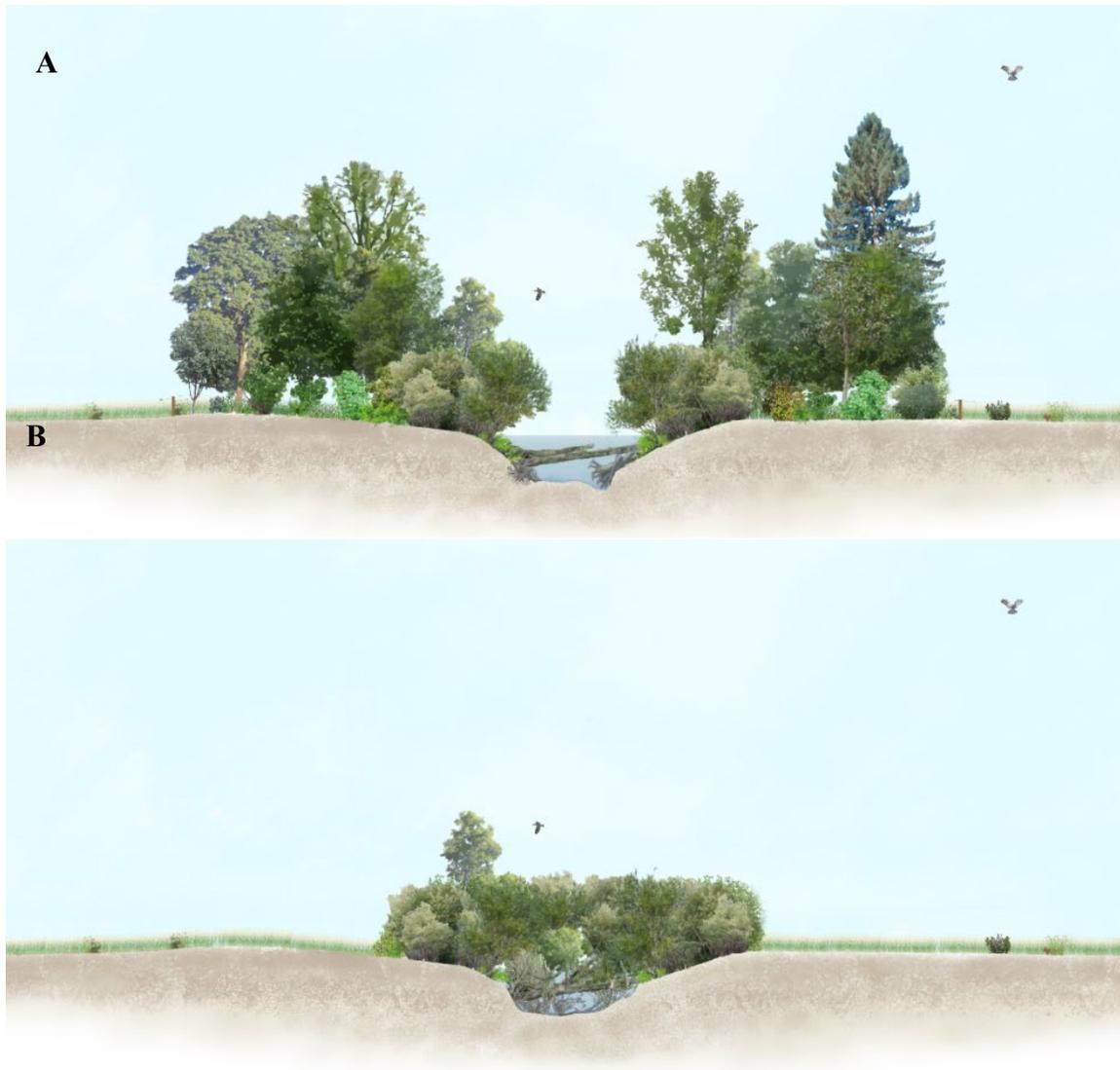


Figure 2-11. Current conditions along sections of Elk River that are dominated by fine stem clonal willow growth that cover the banks (A). Proposed conditions along the Elk River (ER-10 and ER-12) include thinning treatments, interplanting, and expanded width to enhance the riparian corridor in mainstem 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 2-13). 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.

