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ENVIRONMENTAL ASSESSMENT

BONNEVILLE POWER ADMINISTRATION

ENVIRONMENTAL ASSESSMENT

FOR THE

COLUMBIA STOCK RANCH SECTION 536 ECOSYSTEM RESTORATION PROJECT

The environmental review, consultation, and other actions required in accordance with applicable Federal laws for this project is being, or has been, carried-out by the U.S. Army Corps of Engineers, Portland District, under its assumption of responsibility pursuant to 33 C.F.R. Part 230.

22 April 2016

Executive Summary

This draft Environmental Assessment (EA) has been prepared by the U.S. Army Corps of Engineers, Portland District (Corps) in cooperation with the Bonneville Power Administration (BPA), (together, the Action Agencies) to evaluate the *Columbia Stock Ranch Ecosystem Restoration Project*. This project is proposed as part of the Corps' Section 536 Authority to conduct studies and implement ecosystem restoration projects in the lower Columbia River and Tillamook Bay estuaries. The proposed ecosystem restoration requires review under the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] § 4321, *et seq.* and implementing regulations at 40 Code of Federal Regulations [C.F.R.] § 1500 and 33 CFR Part 230). The Columbia Land Trust (CLT) is the land owner for the subject property and BPA is a cooperating agency under NEPA and the project sponsor.

The purpose of this draft EA is to consider the environmental impacts of implementing habitat restoration actions at the Columbia Stock Ranch (CSR) property on Deer Island in Columbia County, Oregon. The CSR project area consists of approximately 460 acres of floodplain and riparian habitats adjacent to the Columbia River, with 1.5 miles of frontage to the river. Currently, the CSR project site is disconnected from the lower Columbia River and estuary by a flood reduction levee and juvenile salmonids do not have access to the project site for rearing and foraging. This draft EA describes and evaluations the benefits of restorating hydrologic connectivity between the Columbia River and the CSR project site to improve habitat for fish and wildlife, including salmonids listed under the Endangered Species Act (ESA) of 1973.

Alternatives were developed to maximize restoration potential on the project site. All alternatives, including the Proposed Action, include construction of a setback levee and breaching the existing Columbia River Levee to facilitate inundation of the project site by tidal waters from the Columbia River and provide off-channel habitat for juvenile salmonids. The Proposed Action includes the following construction elements:

- Acquisition of lands, easements and rights of way from land owners, diking district, utilities, Portland & Western Railroad and the Oregon Department of Transportation for all actions associated with staging, access and construction
- Removal of a residential home, associated outbuildings, and fences
- Construction of temporary haul road to dredged material placement site
- Construction of setback levee, seepage berms, and installation of tide gate at Tide Creek
- Modification to the existing flood control levee, including three (3) breaches and lowering the remaining elevation to approximately 15 feet NAVD 88
- Installation of two (2) bridges in the railroad embankment, spanning existing waterways
- Excavation of tidal channels, marsh and wetland habitats and an overflow channel
- Grading select portions of upland areas below 2-year flood elevation and filling an agricultural drainage ditch
- Removal of existing culvert, tide gate and channel-spanning cattle grates in Tide Creek
- Removal of culvert in existing access road and grade road to match adjacent topography
- Invasive species removal, and planting native vegetation

The draft EA is available for a 21-day public review in compliance with the applicable laws and regulations, including the NEPA. At the end of the public comment period, the Agencies will consider all comments received or post marked by the expiration date of this public notice and make a determination of significance of impacts resulting from the Proposed Action.

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ABBREVIATIONS AND ACRONYMS

Agencies	Bonneville Power Administration together with the U.S. Army Corps of Engineers
BiOp	Biological Opinion
BA	Biological Assessment
BPA	Bonneville Power Administration
CEERP	Columbia Estuary Ecosytem Restoration Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulation
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
DEQ	Oregon Department of Environmental Quality
DPS	distinct population segment
DOE	Washington Department of Ecology
EA	Environmental Assessment
EFH	Essential Fish Habitat
ERTG	Expert Regional Technical Group
ESA	Endangered Species Act
ESU	evolutionary significant unit
FCRPS	Federal Columbia River Power System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
mcy	million cubin yards
MLLW	mean lower low water
MHHW	mean higher high water
Mg/L	milligrams per liter
MTL	mean tide level
NEPA	National Environmental Policy Act
NOAA Fisheries	(formerly National Marine Fisheries Service [NMFS], a division of the National Oceanic and Atmospheric Administration
ODFW	Oregon Department of Fish and Wildlife
PCE	Primary Constituent Element
RPA	Reasonable and Prudent Alternative

SBU	survival benefit unit
SEF	Sediment Evaluation Framework
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
WRDA	Water Resources Development Act of 2000
WRRDA	Water Resources Reform and Development Act of 2014

1. INTRODUCTION

The U.S. Army Corps of Engineers, Portland District (Corps), together with the Bonneville Power Administration (BPA) (together, the Action Agencies) is proposing to implement an ecosystem restoration project on the Columbia Stock Ranch (CSR) to restore floodplain habitats for the benefit of fish and wildlife. In accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4321 *et seq*.), as amended, this draft Environmental Assessment (EA) has been prepared by the Corps and evaluates the environmental impacts of implementing the *Columbia Stock Ranch Ecosystem Restoration Project* in Columbia County, Oregon. The proposed project would improve existing habitat conditions and ecosystem processes by restoring hydrologic connectivity and tidal influence to the floodplain along the lower Columbia River and estuary.

This document summarizes potential environmental impacts from the proposed project in accordance with the Corps' NEPA regulations and agency guidance from the Council on Environmental Quality (CEQ) (2014). Pursuant to the regulations and guidance, this draft EA identifies and evaluates the type and range of environmental impacts that occur when undertaking habitat restoration in tidal and riverine ecosystems. Following the analysis of environmental effects evaluated and disclosed herein, and in full consideration of any issues or comments identified by the public, State and Federal agencies, and Tribes, the Action Agencies will determine whether or not to issue a Finding of No Significant Impact (FONSI) for the implementation of the proposed CSR restoration project.

Real estate acquisition, planning, design, and construction costs for the proposed restoration project would be entirely federally funded by the Action Agencies. Each agency has different roles and responsibilities and would make agency-specific decisions in the approval of the proposed project. The Corps is the lead federal agency under NEPA and would fund planning, design and construction of the major components of the proposed project. BPA is a cooperating agency under NEPA and would fund real estate acquisition and the installation of some project elements.

Given the purpose and need (discussed below) and any issues identified by the public, State and Federal agencies, and Tribes, each agency (Corps and BPA) will review the alternatives and the range of potential effects in order to make the separate decisions.

The Corps' decision would be one of the following:

- Select the No Action Alternative and *not* implement ecosystem restoration actions on the CSR project site, providing no benefit to fish and wildlife; or
- Select the Proposed Action Alternative and implement ecosystem restoration actions on the CSR project site for the benefit of fish and wildlife.

BPA's decision would be one of the following:

- Select the No Action Alternative and *not* fund and acquire real estate interests or fund the implementation of select project elements, providing no benefit to fish and wildlife; or
- Select the Proposed Action Alternative and fund and acquire necessary real estate interests and implement select project elements for the benefit for fish and wildlife.

1.1. Authority and Funding

Congress authorized the *Lower Columbia River and Tillamook Bay Ecosystem Restoration* program in Section 536 of the Water Resources Development Act of 2000 (Public Law 106-541), as amended by Section 4005 of the Water Resources Reform Development Act (WRRDA) of 2014 (Public Law 113-121). Section 536 authorizes the Corps to conduct studies and implement ecosystem restoration projects in the lower Columbia River and estuary necessary to protect, monitor, and restore fish and wildlife habitat. Efforts under the authority are cooperative and include input from the National Estuary Program, six state agencies from Oregon and Washington, four federal agencies, recreation, ports, industry, agriculture, labor, commercial fishing, environmental interests, and private citizens.

The proposed CSR project complies with all the requirements of Section 536 and would provide an opportunity in the Columbia River estuary to protect and restore fish and wildlife habitat. In so doing, pursuant to Section 536(c)(2), the proposed project would neither affect the water related needs of the estuary (navigation, recreation, and water supply), nor would it adversely affect private property rights.

1.2. Federal Columbia River Power System Biological Opinion

In 2008, in response to a court order, the Corps and BPA entered into an agreement to implement projects that would benefit salmonids in the Columbia River basin over a ten year period. The Federal Columbia River Power System (FCRPS) biological opinion (BiOp) (hereafter referred to as the FCRPS BiOp) includes an implementation plan that outlines a comprehensive program of habitat improvements, hatchery reforms, and hydrosystem operations and improvements to protect Columbia and Snake River fish. The plan outlines a broad array of projects to improve spawning and rearing habitat in order to boost the survival rates of fish listed under the ESA. One of the key actions recommended in the FCPRS BiOp includes improving estuarine habitat and restoring off-channel, floodplain habitats for rearing juveniles salmonids. By directly addressing factors which limit quality habitat, the proposed project would help satisfy requirements of the FCRPS BiOp, specifically Reasonable and Prudent Alternative actions 36 and 37 as amended by a supplemental BiOp in 2010 and 2014 (NOAA Fisheries 2008, 2010 and 2014).

1.3. Purpose and Need

The purpose of the proposed Federal action is to restore ecological processes and tidal influence to the floodplain and develop riparian forest habitat to benefit many fish and wildlife species in the lower Columbia River and estuary. Construction of the Deer Island Flood Damage Reduction System (levee) and the Portland & Western Railroad embankment blocked fish passage into the project area and Tide Creek, functionally isolating the property from natural tidal and fluvial processes. The proposed project would improve habitat conditions and provide access/egress to rearing and foraging habitat for 13 Evolutionary Significant Units (ESU) of salmonids listed as threatened and endangered under the Endangered Species Act (ESA) of 1973 (16 U.S.C. § 1531 *et seq.*), as amended[1]. The restoration project also would provide for habitat improvements for a variety of waterfowl, raptors, including bald eagles

[1] An evolutionary significant unit (ESU) is a Pacific salmon population or group of populations that are substantially reproductively isolated from other conspecific populations and that represent an important component of the evolutionary legacy of the species.

(*Haliaeetus leucocephalus*), neotropical migratory birds, reptiles, amphibians and an assortment of mammals, as well as support recovery of the federally endangered Columbian white-tailed deer (*Odocoileus virginianus leucurus*).

The need for habitat restoration within the lower Columbia River and estuary is predicated upon the significant historic losses of tidal slough and tidal swamp habitats along the lower Columbia River. The original extent of tidal marsh and swamp in the estuary has been reduced by more than half and upwards of 80% of the littoral area of the estuary has been lost (LCREP 1999, NPCC 2002). Throughout the estuary, riparian plant communities dominated by Oregon ash (*Fraxinus latifolia*) and black cottonwood (*Populus trichocarpa*) forest have declined about 86% from historical levels, and forested swamp dominated by Sitka spruce (*Picea sitch*ensis) has declined about 70% (Graves et al., 1995; Corps 1996). The project area itself is currently a disturbed ecosystem previously altered by diking, drainage, clearing of tidal swamp forest and subsequent agricultural use. Under Section 536, the Corps and BPA are authorized to partner with willing land owners and non-federal sponsors to implement habitat restoration projects in the lower Columbia River and estuary. The CSR project site was identified as a potential project site and restoration of floodplain habitat at this location meets the Action Agencies' needs in restoring habitat in the lower river and estuary to meet the FCRPS BiOp obligations.

Construction of the railroad and flood reduction levee disconnected the project site from regular tidal influence and seasonal flood events from the Columbia River. This disconnection effectively simplified the remnant aquatic habitats and diminished overall habitat quality and biodiversity. Tidal, estuarine wetlands are one of the most heavily impacted habitats in the lower Columbia River ecosystem and there is a need to restore this priority habitat based on its high functional value to fish and wildlife. Wetlands and riparian habitats benefitting juvenile salmonids migrating through the lower Columbia River and estuary is an important component of regional recovery plans and the successful reestablishment of healthy, self-sustaining populations. The lower river and estuary are critical areas for juvenile salmonids because these areas provide refugia from predators, support foraging and growth, and provide an area to transition physiologically from freshwater to saltwater before out-migration to the ocean.