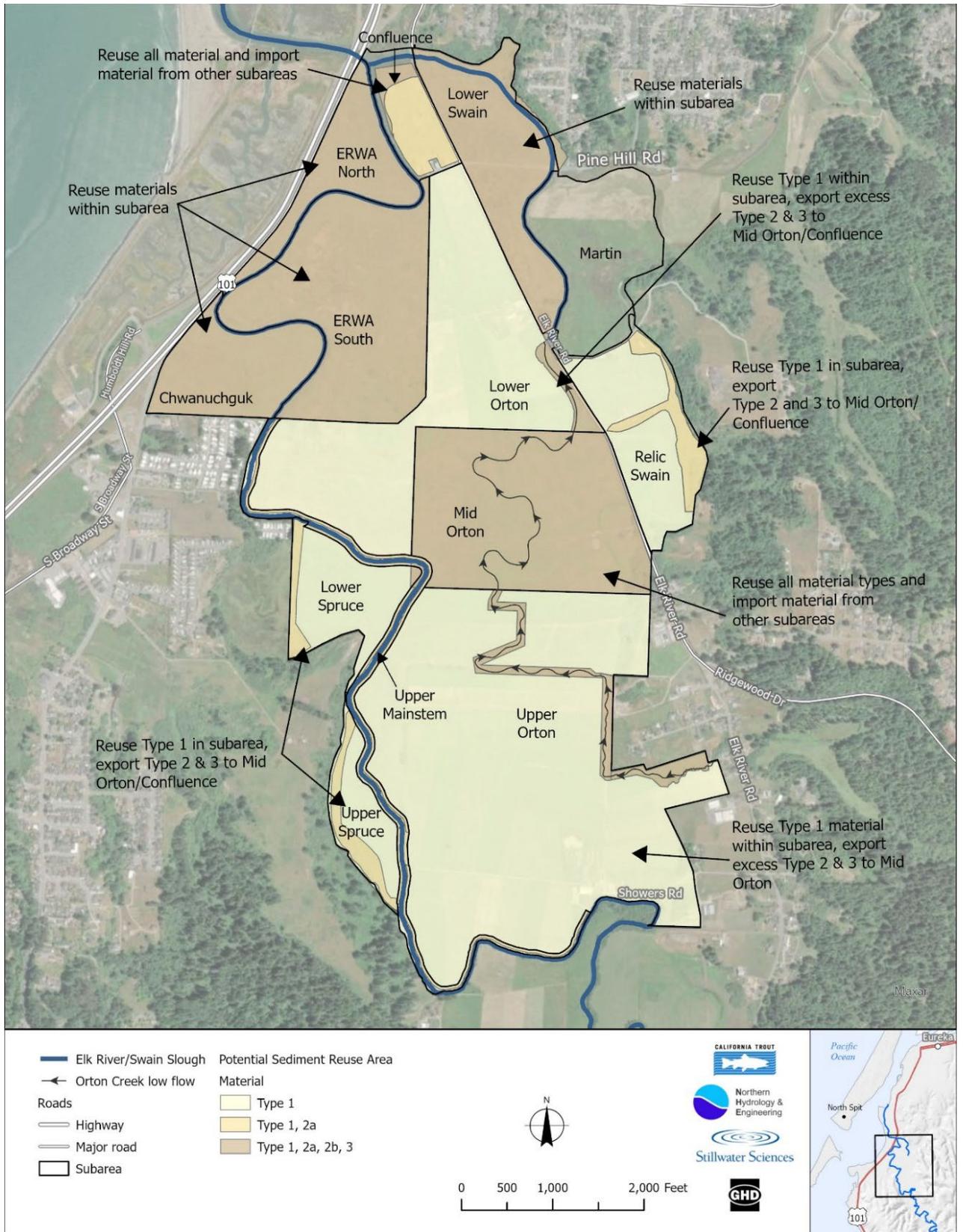


Figure 2-16. Potential sediment reuse areas categorized by material type.

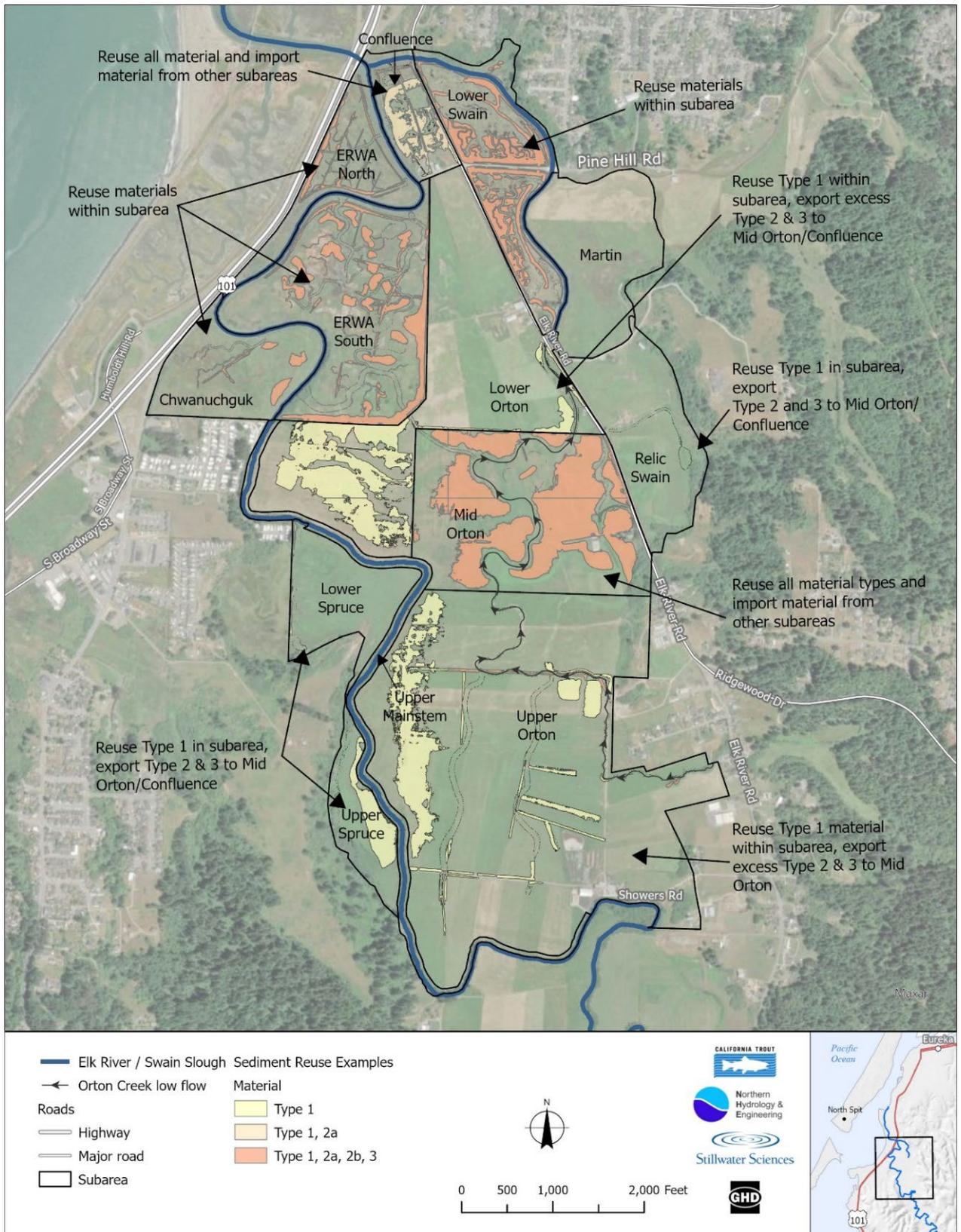


Figure 2-17. Sediment reuse (65% designs).

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.

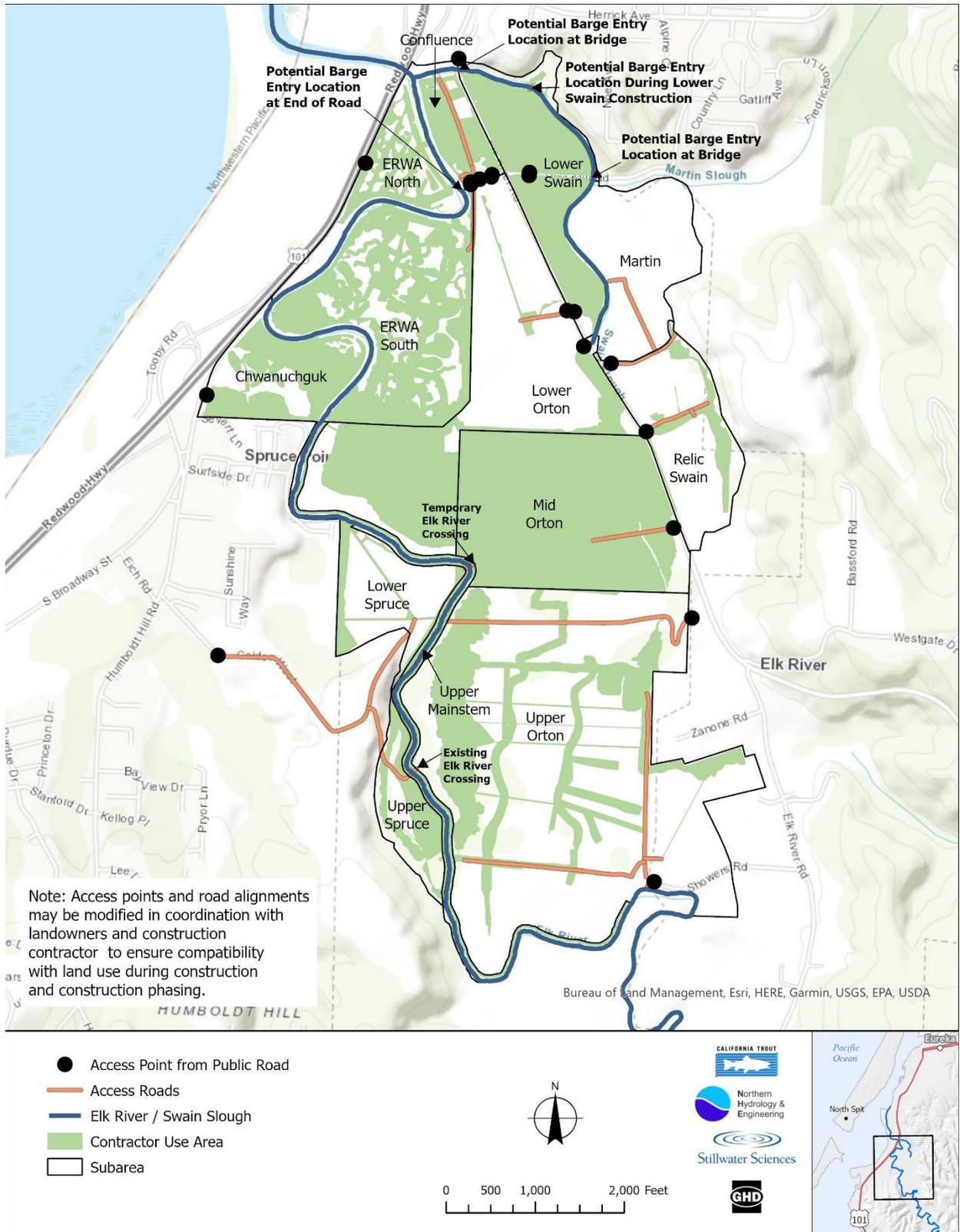


Figure 3-1. Construction-phase access.