In deciding whether to fund and acquire necessary real estate interests, BPA seeks a project that supports efforts to mitigate for the effects of development and operation of the FCRPS on fish and wildlife in the mainstem Columbia River and its tributaries.[2] It also seeks a project that helps meet its obligations under the ESA, as amended, and a project which helps fulfill commitments under the FCRPS BiOp. Additionally, the project would assist in carrying out BPA's obligations related to estuary habitat actions contained in the State of Washington's Memorandum of Agreement (Washington Fish Accord) to conserve salmon and steelhead through improvement of conditions in the estuary.

1.4. Goals and Objectives

The primary goal of the proposed project is to maximize restoration potential on the CSR project site by restoring tidal influence and natural ecological processes to the historic

[2] BPA is a federal power marketing agency that is part of the U.S. Department of Energy. BPA's operations are governed by several statutes, including the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 U.S.C. § 839 *et seq.*), The Northwest Power Act requires BPA to protect, mitigate and enhance fish and wildlife habitat impacted by the development and operation of the FCRPS in a manner consistent with the Northwest Power and Conservation Council's Fish and Wildlife Program (16 U.S.C. § 839b(h)(10)(A)).

floodplain in the project area while maintaining flood protection to adjacent property owners. A secondary goal of the proposed project is to maintain necessary access routes for multiple utilities bisecting the property (natural gas, fiber optics, and transportation).

The main objectives of the restoration plan are to:

1. Re-establish hydrologic connectivity between the project site and the mainstem Columbia River, mimicking historic conditions;
2. Restore high quality off-channel habitat;
3. Provide unencumbered access to critical foraging and rearing habitats on the project site for juvenile salmonids; and
4. Restore native wetland plant communities and functions to enhance productivity.

1.5. Project Sponsor and Land Owner

The Columbia Land Trust (CLT) is a private, non-profit organization owning the CSR project site. In 2012, CLT purchased the CSR property using funding provided by BPA and has been actively coordinating with the Action Agencies to develop restoration plans for construction. BPA is the federal sponsor for the proposed restoration project and would be responsible for all land acquisition associated with the proposed project, as well as all operation and maintenance of project features and hydrologic structures following implementation. Deer Island Drainage Improvement Company (hereafter referred to as the diking district)

2. ACTION AREA

The lower Columbia River and estuary are defined as the Action Area for all FCRPS BiOp related habitat restoration projects. The CSR project site is located adjacent to State Highway 30 (Hwy 30) between RM 75 and 77, in Columbia County, Oregon.

2.1. Columbia Stock Ranch

The project area is between the cities of Rainier and St. Helens, Oregon. The CSR project area is on Deer Island (Oregon) downriver from the Lewis River confluence (Washington) and immediately south of Sandy Island on the Columbia River (see Figure 1). Deer Island is a large island nearly 5 miles long and 2 miles wide, encompassing over 3,000 acres, and is located on the Oregon side of the Columbia River. Directly across the Columbia from Deer Island is Woodland, Washington, and Martin and Burke Islands. Downstream lies Goble, Oregon, and upstream lies Columbia City and St. Helens, Oregon. Just off the east shore of Deer Island lies Goat Island.

The Deer Island Flood Damage Reduction System (levee system) is a system of federally authorized and non-federally operated and maintained flood control levees operated and maintained by the Deer Island Drainage Improvement Company (hereafter referred to as the diking district). The Columbia River Levee is a component of this system of levees, and is operated and maintained by the diking district. The levee system includes six tide boxes (including four freshwater inlets) and a pumping station at Deer Island Slough, protecting a total of approximately 3,920 acres, of which 690 acres are wetlands, lakes and sloughs, and 1,900 acres are agricultural lands. Approximately 19% of the levee system falls within the boundary of CSR.

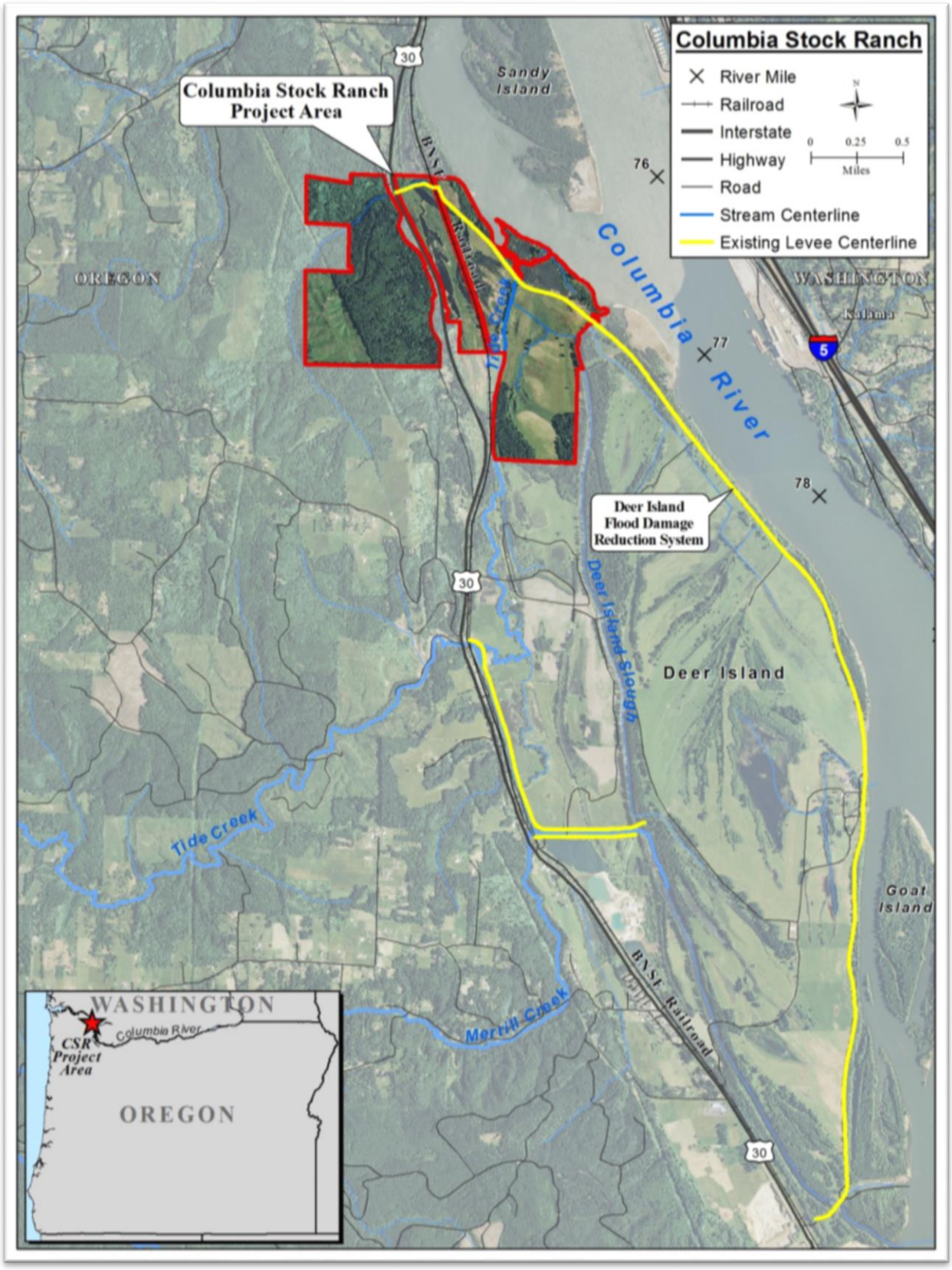

Figure 1: Deer Island and the CSR project site

The CSR project area consists of two parcels of land totalling 935 acres. Approximately 460 acres consist of floodplain and riparian habitats adjacent to the Columbia River, with 1.5 miles of frontage to the river. The remaining 475 acres consist of an upland, mixed Douglas fir and hardwood forest located west and upslope of Hwy 30. The proposed restoration activities would only occur on the lowland portions the property, east of Hwy 30. Prior to construction of the Columbia River Levee, the lower portion of Tide Creek flowed north parallel to Deer Island Slough before entering the Columbia River west of the Deer Island Slough confluence with the river. However, Tide Creek is currently diverted from its historical floodplain and now flows in a constructed channel flowing south and east before entering Deer Island Slough south of the CSR project area. The remnant portion of Tide Creek that flowed through the CSR property is disconnected from both the slough and the mainstem river, fragmenting habitat for aquatic organisms.

3. PROPOSED ACTION AND REASONABLE ALTERNATIVES

The Corps assembled an agency Project Delivery Team (PDT) to evaluate the possible range of actions and refine them into alternatives for consideration. A range of reasonable alternatives meeting the project goals and objectives were evaluated for the CSR project site. Restoration measures facilitating hydrologic connectivity, habitat formation, and continued flood protection were evaluated for implementation. Evaluation criteria also considered public health and safety, ensuring that the preferred alternative would pose no threat to the health or safety of the public and the project would be in compliance with applicable health and safety requirements and guidelines.

In total, six alternatives were evaluated for implementation: the no action alternative and five action alternatives implementing some degree of restoration. Given the unique site conditions and adjacent land use practices (including a state highway bordering the site and an active railway bisecting the property), four alternatives were eliminated from further consideration because they did not meet the purpose and need for action. Ultimately, the PDT narrowed the range of alternatives down to the No Action Alternative and the Proposed Action Alternative.

3.1. No Action Alternative

Under the No Action Alternative, the project site would maintain its current status and the site would continue to be used for agriculture and livestock grazing. The project area would be disconnected from the mainstem Columbia River and the existing flood control levee would remain intact. No active restoration methods would be implemented and existing habitats would remain degraded and functioning poorly. Because the project area would not be connected to the mainstem Columbia River, fish and wildlife in the mainstem would have no access to off-channel habitats and the benefits these areas provide. Invasive plant species would continue to occur on the project site and limited (or no) efforts would take place to control and eradicate invasives from the project area.

3.2. Proposed Action

The Proposed Action was developed through evaluation of the restoration goals and objectives, as well as its potential impact on the human environment and surrounding areas. The Proposed Action is the Action Agencies' preferred action to restore the CSR project site.

The Proposed Action involves modifying a portion of the Columbia River Levee to restore tidal influence to the floodplain below the 2-year flood elevation (see). Following reconnection to

the Columbia River, much of the CSR project site (342 acres) would be semi-regularly inundated by the Columbia River, promoting the exchange of nutrients, minerals, organic material and salmonid prey items between the floodplain and the river. Tidal channels connected to Tide Creek and the Columbia River would be excavated to facilitate inundation of the project site during the tidal cycle, providing juvenile salmonids with increased off-channel rearing and foraging opportunities. Areas adjacent to the tidal channels would be excavated to create marsh and emergent wetland habitat, increasing overall diversity and quantity of wetlands across the floodplain. The Proposed Action for the CSR project site includes the following project elements (see Figure 2):

- Acquisition of lands, easements and rights of way from land owners, diking district, utilities, Portland & Western Railroad and the Oregon Department of Transportation for all actions associated with staging, access and construction
- Removal of a residential home, associated outbuildings, and fences
- Construction of temporary haul road to dredged material placement site
- Construction of setback levee, seepage berms, and installation of tide gate at Tide Creek
- Modification to the existing flood control levee, including three (3) breaches and lowering the remaining elevation to approximately 15 feet (NAVD 88)
- Installation of two (2) bridges in the railroad embankment, spanning existing waterways
- Excavation of tidal channels, marsh and wetland habitats and an overflow channel
- Grading select portions of upland areas below 2-year flood elevation and filling an agricultural drainage ditch
- Replace existing gravity outlet in Deer Island Slough adjacent to the pump station with large structure to increase capacity
- Removal of existing culvert, tide gate and channel-spanning cattle grates in Tide Creek
- Removal of culvert in existing access road and grade road to match adjacent topography
- Invasive species removal, and planting native vegetation

Structures and Staging Areas, Access and Haul Roads

Residential buildings (houses, barn, out-buildings), cattle grates, and fences would be removed from the CSR project site as part of the initial construction activities. The area where the buildings are located would be used as a staging and stockpile area for the duration of construction. Access from Hwy 30 would use an existing gravel road that currently serves as the access road to the buildings and across Tide Creek into the pasture. A temporary haul road would be constructed from the dredge material site at Deer Island to the existing Columbia River Levee, accessing the CSR project site from the levee for the transport of materials needed for construction of project elements. Additionally, permission from the Oregon Department of State Lands is needed to construct this road.