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)	<ul style="list-style-type: none"> • Clean Water Act (CWA) Section 404 • Rivers and Harbors Act Section 10 	<ul style="list-style-type: none"> • Individual or Nationwide Permit, TBD • Section 10 Compliance
US Fish and Wildlife Service (USFWS)	<ul style="list-style-type: none"> • Federal Endangered Species Act (FESA) 	<ul style="list-style-type: none"> • Statewide Restoration Programmatic Biological Opinion issues in conjunction with USACE Section 404 compliance
National Marine Fisheries Service (NMFS)	<ul style="list-style-type: none"> • FESA 	<ul style="list-style-type: none"> • Individual Consultation, Biological Opinion issued in conjunction with USACE Section 404 compliance
California Coastal Commission (CCC)	<ul style="list-style-type: none"> • Coastal Act 	<ul style="list-style-type: none"> • Consolidated Coastal Development Permit
North Coast Regional Water Quality Control Board (RWB)	<ul style="list-style-type: none"> • CWA Section 401 	<ul style="list-style-type: none"> • 401 Water Quality Certification issued through the Statewide Restoration General Order
California Department of Fish and Wildlife (CDFW)	<ul style="list-style-type: none"> • Fish and Game Code (F&G Code) Section 1600 • California Endangered Species Act (CESA) (F&G Code Section 2081[b]) 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • National Historic Preservation Act (NHPA) Section 106 	<ul style="list-style-type: none"> • Consultation in conjunction with USACE Section 404 compliance.
Humboldt Bay Harbor Recreation and Conservation District	<ul style="list-style-type: none"> • State Lands Commission deferred jurisdiction over tidelands and submerged lands of Humboldt Bay 	<ul style="list-style-type: none"> • Shoreline Development Permit
Humboldt County	<ul style="list-style-type: none"> • County Code 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Federal Code of Regulations Title 44 Emergency Management and Assistance 	<ul style="list-style-type: none"> • 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

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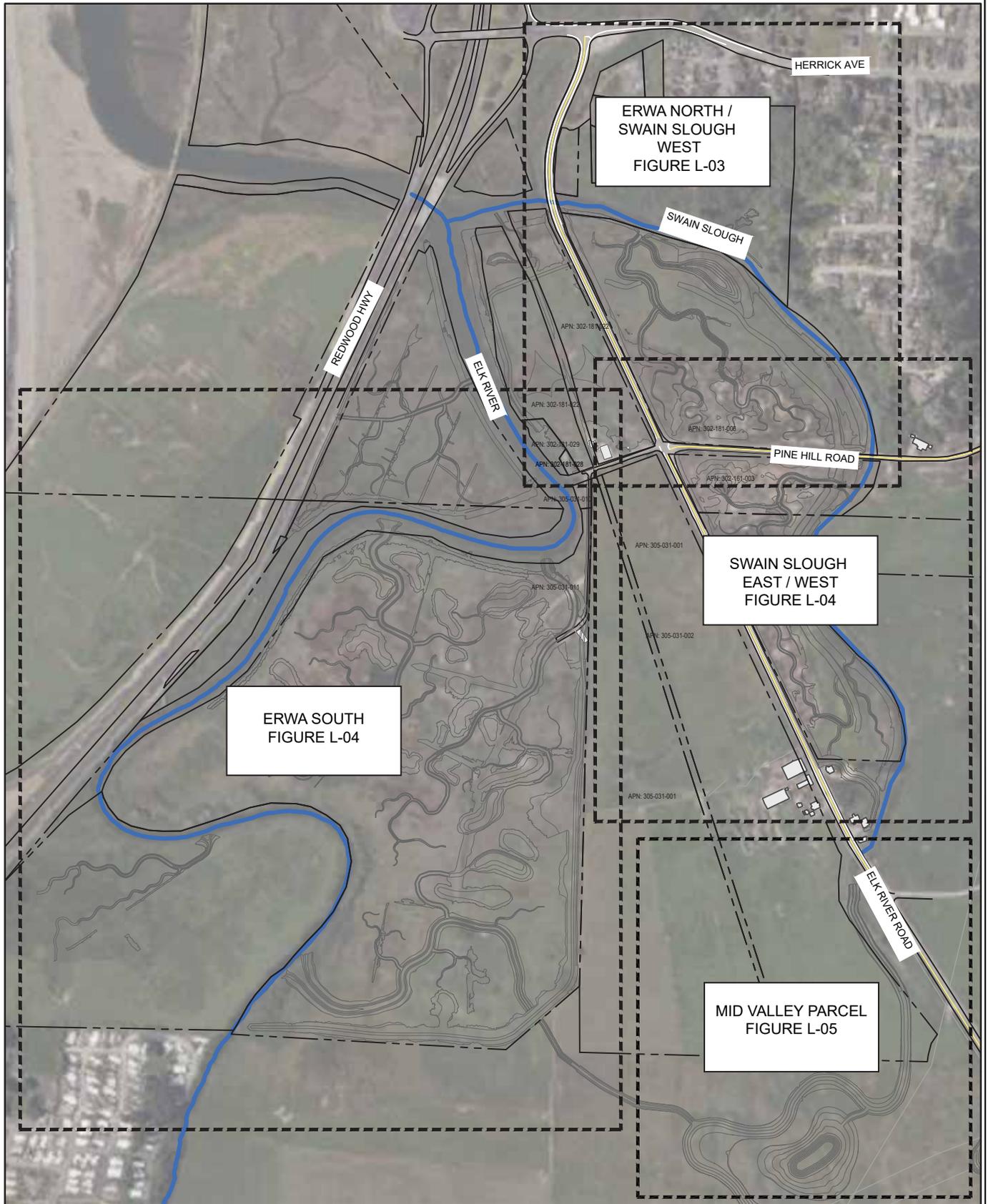
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Attachment 1