It should be noted that the state-owned dredged material placement site at Deer Island was not included in the wetland delineation conducted in 2015. It is assumed that the area between the placement site and the Columbia River Levee consists of some emergent wetlands, but the extent of wetland coverage is unknown. The National Wetlands Inventory shows the area as containing emergent and forested wetlands. It is assumed that gravel used for the haul road would temporarily fill any wetlands existing between the levee and the placement site. However, the location and dimensions of the haul road has not yet been identified and would be field verified and coordinated with the Oregon Department of State Lands to minimize impacts to wetlands.

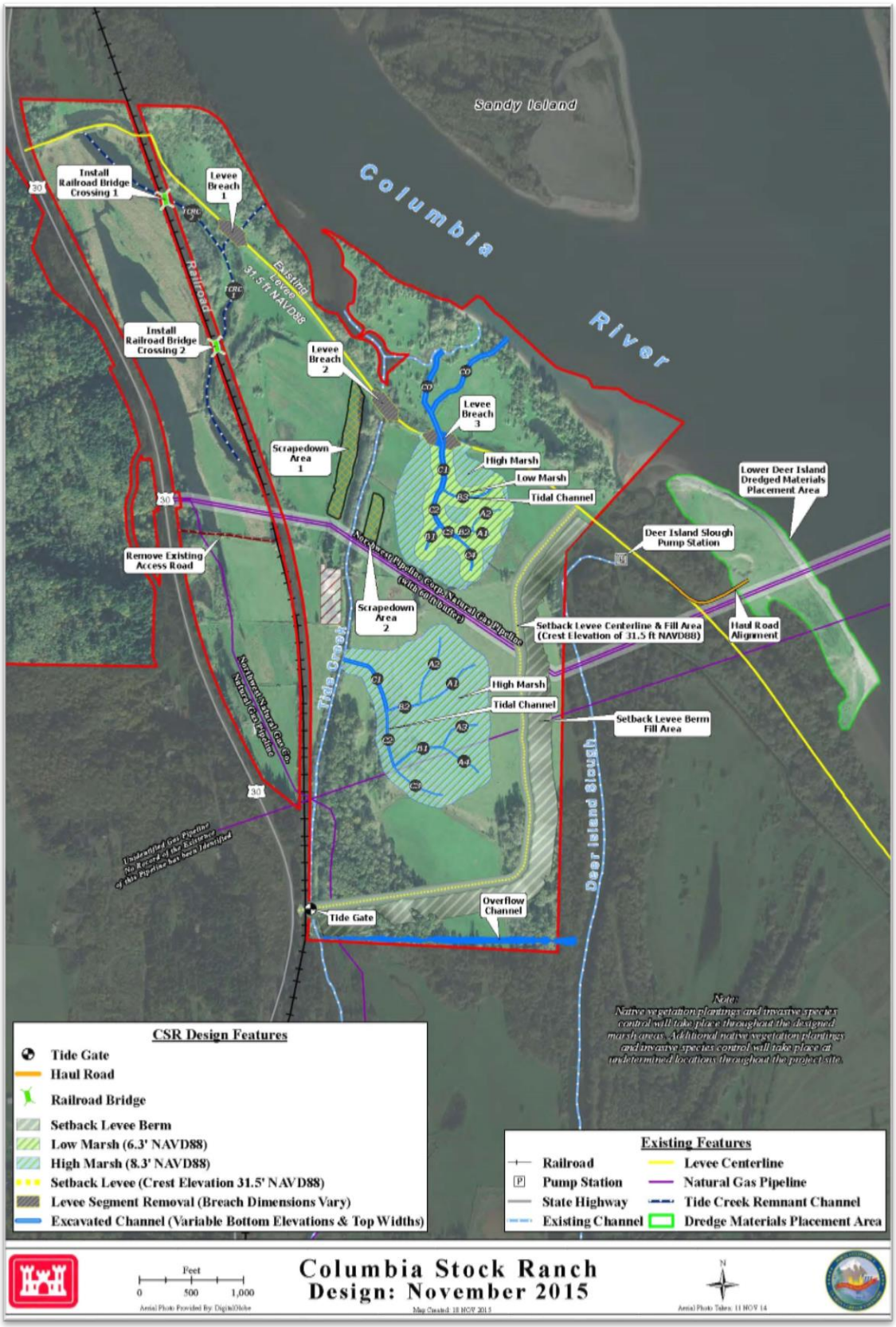

Figure 2: Proposed Action and design features for the CSR project site

There is a natural gas pipeline that crosses the project site (east – west) and Northwest Natural Gas needs to maintain access to the site for maintenance purposes. Currently, an access road passes between the western half of the project site and the eastern half atop a 36-inch corrugated metal culvert in Tide Creek. The proposed plan includes removing the culvert to restore the channel in Tide Creek. Year-round access to the pipeline would be maintained atop the setback levee connecting to Hwy 30. During the dry season, access would occur via the current road from Hwy 30 which would be lowered to adjacent grade of the floodplain.

Levee Modifications, Construction of Setback Levee and Tide Gates

The Columbia River Levee runs a total length of approximately 10 miles along the project site and Deer Island. Adjacent to the CSR project site, the levee runs approximately 7,100 feet. Approximately 3,000 feet of the existing levee would be modified by lowering the surface elevation to 15.0 feet (NAVD 88), representing a reduction in 42 percent of the levee along the project site. The levee, both the portion lowered and the remnant levee would be planted with a mix of shrub and tree plant communities to support riparian habitat development in the project area. Construction of the setback levee would functionally replace the existing levee and provide flood protection to adjacent properties landward of the levee.

In addition to lowering the existing levee, the levee would be modified by breaching the levee at three locations to open the floodplain to tidal inundation and Columbia River flows and permission from the diking district for the breaches would be required. The breaches would be sized to accommodate National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) fish passage guidelines for access and egress into the project site via Tide Creek and accommodate the full tidal prism. Approximately 600 feet of the levee would be breached in total, representing approximately 16 percent of the total levee along the project site. If additional fill material is needed for construction of the setback levee, the overall breach length could be widened. Breach locations are currently proposed for three locations: Breach 1, Breach 2, and Breach 3 (see attached design map). Breach 1 is the western most breach nearest to the Portland & Western Railroad, Breach 2 is located where Tide Creek passes through the existing levee via a gravity flap gate, which is currently non-functional. The tide gate would be removed and a replacement tide gate would be installed in the setback levee. Breach 3 is located east of Breach 2 and connects tidal channels on the northern portion of the site directly to the Columbia River via excavated channels and existing waterways riverward of the existing levee. The current elevation of the Columbia River Levee is 31.5 feet (NAVD 88). Each breach would be approximately 200 feet in width, and excavated to match topography of the adjacent floodplain and channel thalwags. No armoring would be used to stabilize the breach openings, as it is intended for the openings to destabilize naturally over time.

A setback levee and seepage berms would be constructed on the southern and eastern portion of the CSR project site to provide similar flood protection to adjacent properties that the existing levee currently provides. The setback levee would have a top width of 13 feet, a riverward side slope of 3 horizontal feet for 1 foot change in vertical elevation (3H:1V) and landward side slope of 4H:1V. The location of the setback levee is based on existing topography and ties in to high ground at the southern portion of the CSR project site near the railroad and Hwy 30. In addition, the setback levee would also serve as an access road to the CSR project site east of Tide Creek for the landowner and utility companies. To construct the setback levee and access road on the levee, acquisition of easements and permissions from utilities and Oregon Department of Transportation, Rail Section related to this construction would be required. Construction would also require the utilities to install river weights on utility lines (primarily the gas pipeline) and relocate manholes. Geomorphic evaluation of the project site identified

underground seepage as a concern with regards to construction and long-term stability of the setback levee. As a result, seepage berms would be constructed at the toe of the landward side of the levee to minimize the risk of seepage and provide additional levee stability (see Figure 3). Further analysis will determine the final dimensions of the berms, but initial estimates assume a maximum of 5 feet in depth, extending outwards up to 250 feet from the levee.

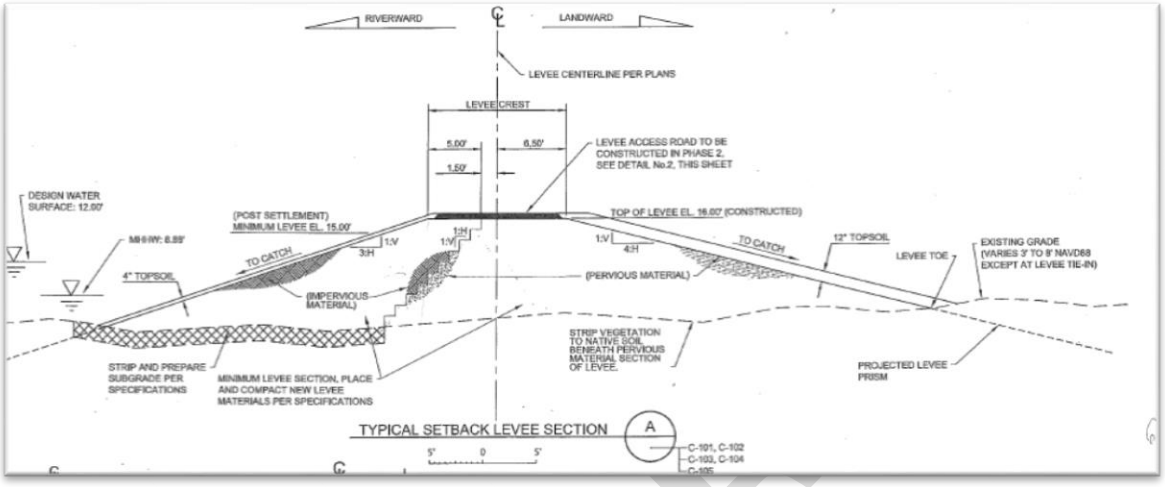

Figure 3: Setback levee cross-section

All offsite drainage would be routed through the setback levee via a side-hinged tide gate (with float control) in Tide Creek and an overflow channel connecting to Deer Island Slough (see Figure 4). The tide gate would close at 9 feet (NAVD 88) to reduce flood risk and minimize the potential for fish stranding landward of the setback levee during high flows. In general, during high flows (above 9 feet), Tide Creek and all off-site drainage would be routed through the overflow channel (discussed in greater detail below) to the existing Deer Island Slough (and pump station) for evacuation to the Columbia River. To decrease the amount of time adjacent properties are inundated during high flow events, the existing gravity outlet in Deer Slough adjacent to the pump station would be replaced with a larger structure to increase capacity and the rate of evacuation. The replacement structure would be a gravity outlet (culvert with flag gate), providing one-way flow out of the flooded areas. Alternatively, existing freshwater inlets installed at various locations along the levee could be replaced to increase evacuation rates.

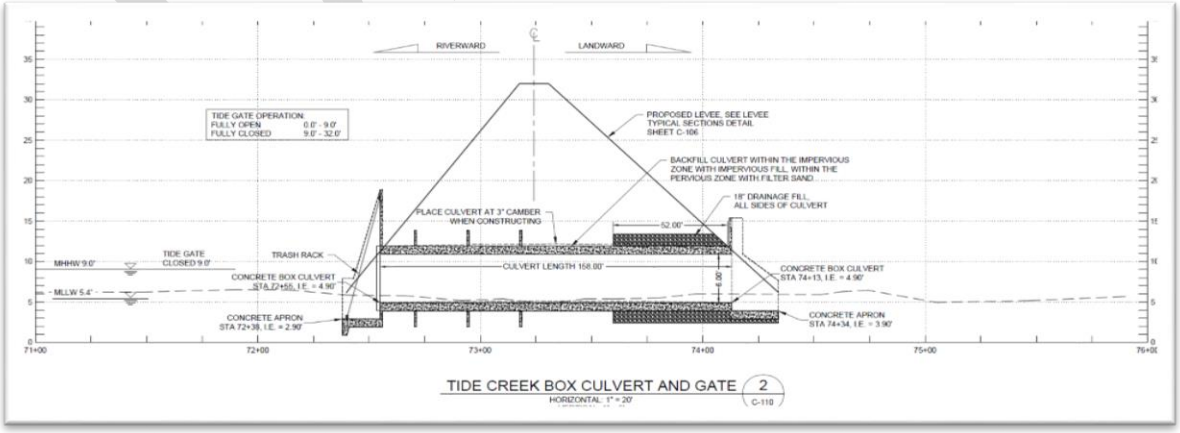

Figure 4: Draft plans for tide gate located in setback levee at Tide Creek

Channel-Spanning Structures: Railroad Bridges

The Portland & Western Railroad embankment bisects the property and disconnects the western portion of the property from the Columbia River and crosses a remnant channel and wetland. Two bridges would be installed in the embankment to provide hydrologic connectivity across the entire project site. Each railroad crossing would consist of three 40 feet spans, for a total opening width of 120 feet at each bridge. It should be noted that coordination with railroad personnel and the Oregon Department of Transportation have confirmed that, while additional coordination and permitting are required, making a connection within the rail embankment is feasible. Installation of the two railroad bridges would require a channel improvement easement and permission from the railroads to allow construction within the railroad right-of-way.