Public Access Design Overview



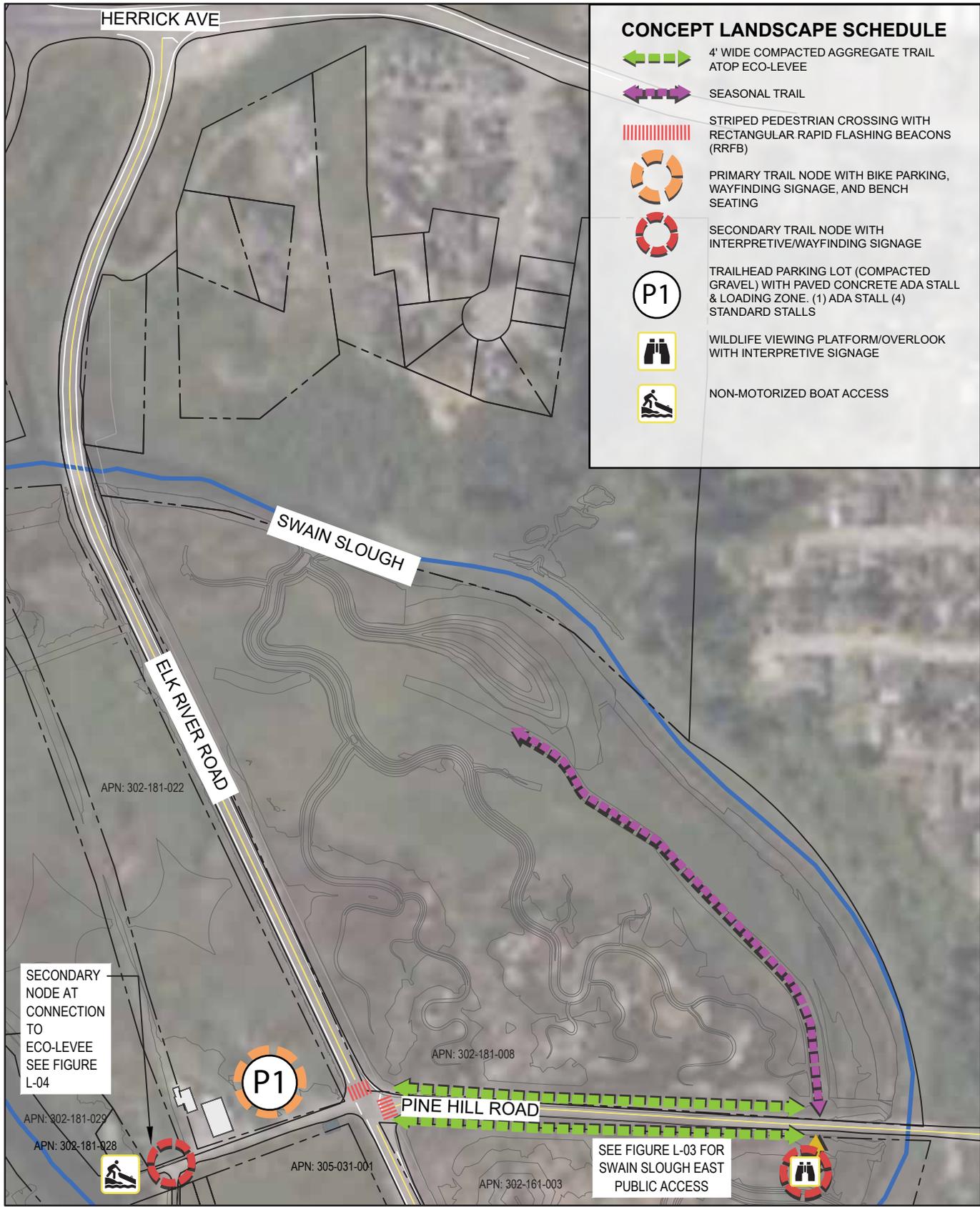
CONCEPTUAL - NOT FOR CONSTRUCTION



CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND
HABITAT REHABILITATION PROJECT
EXISTING CONDITIONS AND KEY MAP

Project No. 12624303
Date July 8

FIGURE L-01



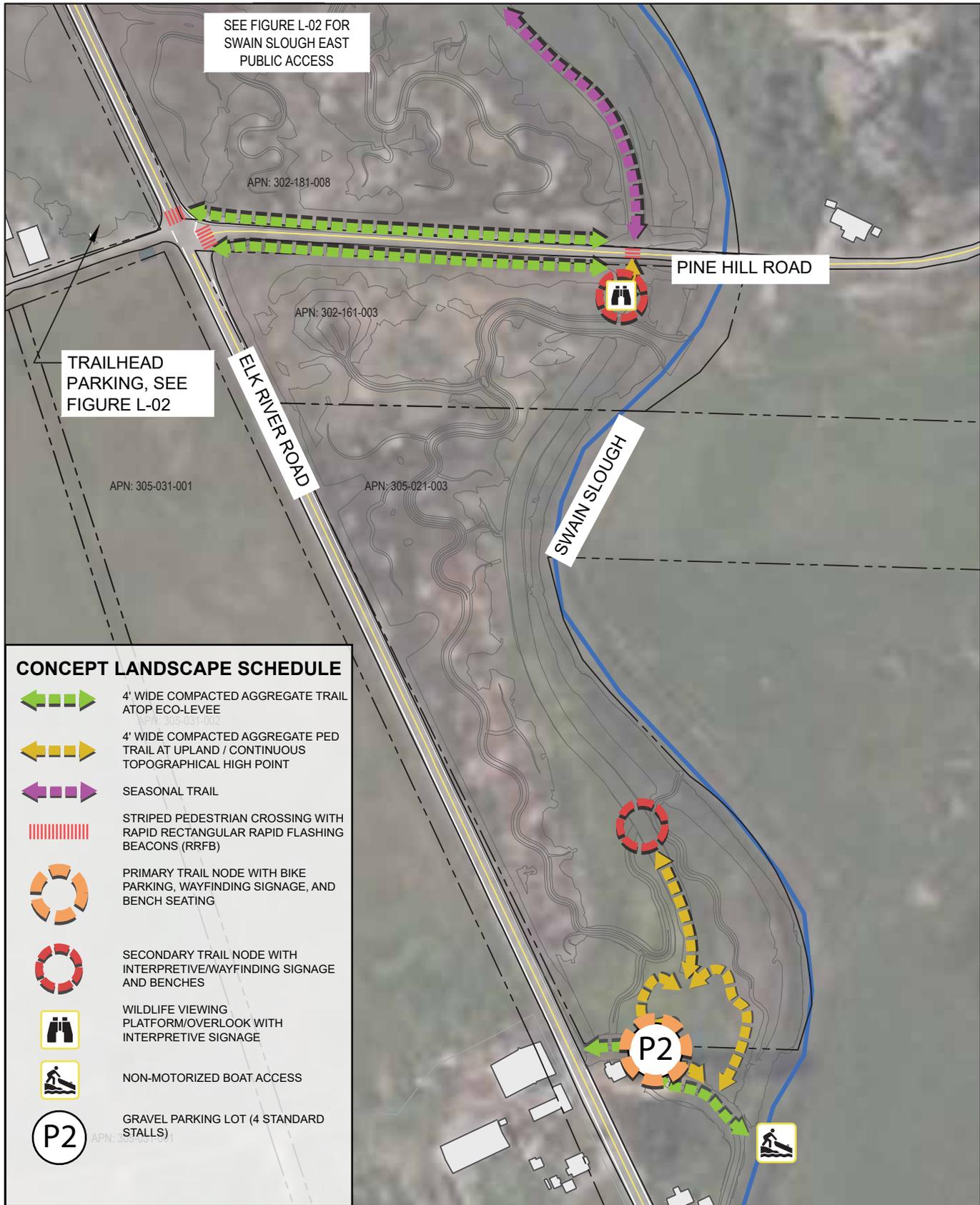
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CALTROUT
 ELK RIVER SEDIMENT REMEDIATION AND
 HABITAT REHABILITATION PROJECT
 ERWA NORTH/ SWAIN SLOUGH WEST -
 PUBLIC ACCESS EXHIBIT

Project No. 12624303
 Date October 2

FIGURE L-02



CONCEPT LANDSCAPE SCHEDULE

-  4' WIDE COMPACTED AGGREGATE TRAIL ATOP ECO-LEVEE
-  4' WIDE COMPACTED AGGREGATE PED TRAIL AT UPLAND / CONTINUOUS TOPOGRAPHICAL HIGH POINT
-  SEASONAL TRAIL
-  STRIPED PEDESTRIAN CROSSING WITH RAPID RECTANGULAR RAPID FLASHING BEACONS (RRFB)
-  PRIMARY TRAIL NODE WITH BIKE PARKING, WAYFINDING SIGNAGE, AND BENCH SEATING
-  SECONDARY TRAIL NODE WITH INTERPRETIVE/WAYFINDING SIGNAGE AND BENCHES
-  WILDLIFE VIEWING PLATFORM/OVERLOOK WITH INTERPRETIVE SIGNAGE
-  NON-MOTORIZED BOAT ACCESS
-  GRAVEL PARKING LOT (4 STANDARD STALLS)