Excavation and Grading of Tidal Channels, Marsh and Wetland Habitats, and Tide Creek Overflow Channel

Tidal fluctuations for the Columbia River at river mile 76.5 (immediately adjacent to the CSR project site) are 4 feet. Elevations for mean higher-high water (MHHW), mean high water (MHW), mean tide level (MTL), mean sea level (MSL), mean low water (MLW), and mean lower-low water (MLLW) have been interpolated based on observations of tidal fluctuations from NOAA's Longview and St. Helens gauges and the results are summarized in the table below.

Table 1: Mean water surface elevations at the CSR project site

Tide Level	*NAVD 88 (feet)*
MHHW	9.4
MHW	8.9
MTL	7.3
MSL	7.2
MLW	5.7
MLLW	5.4
Data source: http://tidesandcurrents.noaa.gov/	

To support inundation of the tidal channels and marsh habitats during the daily tidal cycle for fish access and use, tidal channels on the northern portion of the site would be excavated to 3 feet (NAVD 88) and tidal channels on the southern portion of the site where the channel ties into Tide Creek would be excavated to 5.5 feet (NAVD 88). Water levels in the excavated marsh would fluctuate in response to Columbia River water levels and tidal fluctuations. The excavated areas would provide daily wetting and drying for most of the year, and prolonged inundation during the rainy winter months and spring freshet. During the summer dry months when river and groundwater levels are lower, the tidal channels on the southern portion of the project site would drain between diurnal tides and not be fully wetted during the high tide. An existing irrigation channel spanning the project site between Tide Creek and Deer Island Slough would be filled to maintain the structure of the tidal channels and ensure the irrigation channel does not re-water during tidal inundation from the Columbia River.

The proposed restoration action incorporates the existing channel morphology of Tide Creek into the design of the proposed tidal channels. The bottom elevation of Tide Creek varies between approximately 3 feet (NAVD 88) near its terminus at the existing Columbia River Levee and 5.5 feet (NAVD 88) near the southern portion of the property where the setback levee is

proposed for construction. Consequently, the tidal channels are designed to match the existing Tide Creek thalwag to prevent fish stranding between tidal cycles and high flood events. The bankfull width of the proposed tidal channels vary between 75 feet where they intersect with Tide Creek or the Columbia River, decreasing up to 24 and 19 feet bankfull width at the upper, terminal ends. Similarly, bottom widths of the proposed tidal channels vary between 68 feet to 12 feet.

Excavation of marsh and wetland habitats adjacent to the tidal channels is intended to target a gradient of low and high marsh elevations for the establishment of intertidal wetland habitats across the project site. "Low marsh" areas would be excavated between 6.3 feet and 8.3 feet (NAVD 88) before grading up to the adjacent floodplain, supporting the establishment of wetland vegetation between MLLW and MTL. Annual tidal fluctuations indicate that these areas would remain semi-permanently flooded for the majority of the year, drying out between August and October when river elevations are lowest. The "low marsh" habitat would extend 100 feet on either side of a tidal channel. It should be noted that "low marsh" habitat would only occur on the northern portion of the project site because the existing topography and channel grade of Tide Creek would require extensive excavation to support low marsh habitat on the southern portion of the project site and low marsh habitat was also deemed unsustainable over the long-term (see Figure 5).

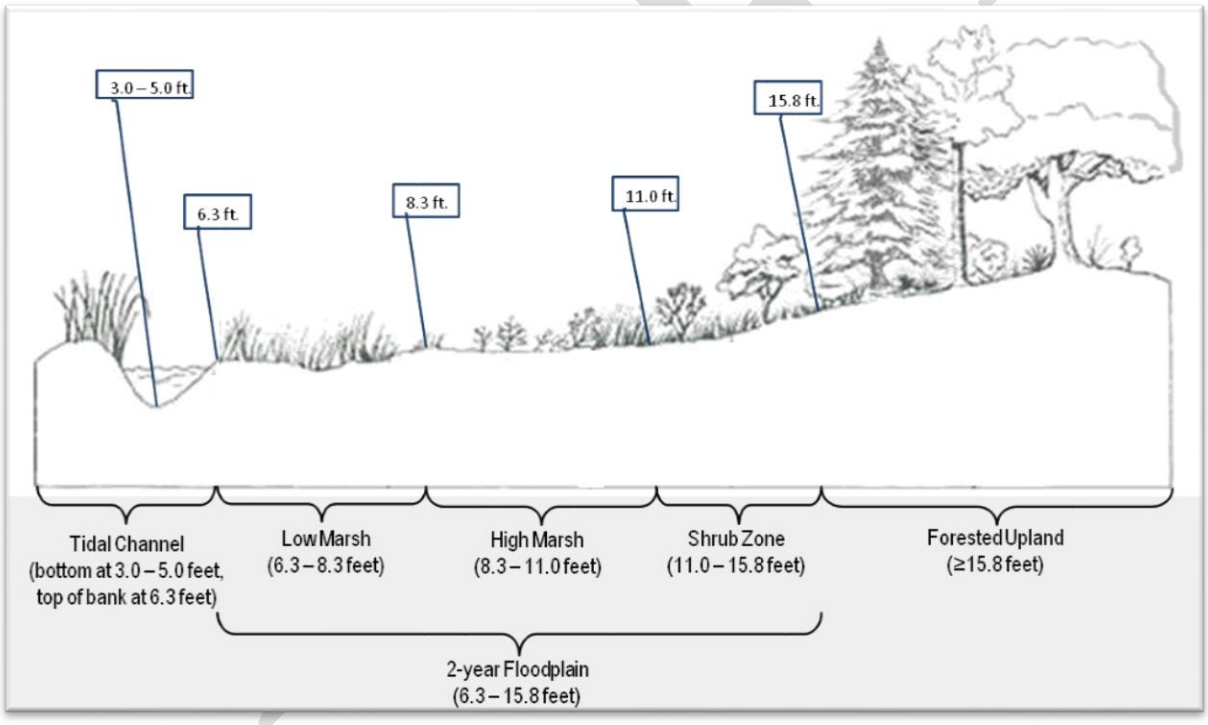

Figure 5: Schematic for low and high marsh elevations on northern portion of CSR project site

"High marsh" areas are proposed for both the northern and southern tidal channel (see Figure 5 and Figure 6). High marsh elevations promote the establishment of intertidal habitats and would be excavated to 8.3 feet (NAVD 88), an elevation between MTL and MHHW providing added resilience to anticipated changes in water surface elevation as a result of climate change. In the northern portion of the project site, high marsh habitat would be excavated to 8.3 feet and graded up to 11.0 feet (NAVD 88). In the southern portion of the project site, the high marsh habitat would be excavated to 8.3 feet and graded up to a 9.6 feet (NAVD 88) to increase

topographic diversity between MTL and MHHW. Annual tidal fluctuations indicate that these areas would be wetted on a daily basis, but could dry out during low tide for most of the dry, summer season. During the April – June freshet, low tide would likely stay above the high marsh elevation, temporarily inundating this area for weeks or months. The "high marsh" area would be excavated as a buffer around the tidal channels in the southern portion of the project site, creating a micro-basin around the tidal channels. High marsh areas would tie into the existing grade with a gradual slope to mimic natural conditions and minimize the potential to strand fish as water recedes and would be planted with a mix of native wetland plants to support habitat needs for fish and wildlife.

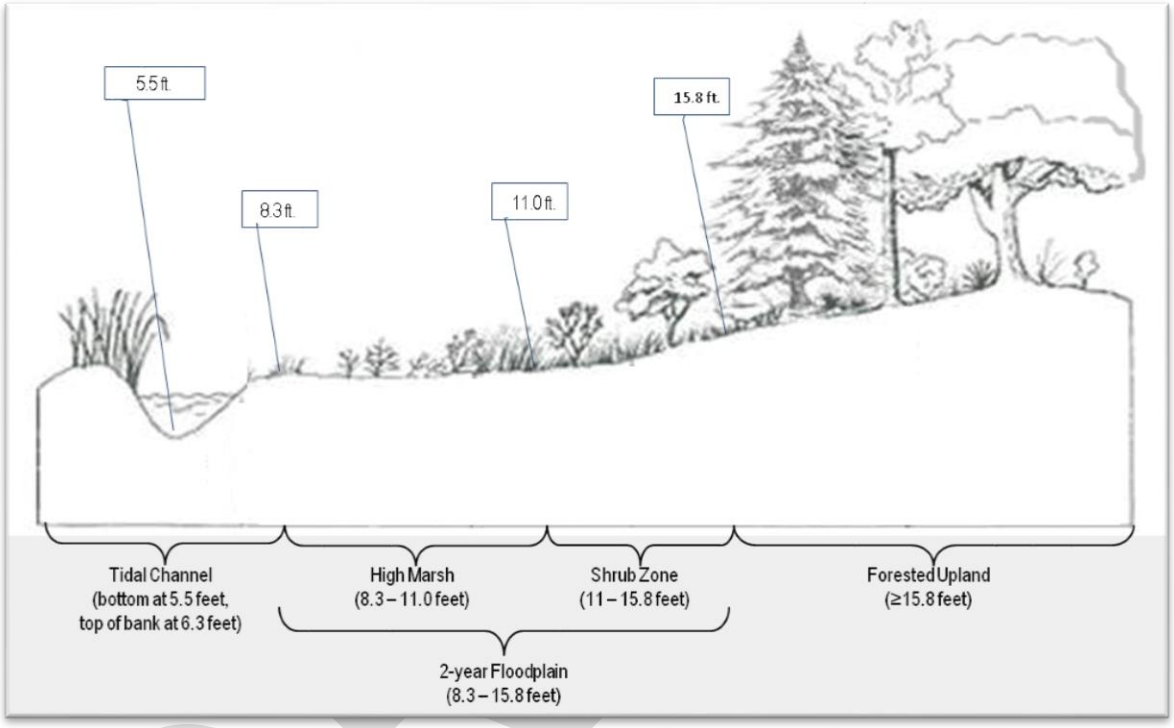

Figure 6: Schematic for low and high marsh elevations on southern portion of CSR project site

As noted above, an overflow channel is needed to direct off-site drainage from Tide Creek into Deer Island Slough during high water events to minimize interior flooding landward of the setback levee. The overflow channel would have trapezoidal cross section with a bottom width of 10 feet and sides gradually sloping up to the adjacent floodplain elevation. Bank elevations would tie into the nearest adjacent grade and top width could vary along the length of the channel. The diversion channel would be aligned with existing low spots along the setback levee and utilize swales where they occur on the landscape. Acquisition of 13.4 acres of Deer Island by the Columbia Land Trust would also be required for the overflow channel and Corps or BPA would then acquire a right-of-way for construction and a channel improvement easement on this parcel.

Additional excavation would occur in two locations adjacent to Tide Creek where the existing floodplain topography is higher than the ordinary high water elevation, which is the same as the 2-year flood elevation (15.8 feet NAVD 88). These areas would be excavated to 15 feet (NAVD 88) to increase the areal extent of inundation during a 2-year flood event to support fish and wildlife habitat and promote natural ecological processes. Any excess material not used for

construction of the setback levee would be disposed in upland areas where the residential house and barn are located, minimizing impacts below ordinary high water.

Invasive Species and Native Vegetation

Currently, the CSR project site is largely dominated by non-native pasture grasses that were promoted for cattle grazing and agriculture and invasive species that have become established throughout the project site. The proposed restoration includes removal and control or treatment for invasive species, as well as planting native vegetation to increase the composition of native plant communities and overall biodiversity. Invasive species control is proposed by spraying herbicides formulated for aquatic environments (glyphosate and imazapyr) via a backpacker sprayer and a boom sprayer mounted on an ATV. Timing of herbicide application would depend on species present and season of activity (spring and fall). It is assumed that the proposed restoration project would be implemented over two (2) field seasons and invasive species control measures could be implemented up to four (4) times during construction activities: fall of 2016, spring and fall of 2017, and spring of 2018 before the final levee breach is completed. Following reconnection to the Columbia River, invasive species control on the project site would be timed to coincide with seasons of low water when the project site is not flooded.

The setback levee would be constructed during the summer and fall months, before weather conditions make effective construction prohibitive. The contractor would return the following year to complete channel work, vegetation measures, and finally the removal of segments of the existing levee. If necessary to establish vegetation, the final phase may occur in a third construction season.

The proposed planting plan for low and high marsh habitats include broadleaf arrowroot, or wapato (*Sagittaria latifolia*), common spikerush (*Eleocharis palustris*), yellow water-lily (*Nuphar lutea*), and slough sedge (*Carex obnupta*). Silverweed cinquefoil (*Potentilla anserine*) and water parsley (*Oenanthe sarmentosa*) were included to provide bank stability and attract waterfowl. Common or soft rush (*Juncus effuses*), spike bentgrass (*Agrostis exarata*), common velvetgrass (*Holcus lanatus*), fowl bluegrass (*Poa palustris*), fowl mannagrass (*Glyceria elata*), and tufted hairgrass (*Deschampsia caespitosa*) are target species for the higher marsh elevations. Many of these species are sod- or bunch-forming grasses and their establishment would help control invasion by reed canary grass (RCG) (*Phalaris arundinacea*). Riparian scrub-shrub habitat would provide a transitional zone between high marsh habitat and floodplain forests and upland grasslands. Vegetation in this zone would be dominated by trees and shrubs less than 15 feet in height, including Douglas spirea (*Spiraea douglasii*), Scouler's willow (*Salix scouleriana*), Pacific willow (*S. lucida*), Pacific dogwood (*Cornus nuttallii*), thimbleberry (*Rubus parviflorus*), evergreen huckleberry (*Vaccinium ovatum*), American elder (*Sambucus rubra*), and nootka rose (*Rosa nutkana*). Native asters, yarrow, and milkweed would be seeded in the understory to attract butterflies, moths and other pollinators.

Construction Sequence and Schedule

Implementation of the Proposed Action requires that flood protection must be maintained throughout the duration of the project in compliance with the authorized intent of the existing levee. While the Proposed Action could logistically be constructed in one calendar year beginning in April, this would be highly dependent on weather conditions and soil moisture content. To reduce the uncertainty of project delivery based on winter and spring rainfall amounts, a two year construction schedule is recommended. Table 2 provides a schedule that

can be used for construction of the ecosystem restoration project over two construction seasons.

Construction would begin in spring of 2017 and is expected to be complete in late fall 2018. In order to maintain flood protection to adjacent property owners, the following construction sequence is proposed for project implementation following acquisition of real estate interests in 2016 and 2017 (see Table 1):

1. Access project site and establish traffic signage, work staging areas, job facilities, and initial erosion control measures.
2. Demolish existing ranch structures and fences, prepare construction staging area, and decommission existing septic systems, water wells, power lines and agricultural drainage.
3. Demolish radio control airport structure and decommission access driveway to airport.
4. Strip, clear, and grub vegetation along proposed setback levee and setback levee access road to Highway 30, stockpile for incorporation as wood elements in marsh areas.
5. Excavate and stockpile topsoil along alignment of proposed setback levee and marsh areas.
6. On landward side of existing levee, excavate tidal channels, marshes, scrape-down areas, and overflow channel and haul material to proposed setback levee.
7. Construct setback levee using excavated site material to an elevation of 25.0 ft NAVD 88.
8. Stabilize and winterize site with erosion control measures, demobilize equipment as necessary.
9. Mobilize equipment and build setback levee to final elevation of 32.0 ft NAVD 88.
10. Build setback levee access road connection from railroad crossing to Highway 30.
11. Install tide box culvert and levee closure structure at railroad embankment tie-in location.
12. Place large wood habitat complexity throughout marsh areas.
13. Place stockpiled topsoil on proposed setback levee.
14. Excavate existing levee breaches and channels to the Columbia River and transport material to new setback levee for seepage blanket on landward side of levee.
15. Seed and plant site including sod cover on levees and wetland plants within excavated channels.
16. Remove existing Tide Creek culvert crossing at existing access road near ranch headquarters.
17. Install railroad bridges at crossing 1 and 2 on existing rail line.
18. Regrade the existing access road down to the surrounding ground elevation for slough and habitat connectivity.
19. Demobilize and restore construction staging areas.

Table 2: Anticipated construction activity schedule

Construction Activity	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*
2017									
Access project site, establish signage, work staging areas, job facilities, erosion control measures.									
Demo existing structures and fences, and prepare construction staging area.									
Demo RC airport structure and decommission access driveway to airport.									
Clear and grub vegetation along setback levee and access road to Hwy 30, stockpile large wood.									
Excavate and stockpile topsoil along alignment of proposed setback levee.									
Excavate channels, marshes, scrape-down areas, overflow channel; haul material for setback levee.									
Construct setback levee using excavated site material to 25.0 ft NAVD 88.									
Stabilize site with erosion control measures for winter conditions, demobilize equipment.									
2018									
Mobilize equipment and build setback levee to 32.0 ft NAVD 88 and setback levee access road.									
Build setback levee access road connection from railroad crossing to Highway 30.									
Install tide box culvert and levee closure structure at railroad embankment tie-in location.									
Place large wood habitat complexity throughout marsh areas.									
Excavate breaches and channels to Columbia River, transport material for seepage blanket.									
Seed and plant site including sod cover on levees and wetland plants within excavated channels.									
Remove existing Tide Creek culvert crossing at existing access road near ranch headquarters.									
Install railroad bridge crossing 1 and 2 on existing rail line.									
Regrade existing access road down to the surrounding ground elevation.									
Demobilize and restore construction staging areas.									

3.3. Alternatives Considered but Dismissed from Further Evaluation

Along with the No Action and Proposed Action Alternatives selected for impact analysis, other alternatives were considered for further evaluation. The Action Agencies follow an established process to estimate the relative benefits of ecosystem restoration projects in the Columbia River estuary to improve the survivial of ocean- and stream-type juvenile salmonids. The process assigns survival benefit units (SBUs) by scoring for three factors: (1) certainty of success; (2) potential benefits for habitat access/opportunity; and (3) potential benefits for

habitat capacity/quality. Scoring criteria were developed for each of these metrics and an expert regional technical group (ERTG) reviews proposed habitat restoration projects and assigns SBUs to individual projects and alternative designs. The ERTG is comprised of regional experts in estuarine, riverine and ocean ecology, fisheries biology, and restoration science. The CSR project site was identified as a potential site for restoration and scoring with SBUs. The project site was evaluated as a stand-along location and not compared against alternative locations.

The Corps evaluated restoration opportunities in terms of maximizing restoration potential across the CSR project site. The project site was divided into four quadrants and four conceptual designs were evaluated for potential project benefits and impacts, including the No Action and Proposed Action described below. All conceptual designs included construction of a setback levee and adjoining seepage berms to minimize adverse impacts to adjacent properties, modifications to the existing levee to reconnect the Columbia River to the floodplain, as well as removal of the residential buildings, outbuildings, cattle grates and fences lines. All alternatives incorporated aspects of the final proposed design to increase restoration potential.

The simplest alternative (Alternative 1) restored hydrologic connectivity via modification of the existing levee, but did not actively restore habitat conditions across the site; following construction, much of the site would remain dominated by pasture grasses and non-native species. Under Alternative 1, the majority of the fill material needed for construction of the setback levee and adjoining seepage berms would be imported from off-site. Alternative 2 consisted of breaching the existing levee and excavating tidal channels on the southern portion of the project site to create wetlands across 42 acres. Excavation of tidal channels and wetlands had the added advantage of providing some of the material needed for construction of the setback levee, but additional material would be needed to construct the setback levee. Because the restoration potential of the CSR project site was not maximized under Alternatives 1 or 2, these alternatives were not further evaluated because they did not meet the goals and objectives of the project.

Alternative 3 included additional excavation of tidal channels and 14 acres of marsh habitat on the northern portion of the project site, connecting directly to the Columbia River via a second modification to the existing levee approximately 500 feet east of the levee breach at Tide Creek. Excavation of the channel network and marsh habitats in Alternative 3 had the added benefit of reducing imported materials required to construct the setback levee and adjoining seepage berms, all pervious and impervious material needed for levee and berm construction would originate from this increment. However, this alternative was not considered further because restoration across the project site was not maximized, as much of the site west of Tide Creek was not restored by these actions.

Alternative 4 included partial restoration of shrub and emergent wetlands west of Tide Creek by modifying the existing levee 2,250 feet west of the breach at Tide Creek and additional channel excavation to facilitate direct connection to the Columbia River. Because Alternative 4 did not maximize restoration potential of the CSR project site west of the railroad, it was not further evaluated.

Alternative 5, the Proposed Action, reconnected the ponded areas west of the railroad to the third levee breach via the installation of two bridges in the railroad embankment. Additionally, the access road between Highway 30 and the existing residence would be graded to match adjacent topography and facilitate hydrologic connectivity to the southwest portion of the project site.

3.4. Comparison of Alternatives

Each alternative, including the Proposed Action (described in detail above) was evaluated for environmental benefits and adverse impacts relative to the goals and objectives stated above. While No Action Alternative and Alternatives 1-4 provided fewer environmental impacts, they also provided fewer ecological benefits compared to Alternative 5, the Proposed Action. Over time, the proposed project is expected to provide the greatest environmental benefit to fish and wildlife, increasing wetland quality and quantity across the project site.

3.5. Best Management Practices

The Proposed Action would primarily result in beneficial environmental effects. However, in areas with the potential for deleterious effects, either short-term or long-term, best management practices (BMPs) would be used to minimize adverse impacts. All project actions would incorporate BMPs recommended by NOAA Fisheries and Oregon Department of Fish and Wildlife (ODFW) to protect fish and wildlife, as well as BMPs recommended by the Oregon Departments of State Lands and Environmental Quality to protect water quality and waters of the U.S.

The Corps would also follow all recommendations specified in the permitting and compliance documents associated with the proposed CSR restoration project. The proposed BMPs include, but are not limited to the following:

- Clearing and grading of vegetation would be limited to the minimum practicable extent and would occur immediately preceeding active construction to minimize potential impacts from increased erosion;
- Trees or vegetation not removed for construction would be maintained and protected against damage;
- Sediment fencing or another effective erosion control method would be installed in areas along the ordinary high water line to prevent siltation from adjacent work in upland areas;
- All completed bank sloping and stream channel work would be covered with mulch or fiber matting and revegetated as soon as practicable;
- Construction work would be sequenced and timed to occur during the ODFW approved in-water work window to limit erosion and sedimentation and minimize impacts to fish and aquatic wildlife;
- Staging areas would be located in previously disturbed uplands and all staging and stockpile areas would be restored after construction is complete;
- All areas disturbed during construction of the Proposed Action would be seeded or replanted with native vegetation following construction to support establishment of a native plant community and to prevent erosion and sedimentation;
- The Corps would implement the recommended guidance of the Oregon State Historic and Preservation Office (SHPO) for archaeological resources and would conduct monitoring during all ground disturbing activities; and
- Prior to construction, fish salvage and removal would be performed by a qualified fisheries biologist in all in-water work areas using guidelines from by NOAA Fisheries and ODFW.

3.6. Monitoring and Adaptive Management Plan

Under the Section 536 restoration authority, the Corps would monitor habitat changes and species response according to requirements of Section 2039 of Water Resources Development Act of 2007 and subsequent Corps implementation guidance. Monitoring would be conducted until such time that the Corps determines the project has achieved success and it is anticipated this would require five years of monitoring following project implementation. Ecosystem monitoring would evaluate physical and biological responses to the proposed restoration actions. In addition, all ground-disturbing activities associated with construction, including all excavations, grading and surface reconfigurations, would be monitored by professional archaeologists during construction for cultural and historic resources.

A monitoring and adaptive management plan has been developed to ensure the success of the recommended ecosystem restoration plan in meeting project objectives (refer to objectives in Section 1.4). Additional monitoring could occur at the CSR project site to support and inform research that the agencies conduct in conjunction with other programs, which would be separate from the monitoring conducted specifically to evaluate project success following implementation of the Proposed Action.[3] If adaptive management actions are warranted, the plan contains triggers to reevaluate the status of the project and recommend action needed to address issues so the project can again meet its restoration potential. The monitoring plan would include activities to measure connectivity to the mainstem Columbia River as a means of ensuring the project successfully restores hydrologic connectivity, meeting Objective 1. Connectivity would be evaluated by monitoring channel morphology at the levee breaches and tidal channels by measuring cross-sectional dimensions of the constructed channels. Similarly, fish surveys would be conducted to document the presence of juveniles salmonids and describe the composition of the fish in the project area following project implementation. Monitoring results from fish surveys would be used to ensure the project area is hydrologically connected to the Columbia River providing unencumbered access to critical foraging and rearing habitats on the project site for juvenile salmonids, thereby meeting Objectives 1 and 3.