CONCEPTUAL - NOT FOR CONSTRUCTION



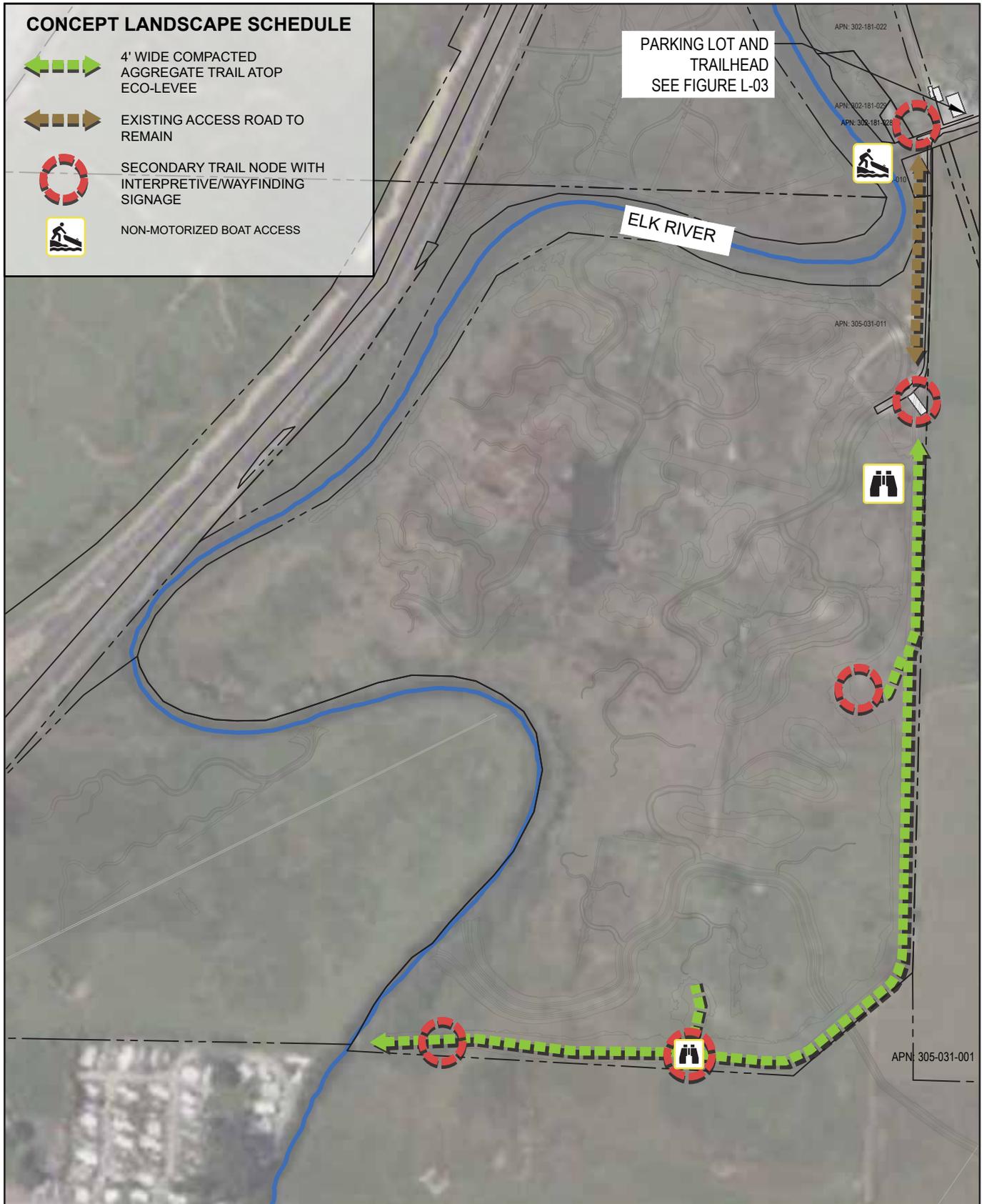
CALTROUT
 ELK RIVER SEDIMENT REMEDIATION AND
 HABITAT REHABILITATION PROJECT
**SWAIN SLOUGH EAST/WEST - PUBLIC
 ACCESS EXHIBIT**

Project No. 12624303
 Date October 2

FIGURE L-03

CONCEPT LANDSCAPE SCHEDULE

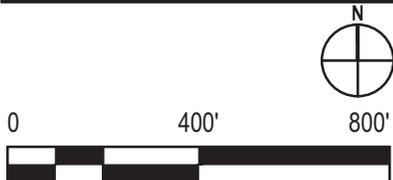
-  4' WIDE COMPACTED AGGREGATE TRAIL ATOP ECO-LEVEE
-  EXISTING ACCESS ROAD TO REMAIN
-  SECONDARY TRAIL NODE WITH INTERPRETIVE/WAYFINDING SIGNAGE
-  NON-MOTORIZED BOAT ACCESS