Additional biological parameters would be monitored via annual surveys to evaluate the presence/absence of fish and wildlife, including juvenile salmonids, and the composition of native plant communities, meeting Objectives 2, 3, and 4. Vegetation transects and photo points could be used to measure species composition, survival rates and percent cover of vegetation in tidal channel, marsh, wetland, riparian and forested upland habitats. Survey transects through the CSR project area would be used to evaluate the percent cover of native versus non-native vegetation, including an evaluation of percent shade of tidal channels and wetland habitats contributing to off-channel habitat quality and the composition of native wetland plant communities, supporting overall productivity and the growth and survival of juvenile salmonids in the CSR project area, meeting Objectives 2 and 4.

[3] Additional data could be collected to inform research programs, examples of which include the installation of sediment pins to evaluate accretion, erosion and settlement in the tidal channels and marsh habitats following reconnection to the tidal prism. Water quality could be evaluated via temperature sensors to monitor changes across the CSR project site following implementation of restoration measures, informing how project actions change or impact (beneficial or adverse) the affected environment. Research monitoring results would provide lessons learned, informing future restoration projects to ensure successful implementation in meeting project objectives.

Adapative management triggers include the accretion of sediment such that hydrologic connectivity between the mainstem Columbia River and the CSR project site is blocked, there is a loss of off-channel rearing habitat, an absence of juvenile salmonids, or a widespread loss of native plant communities. If adaptive management actions are warranted, the Corps, BPA and CLT would review all data and causal factors to identify potential management actions and make a recommendation for implementation. Following a determination of project success, or the implementation of adaptive management measures to reach project success, the Corps could add this project to an existing program which regularly inspects completed restoration projects. After meeting project goals and objectives, if additional monitoring is warranted it would be funded by non-Federal dollars by the project sponsor (BPA) or land owner (CLT).

4. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The sections below describe the existing conditions of all human and natural resources that could be affected as a result of implementing the project alternatives described above. The resource descriptions provided below serve as the environmental baseline with which to compare the potential effects of the project alternatives considered in this draft EA. Two alternatives are evaluated in detail: the No Action Alternative and the Proposed Action.

Section 102 of NEPA, as amended, instructs federal agencies to insure that environmental amenities and values be given appropriate consideration in decision-making processes along with economic and technical considerations. For this action, only those resources which would influence the Proposed Action or which may be affected by the Proposed Action were evaluated. Other resources, including hydropower, irrigation, and navigation, were considered but not carried forward for detailed analysis because those resources would not be impacted by the Proposed Action. The following resources evaluated for potential effects include:

1. Hydrology and Hydraulics
2. Geography and Topography
3. Wetlands and Aquatic Habitats
4. Fish and Wildlife, including Threatened and Endangered Species
5. Water Quality
6. Soils and Sediment Quality
7. Air Quality and Noise Pollution
8. Cultural Resources
9. Recreation
10. Socio-Economic
11. Climate Change

The range of potential environmental consequences are discussed with respect to the context and intensity the No Action Alternative and the Proposed Action would have on each of the above listed resources at the CSR project site. The range of impacts are evaluated as two categories of effects: (1) direct effects, which occur at the same time and in the same place as the action; and (2) indirect effects, which occur later or at a location away from the action. Baseline conditions are used to evaluate and predict the range of potential effects, both temporary and permanent, resulting from implementing the No Action Alternative or the Proposed Action. The period of analysis for direct and indirect effects begins upon completion of the construction activities when potential benefits may first be achieved (2018) and extends for a duration of 50 years (2068) following implementation. It is assumed that the full extent of effects would be realized within the 50-year planning horizon, at which time, the project would

have reached a state of equilibrium. Cumulative effects are additive and include those effects which occur in the past, present, and reasonably foreseeable future, are discussed in Chapter 5.

As described in Chapter 1 of this document, prior to the conversion of floodplain habitats into agricultural lands, the Columbia River floodplain consisted of a complex mosaic of marsh and wetland habitats, tidal channels and sloughs, swamps and riparian forests supporting natural ecosystem functions and processes. Alterations in the hydrograph coupled with construction of the Columbia River Levee and 100 years of human uses in the lower Columbia River and estuary have fundamentally altered natural habitats and contributed to the evolution of present-day conditions in the lower Columbia River and estuary. For each of the resource categories listed above, the environmental consequences of the No Action Alternative are evaluated under the assumption that no restoration actions are implemented and existing conditions prevail for the duration of the planning horizon (50 years). Environmental consequences under the Proposed Action Alternative describe the state of the project site assuming the restoration actions described in Section 3.2 are implemented as described.

4.1. Hydrology and Hydraulics

At RM 75, the Columbia River is in a transitional zone subject to both tidal influences and streamflow generated from upstream runoff in the Columbia basin. Water levels on the mainstem Columbia River are managed most actively by the Corps between May and June to support navigation, downstream fish passage and minimize flooding during high water events. Table 3 summarizes the flood profile for the Columbia River at the CSR project site at RM 75.[4]

Table 3: Exceedance Flood Elevations from Columbia River Profiles

Exceedence	Water Surface Elevation (*NAVD 88*)
0.2 %	26.2
1%	23.4
2%	22.3
10%	19.6
50%	15.8

In addition to Columbia River flows, local hydrology, and hydraulics at the CSR project site are impacted by the overall drainage network for Deer Island and the historic Columbia River floodplain (see Figure 7). Deer Island, inclusive of the CSR project site, contains three natural conveyance channels: Tide Creek, Merrill Creek and Deer Island Slough. Tide Creek and Merrill Creek drain approximately 30 square miles, consisting of a mix of forested upland and cleared agricultural area. Drainage from this upland area collects at two distinct locations along Hwy 30, flowing under the highway, a frontage road and under a railroad bridge before finally discharging into a diversion channel that carries water south to Deer Island Slough. Merrill Creek flows is discharged into a diversion channel that directs water to Deer Island Slough. Deer Island Slough is split such that upland runoff is directed south to a tide box before discharging to the Columbia River and locally generated runoff is directed north to a manually operated pump station and a 72-inch gravity outlet with a flap gate.

[4] Elevations in Table 3 were obtained from flood frequency profiles based on storage-frequency relationships, unsteady flow models and engineering judgment. The flood profiles were developed in 1987 by the Corps.

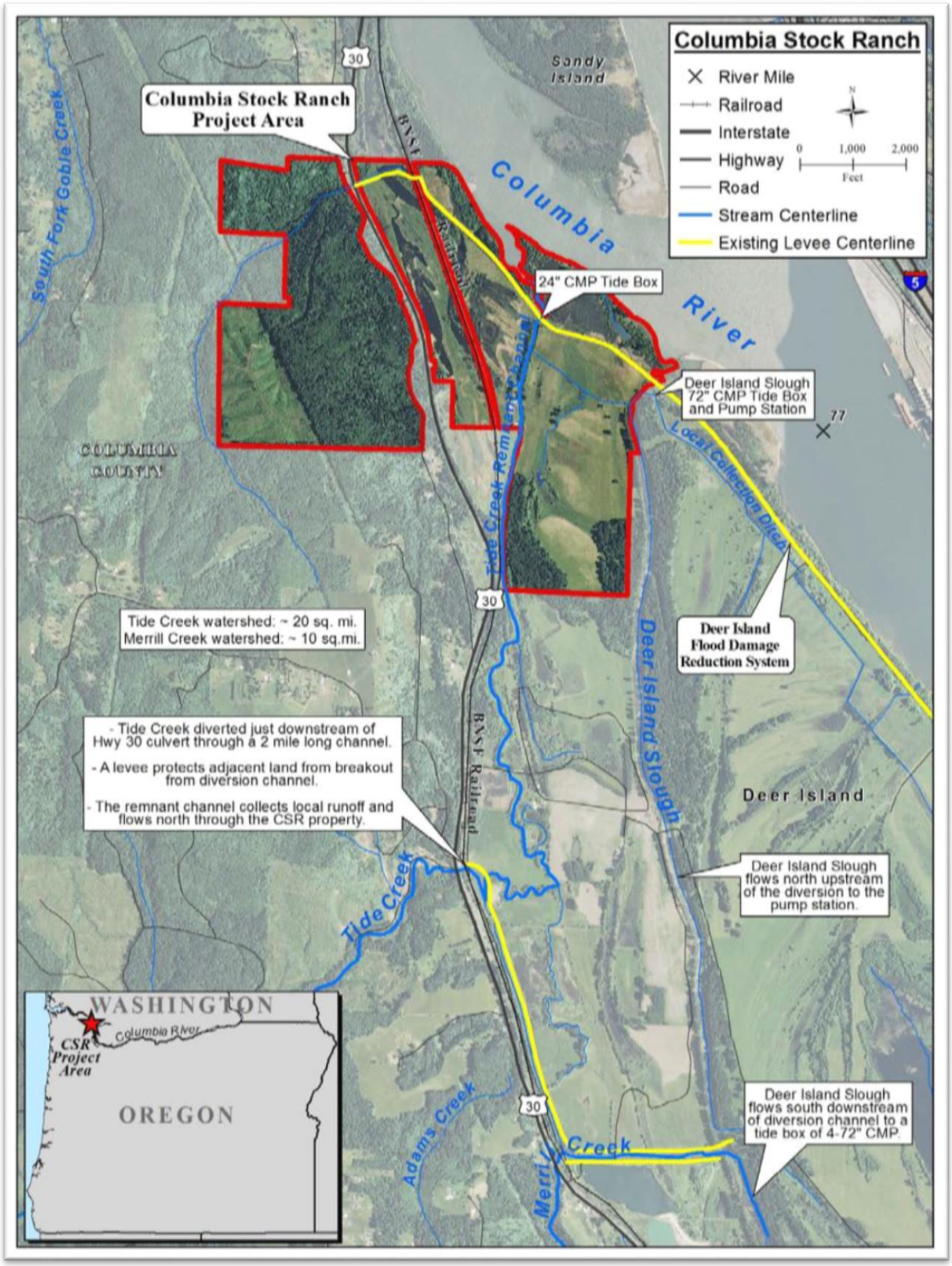

Figure 7: Drainage network associated with Deer Island and the CSR project site

Specific to the CSR project site, drainage within the site originates from local runoff that is carried by the remnant channel of Tide Creek and terminates in a 24-inch culvert with a flap gate in the levee before flowing into the Columbia River. There are several wetted areas on the project site fed by groundwater seepage, as well as local precipitation. These areas are not directly connected to the Columbia River or any other conveyance channels because the site is isolated from the mainstem river. During large interior flooding events, surface waters from Deer Island Slough can spill into the CSR property.

Flooding in the Deer Island complex landward of the levee coincides with high flows on the Columbia River, which halts gravity drainage through the flap gates at Tide Creek and Deer Island Slough. When the flap gates are closed, rainfall runoff, groundwater flux and seepage accumulates behind the levees and contributes to interior flooding. During the wet season, the pump station is currently operated to prevent nuisance flooding, and while not used frequently, pumping can occur for weeks at a time.

The pumping history between 2005 and 2013 is documented by the Deer Island Diking District log book, which reports that pumping was initiated at least four times to combat winter flooding and three times for spring freshets over the eight-year period of evaluation. Documented pumping shows that the pumps are used when runoff accumulates in the Deer Island watershed in response to prolonged rainy periods coincident with high Columbia River water levels. All permanent structures currently on the CSR project site and on Deer Island are located on relatively high ground with a minimum ground surface elevation of approximately 18 feet (NAVD 88).

Environmental Consequences

No Action Alternative

If no action were taken, the hydraulics and hydrology of the CSR project site would remain relatively unchanged from current conditions. The area would remain disconnected from the mainstem Columbia River, experiencing no tidal influence or connectivity to daily inundation patterns. Furthermore, current conditions are not anticipated to degrade during the period of analysis, nor are they anticipated to markedly improve with regards to habitat structure and function. Water control structures (culverts, tide gates, flap gates, pump stations, etc.) would remain in place and continue to limit or restrict floodplain inundation and surface water exchange. Operation of the pump station at Deer Island Slough would be maintained by the diking district to address incidental flooding associated with high flows and large rainfall events. Water levels within the Deer Island watershed and floodplain would not change as a result of the No Action Alternative and there would be no change to surface water elevations in the project site or adjacent properties.

Additionally, no off-channel habitats would be protected or restored and there would be no change in flood storage capacity and conveyance of waters during high flows under the No Action Alternative. Ponded waters west of the railroad would be disconnected from the Columbia River and would therefore be unable to support riverine and estuarine processes for the benefit of fish and wildlife.

Proposed Action

Following implementation of the Proposed Action and reconnection with the Columbia River, there would be effects to hydrology and hydraulics in the CSR project site. Where the existing levees would be breached or lowered, the project site would be inundated and hydrologic processes which have been disconnected for decades would be restored almost

instantaneously. The direct effects of this action would include localized increases in turbidity during and immediately following the initial breach, but it is assumed that these effects would be short-term and last no longer than the duration of construction. Due to these temporary impacts, the timing and method of construction would be coordinated to minimize potential adverse effects to water quality, nesting birds, and other environmental factors. Over time, the restoration of hydrologic connectivity and inundation at a project site would support the restoration of natural processes contributing to habitat establishment and development, fish and wildlife usage, and would influence structural and functional dynamics at the project site.

The hydrologic effects resulting from excavation of tidal channels to mimic historic conditions includes a change in the frequency, duration, and spatial extent of intertidal inundation on the floodplain and channel habitat compared to current conditions. Re-establishing surface connectivity via levee breaching and channel excavation would restore tidal exchange in the excavated channels and marsh habitats on a daily basis during normal or low flow conditions and throughout most of the project site during flows higher than the 2-year flood event (15.8 feet NAVD 88). These actions support the restoration and long-term maintenance of ecological processes and estuarine habitats in the lower Columbia River and estuary. The size and shape of the tidal channel networks is designed to support the full tidal prism and allow for sediment erosion and accretion to equilibrate over the course of several years and a variety of hydrologic conditions. Restoring the tidal prism and hydrologic connectivity has indirect effects on the project site, including increased support for ecological processes influencing fish and wildlife production, water quality, sediment transport processes, nutrient cycling, primary production and food web dynamics, and water storage to attenuate the impacts of high flow and flood events.

In addition to the ecological effects of the Proposed Action, the Corps evaluated potential impacts to adjacent properties in response to alterations to the downstream boundary of Tide Creek from its current configuration. These changes include altering drainage patterns and a reduction in the total drainage area and storage capacity within the Deer Island watershed by 3 percent. Seepage and groundwater exchange influence interior flooding on Deer Island, and both processes are associated with a deep, highly permeable layer of uniformly graded, clean sand. Following implementation of the proposed restoration actions, namely construction of the setback levee, seepage rates and groundwater exchange are assumed to remain similar to existing conditions because there would be no effective change in the total length of the flood protection levee and subsurface materials would remain unchanged. Because the drainage area and storage capacity of the Deer Island watershed would be reduced following implementation, there could be increased water levels and interior flooding during intense rainfall events and high flows on the Columbia River. In response to these potential impacts, the Corps conducted a hydrologic and hydraulic (H&H) analysis to assess the range of impacts resulting from implementation of the Proposed Action.

The H&H analysis assessed maximum water levels, the Deer Island pump station, and corresponding impacts to adjacent properties during flood events. Conclusions were drawn from model simulations, field observations, and general understanding of the hydrology on Deer Island. During normal and low flow conditions when the pump station is not operated, surface water levels may be consistently higher due to the introduction of a fish-friendly tide gate replacing the gravity outlet at Tide Creek, but water levels would remain in-bank and there would be no flooding. Introduction of a fish-passable tide gate in Tide Creek would result in a daily tidal signal in Tide Creek during most of the year. Under normal conditions when the pumps are running and inflow does not overwhelm the pump station, there would be virtually no rise in maximum water levels due to normal operation of the pumps; large storms could

result in instances when inflow exceeds the pumping capacity at Deer Island Slough, and water levels could rise 0.2 feet and result in nuisance flooding until the pump station catches up with the inflow. During extreme events, water levels could increase upwards of 0.5 feet. The probability of flood conditions resulting in a 0.5 feet rise is less than 1 percent (100-year recurrence interval).

Based on the results of the H&H analysis, operation of the pump station is not expected to change considerably. Simulations of large rainfall events did not change the duration of pumping, but rather altered the window during which the pumps were turned on (i.e. the pumps were turned on earlier in an event). Because the pumps are usually operated for days to weeks during flooding events, this change would have no noticeable impacts in the operation of the pumps compared to current conditions. During a moderate flood event that is driven by seepage from high flows on the Columbia River, pump capacity could exceed inflow volumes, resulting in rapid dewatering of Deer Island Slough. In this case, one pump would likely be operated with frequent on-off cycles to reduce nuisance flooding until the Columbia River recedes to lower flows, resulting in an increased frequency of shorter pump cycles, which ultimately could increase pump maintenance and repair needs.

An overflow channel was incorporated into the design of the Proposed Action to maintain the current pattern of drainage between Tide Creek and the Deer Island Slough. Model results were used to optimize the channel geometry and invert elevation (the elevation at which the overflow channel connects to Tide Creek) of the overflow channel. It should be noted that without the overflow channel included as part of the restoration actions, model results showed water surface elevations would increase by as much as 1.0 foot upstream of the CSR project site during common flood conditions and throughout the entire Deer Island complex during major flood events. Additionally, replacement of the gravity outlet in Deer Island Slough would support evacuation of flood waters during high flow events. Replacement of this water control structure would not minimize the maximum extent of inundation; rather, increasing the capacity of this outlet would increase the rate of evacuation, minimizing the time agricultural areas landward of the setback levee are inundated during high flow events.

4.2. Geology, Topography and Soils

The CSR project site is generally characterized as a flat, low lying historic floodplain with pockets of wetlands, channel bars, and numerous existing and abandoned channel features. Construction of the Deer Island Levee in 1942 interrupted the natural interaction of Tide Creek and Deer Island Slough with the Columbia River, disconnecting the CSR project site from flood events. Embankments and levees constructed over the past 100 years have further fragmented the site, including the railroad alignment bisecting the CSR property.

Site elevations east of the Hwy 30 range from 4 to 40 feet (NAVD 88), with the majority of the site ranging from 10 to 20 feet (NAVD 88). Some isolated low lying elevations fall below 10 feet, but these are confined to ponded areas and existing channels. Land use practices and anthropogenic activities have fundamentally altered the topographic landform of the CSR project area. In the project area, the top of the railroad embankment is between 20 and 28 feet, which is approximately 10 feet above adjacent ground elevations. The portion of the levee bordering the eastern boundary of the project site tops at 30 to 32 feet, which is approximately 20 feet above the adjacent ground level. State Highway 30, located at the western boundary of the CSR site, is between 30 and 40 feet, and is situated approximately 20 feet higher than the adjacent grade. Consequently, the existing landform at the project site has many areas that are higher in elevation than historic conditions.

Soils consist primarily of silty loams deposited during frequent historic flooding from the Columbia River (NRCS 2012). Geologic mapping by the U.S. Geologic Survey show the CSR project site is underlain by Holocene and Pleistocene, unconsolidated alluvial deposits[5]. Generally, these deposits are mostly silt and fine sand, ranging from 65 to 100 meters thick around Deer Island; surface soils consist of silty alluvium between 1 and 15 feet thick. Additionally, the Natural Resources Conservation Service (NRCS) listed soils located in the project site as:

- rafton silt loam
- rafton silt loam, protected
- Sauvie silt loam
- Sauvie silt loam, protected
- Wauld very gravelly loam, 30 to 70 percent slopes
- Wauld-rock outcrop complex, 5 to 30 percent slopes
- Xeropsamments, nearly level
- Xeropsamments, nearly level, protected.

Sediment samples were collected by the Corps' Sediment Quality Team on June 11, 2015, to screen CSR project soils and sediments for contaminants. Section 404 of the Clean Water Act (CWA) (40 C.F.R. § 230.60-230.61) requires sediment testing when there is reason to believe contaminants may be present within dredged or fill material that are discharged into waters of the United States, including wetlands. The Corps uses the 2009 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) to comply with the CWA sediment testing regulations (Corps 2009a). Soil samples were evaluated for a multitude of compounds, but semi-volatile organic compounds, polychlorinated biphenyls (PCBs), organotin compounds, total petroleum hydrocarbons (TPHs), and dioxin and furan congeners were not analyzed. Based on the current and historical land use, there is no reason to believe that these contaminants would be onsite, however TPHs may be present at low concentrations in the farmstead area (e.g., where tractors and farm equipment have been stored throughout the years).

Three composite samples were collected from the CSR project area and laboratory results were compared to the 2015 freshwater benthic toxicity screening levels[6]. All samples were composed mostly of fine silts and clays, and total organic carbon ranged from 1.2 to 2.0%. No pesticides were detected above laboratory limits of quantitation in any of the three samples. Metals concentrations were below their respective screening levels, except for arsenic, which was slightly elevated. The reported arsenic concentration is not substantially different from the screening level and the reported concentration is less than 10% above the screening level[7]. This difference is within the margin of error associated with the laboratory's instrumentation. Additionally, the SEF allows for background considerations of metals in sediments and the

[5] Evarts, R.C. 2002, Geologic Map of the Deer Island Quadrangle, Columbia County, Oregon, and Cowlitz County, Washington, U.S. Geologic Survey, Miscellaneous Field Studies Map MF-2392.

[6] Screening levels were developed by the interagency Regional Sediment Evaluation Team (chaired by the Corps, Northwestern Division, and EPA-Region 10) for use in the SEF.

[7] 1 mg/kg = 1 part per million

reported arsenic concentration falls within the range of background soil concentrations measured for the Coast Range region of Oregon (ODEQ 2013).

In addition to sediment quality, subsurface explorations were conducted between July and October 2015 to facilitate evaluation and design considerations for construction of the setback levee and seepage berms. Hand augers, borings and cone penotrometer testing was conducted to evaluate sub-surface conditions on the CSR project site. Holes were drilled to depths generally between 30 and 50 feet, with the deepest cone penotrometer test reaching a depth of 100 feet below the ground surface. Pervious sand with silty layers was encountered at depths 11 to 12 feet below silty alluvial material at the surface. At the time of drilling, groundwater was encountered between 3.5 and 7.5 feet (NAVD 88). The silty alluvial material ranged from 2 to 3 feet near the Deer Island Slough pump station, 5 to 10 feet thick near the center of the CSR project site.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, the geology, topography, and soil type and structure of the CSR project site would remain unchanged from existing conditions. Short-term construction related impacts, including the opportunity for increased erosion, compaction, and importation of non-native material would not occur. Current levees, dikes, and drainage channels would remain in place and continue to limit tidal influence on the CSR project site, providing limited benefit to physical processes dependent on tidal exchange and hydrologic circulation of the lower Columbia River. Water control structures would remain in place and continue to limit or restrict alluvial sediment transport processes and erosion/accretion rates. No off-channel habitat would be protected or restored, and floodplain wetlands would be disconnected from the mainstem river and channel forming processes would be absent from the CSR project site.

Proposed Action

Construction of the setback levee, modifying the existing levee, and excavating tidal channels and marsh habitat throughout the CSR project site would impact local geology, soils, and topography than other project components. These effects include temporary erosion and sedimentation, altered channel form, structure and density, localized changes in velocity, flow and circulatory patterns influencing channel form and function, and increased groundwater exchange resulting in changes to soil structure and porosity. Short-term construction-related impacts include temporary increase in soil erosion, compaction, and mixing of soil horizons associated with staging and access roads, earthwork and grubbing of vegetation.

Following implementation of the Proposed Action, soil erosion would occur during and immediately after levee breaching, when destabilized soils would be exposed to daily tides and high flows. However, soil erosion would decrease rapidly over time as the site becomes stabilized and vegetation becomes established on the project site. Because vegetation communities in the lower river are highly dependent on elevation and inundation frequency, as tidal marsh habitat develops and habitat succession occurs, site topography and elevation could change in response to sediment accretion and localized patterns of erosion that occur as a function of increased tidal exchange and the restoration of alluvial and sediment transport processes. Accretion is expected to balance with erosional forces over time to establish a self-sustaining marsh ecosystem.

Soils in the project area have slightly elevated arsenic concentrations, but concentrations are within range of natural background concentrations found in the region. For this reason, there

would be no adverse impacts from disturbing these sediments during construction and the Proposed Action does not present a substantial ecological risk. In addition, sediment quality represented by the Corps' sampling framework are suitable for unconfined, aquatic placement and exposure.