PARKING LOT AND TRAILHEAD
SEE FIGURE L-03

ELK RIVER

CONCEPTUAL - NOT FOR CONSTRUCTION



CALTROUT
ELK RIVER SEDIMENT REMEDIATION AND
HABITAT REHABILITATION PROJECT
ERWA SOUTH - PUBLIC ACCESS EXHIBIT

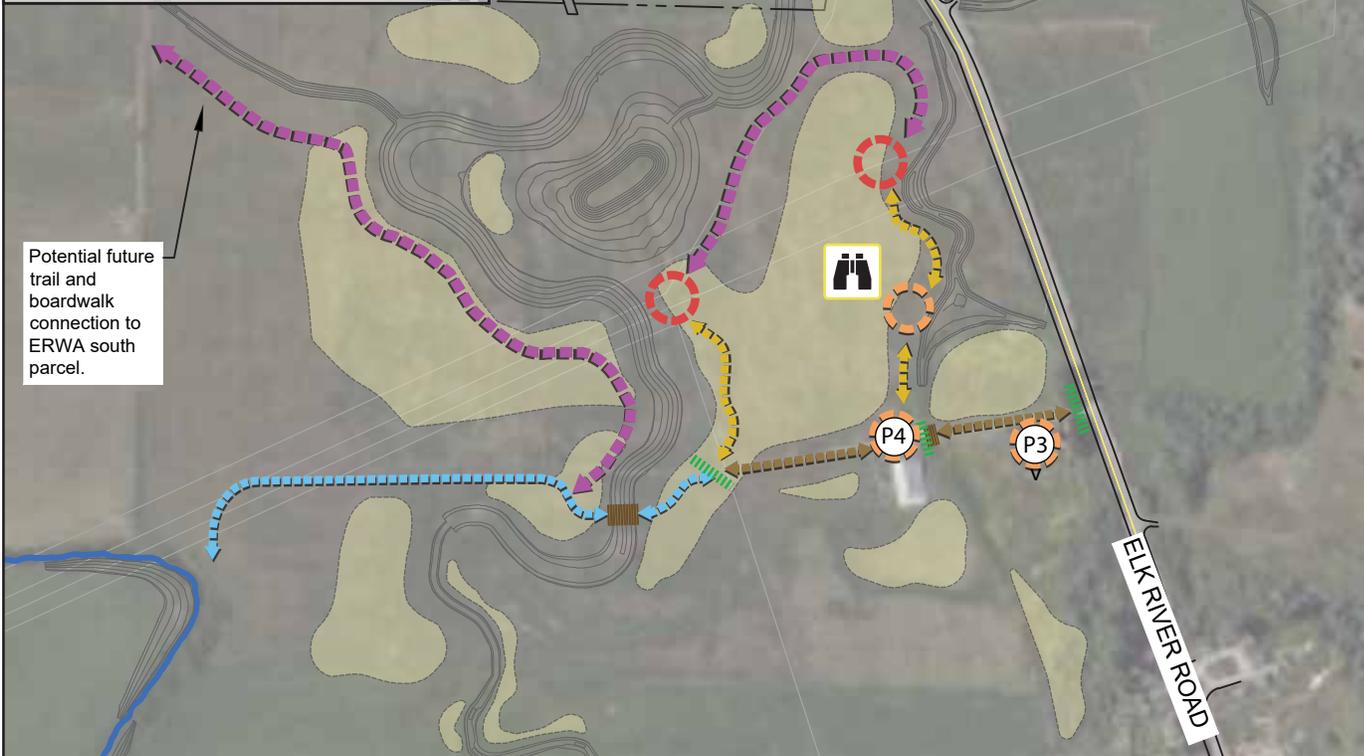
Project No. 12624303
Date October 2

FIGURE L-04

CONCEPT LANDSCAPE SCHEDULE

-  4' WIDE COMPACTED AGGREGATE PED TRAIL AT UPLAND / CONTINUOUS TOPOGRAPHICAL HIGH POINT
-  SEASONAL TRAIL
-  EXISTING ACCESS ROAD TO REMAIN
-  COMPACTED GRAVEL, ACCESS ROAD
-  WILDLIFE VIEWING PLATFORM/OVERLOOK
-  NON-MOTORIZED BOAT ACCESS
-  BRIDGE
-  VEHICULAR GATE
-  PRIMARY TRAIL NODE WITH BIKE PARKING, WAYFINDING SIGNAGE, AND BENCH SEATING
-  SECONDARY TRAIL NODE WITH INTERPRETIVE/WAYFINDING SIGNAGE
-  TRAILHEAD PARKING LOT (COMPACTED GRAVEL) WITH PAVED CONCRETE ADA STALL & LOADING ZONE. (1) ADA STALL (14) STANDARD STALLS
-  PICNIC AREA AT MILK BARN, OVERFLOW/EVENT PARKING ONLY, TURNAROUND AND BUS DROP OFF
-  PROPOSED HUMMOCK APPROXIMATELY 1FT HIGHER THAN SURROUNDING GRADE. TRAIL WILL BE COORDINATED WITH RIPARIAN ESTABLISHMENT NEEDS

SEE FIGURE L-03 FOR SWAIN SLOUGH EAST/WEST



Potential future trail and boardwalk connection to ERWA south parcel.

CONCEPTUAL - NOT FOR CONSTRUCTION



CALTROUT
 ELK RIVER SEDIMENT REMEDIATION AND
 HABITAT REHABILITATION PROJECT
 MID VALLEY - PUBLIC ACCESS EXHIBIT

Project No. 12624303
 Date October 2

FIGURE L-05