The Corps conducted a geotechnical analysis to evaluate the range of impacts to physical characteristics of the CSR project site following implementation of the Proposed Action. The analysis modeled seepage, internal erosion, stability, groundwater observations and estimates of settlement. Observations of geologic conditions following historic flooding events (for example, the 1948 Columbia River flood) reveal that numerous sand boils have occurred on the CSR project site, indicating that the setback levee may be susceptible to failure via internal erosion of the levee foundation. Internal erosion occurs when water flows through a cavity in an embankment, washing fine particles of soil out of the core ultimately leading to failure of the embankment. Analysis results indicate the thin alluvial cover and pervious sand underlying the alluvium is susceptible to heave and internal erosion at the design height of the setback levee (32 feet NAVD 88), but inclusion of seepage berms on the landward side of the setback levee would alleviate this potential issue. Further, during the 1948 flood, the existing levee with the relatively steep side slopes was stable and the proposed setback levee is assumed to remain stable given its flatter design and similar foundation conditions.

4.3. Vegetation, Wetlands and Aquatic Habitats

Historic topography sheets (t-sheets) indicate this portion of the Columbia River floodplain was largely composed of wetland forest and freshwater, emergent marsh along the floodplain channels. Wetlands on the project site are a mosaic of riverine, palustrine, and lacustrine (including forested and emergent vegetation communities and permanent, semi-permanent, seasonal, and temporary hydrologic regimes). Riverine, forested wetlands are found bordering the Columbia River north of the levee. This area is seasonally flooded and consists of a mosaic of deciduous vegetation and other woody strata. Many native plants are crowded out by a dense monoculture of RCG found throughout the CSR project site, degrading overall habitat condition.

Following construction of the Columbia River Levee in 1942, arable lands south and west of the levee were managed as pasture for cattle grazing and are now largely dominated by non-native grasses. Aquatic habitats south of the levee are a continuum of palustrine (forested and emergent) wetlands and open water ponds. These wetland areas provide habitat for an assortment of waterfowl, amphibians, and isoloated fish populations, but are disconnected from regular hydrologic exchange with the mainstem Columbia River. Forested areas buffering the wetland complex west of Tide Creek, where elevations are slightly elevated, also support seasonally flooded forests. Tide Creek bisects the property north-to-south and is bordered by a riparian corridor, providing the only stream habitat on the CSR project site.

In July 2015, the Corps conducted a wetland delination to evaluate the status of wetlands on the CSR project site. Emergent, forested, shrub, and tidal wetlands were documented primarily along the waterways and lowland areas of the site (see Figure 8). Emergent wetlands are common and the herbaceous-dominated lowlands include fringe wetlands along waterways, depressions, and sloped wetlands. The total acreage of emergent wetlands on the site is approximately 117.4 acres, ranging between 11.5 and 14 feet (NAVD 88). Hydrology in the area is impounded by the railroad and levee and the emergent wetlands riverward of the levee are connected to tidal wetlands and channels which are directly influenced by the Columbia River. Forested wetlands are located in the southern portion of the site, totaling approximately 1.5 acres. Shrub wetlands are uncommon and located in the central portion of the site, totaling

approximately 7.5 acres. Tidal wetlands are present near the former connection of Tide Creek to the Columbia River, riverward of the existing levee, and total approximately 5.7 acres.

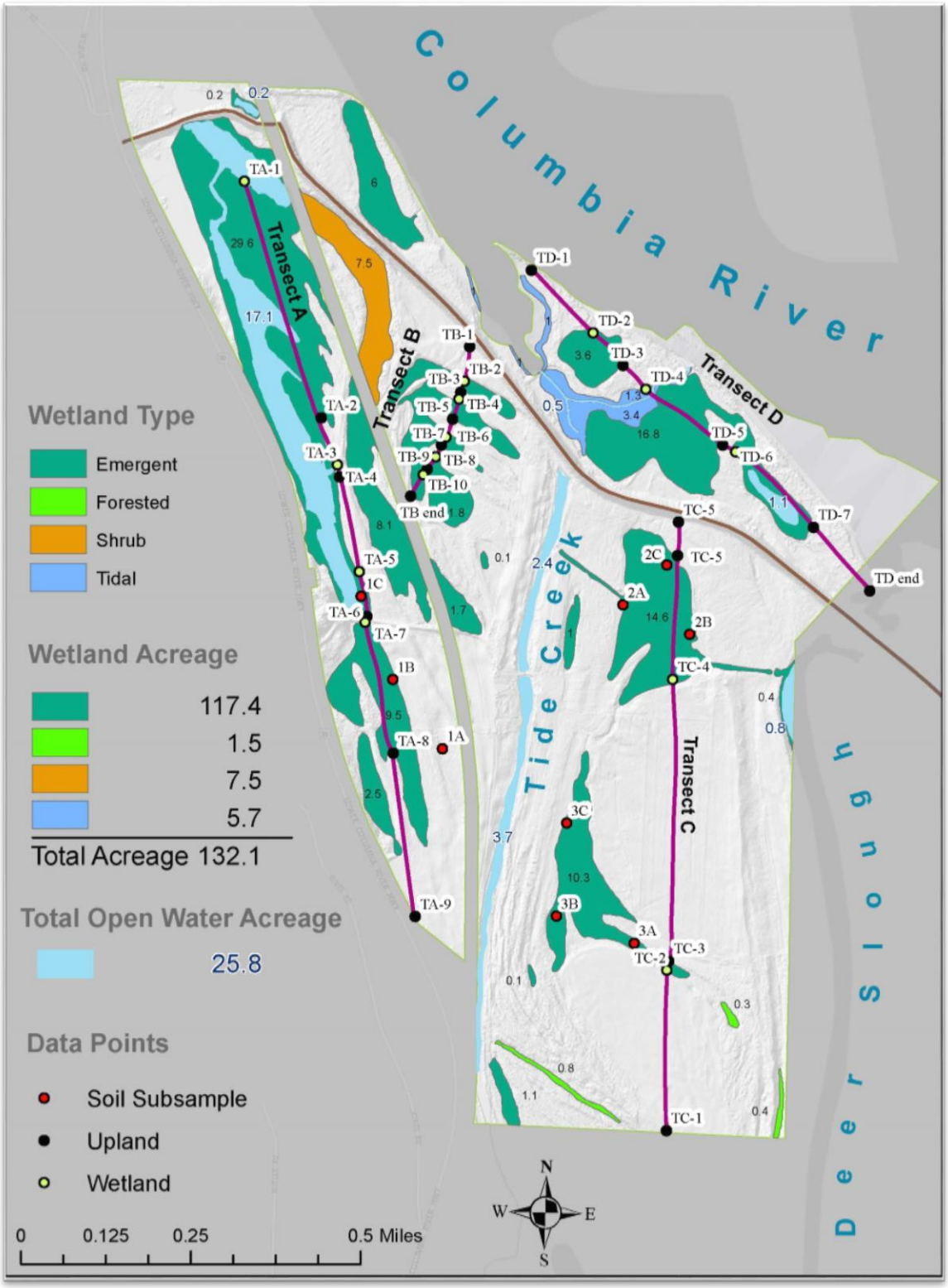

Figure 8: Wetlands and waters of the U.S. within the CSR project area

Common vegetation communities on site range from low diversity areas of pastures, fence rows, and hay fields to more diverse areas of riparian forests, ponds, emergent wetlands, and tidal wetlands. Dominant forest species include big-leaf maple (*Acer macrophyllum*), black cottonwood (*Populus balsamifera*), black hawthorn (*Crataegus douglasii*), Oregon ash (*Fraxinus latifolia*), nootka rose, elderberry (*Sambucus racemosa*), Himalayan blackberry (*Rubus armeniacus*), and red alder (*Alnus rubra*). Dominant pasture species include velvet grass, red fescue (*Festuca rubra*), perennial rye grass (*Lolium perenne*), barnyard grass (*Echinochloa crus-galli*), bluegrass (*Poa palustris*), orchard grass (*Dactylis glomerata*), and RCG. Wetland plant species include wapato, arrowhead (*Sagittaria longiloba*), large-leaf pondweed (*Potamogeton natans*), common velvetgrass, and water purslane (*Ludwigia palustris*). Other common plant species across the site included cat's ear (*Hypochaeris radicata*), tufted hairgrass, Canadian thistle (*Cirsium arvense*), Pacific willow, Douglas fir (*Pseudotsuga menziesii*), soft rush, white clover (*Trifolium repens)*, elderberry (*Sambucus racemosa*), and bentgrass (*Agrostis scabra*).

Environmental Consequences

No Action Alternative

Under the No Action Alternative, vegetation throughout the CSR project would continue to provide low quality habitat to fish and wildlife. Invasive species would not be sufficiently managed and would likely continue to spread throughout the project area. Native vegetation would continue to be limited by non-native species.

Wetlands are complex ecosystems that perform a variety of important physical, chemical and biological functions which are essential to the health of the environment, including:

- Water storage and flow regulation: Wetlands provide temporary storage of storm flows, which reduces erosion and flood peaks, as well as maintenance and recharge of water flows during dry periods.
- Water quality protection and improvement: Wetlands retain and filter excess nutrients, sediments, and contaminants, and native vegetation communities support water quality through temperature moderation and shade cover.
- Biological productivity: Wetlands provide diverse habitats for fish and wildlife, including breeding grounds, nesting and foraging sites, refuge, and other critical habitat for a variety of fish and wildlife.

The extent of wetlands in the CSR project area would remain the same and functional processes would be limited under the No Action Alternative. Construction-related impacts to wetlands would not occur and wetland functions and values would not improve, limiting water storage, flow regulation, and filtration, and provide no benefits to fish and wildlife.

Proposed Action

Hydrology would be the driving force determining the composition of plant communities and wetland function following implementation of the Proposed Action. The duration and frequency of tidal and seasonal inundation would return to a more natural hydrologic regime. These factors are expected to increase the abundance and diversity of native wetland plants and reduce the composition and spatial extent of non-native species over time. Low elevation marsh habitats would experience daily tidal inundation throughout most of the year, and planting dense concentrations of native wetland species in the excavated marshes would reduce the likelihood of the RCG dominating the aquatic habitats. Higher elevation marsh habitats would be planted with a combination of native "wet" tolerant herbaceous plants,

shrubs and trees. The plant community on the CSR project site is expected to undergo successional changes, largely seeding itself from surrounding sources over the long-term and develop into shrub-scrub habitat.

Two primary emergent wetland areas (14.6 acres and 10.3 acres) would be affected by construction activities associated with implementing the Proposed Action at the CSR project site. Excavation of tidal marsh habitats and construction of the setback levee would result in the temporary loss of approximately 20 acres of emergent, tidal, and forested wetlands. However, the restoration of hydrologic connectivity is expected to result in a substantial net gain to the quality and quantity of wetlands in the project area. In response to the Proposed Action, the establishment and restoration of wetlands in the project site is expected to directly result in increased water storage capacity and flow moderation during flood events, improved water quality via retention and filtration, and indirectly support overall biological productivity by providing feeding and rearing habitat and nesting, and foraging opportunities, benefiting a wide variety of fish and wildlife.

Following implementation of the Proposed Action, the CSR project site would be dominated by three main habitat types: tidal channels and streams, marsh, scrub shrub and forested wetlands. Riparian and upland forests would be maintained to the maximum extent practicable, but some trees would be removed during construction of the setback levee. It is important to note that planned vegetation communities would not adhere to a prescribed planting plan. Rather, a diversity of native species would be planted at variable densities at species-specific elevations to promote varied vertical and horizontal strtucture across the project site according to the different project elements.

Construction would require the use of scrapers, graders, excavators, dump trucks, and other heavy equipment as needed. Equipment would be used to create intertidal channels, marsh habitats, and scrub-shrub habitat on the floodplain. Trees removed during construction of the setback levee would be used during the restoration activities associated with tidal channels and marsh habitats to simulate beaver activity and fallen trees from adjacent riparian areas or drift wood from the Columbia River. Because the CSR floodplain would be a low-energy environment, trees would not be anchored using mechanical means (rebar), but would be free to move with the tides and high flood waters.

While native grasses and other graminoids would be seeded and planted across the site, native species take longer to establish and are often unable to compete against aggressive species like RCG. Because RCG is known to occupy elevations above 8.7 feet (NAVD 88) in this reach of the Columbia River watershed, it is expected to be difficult to control in wetland habitats. Invasive species control on the CSR project site following implementation of the Proposed Action would rely primarily on mechanical and chemical methods for eliminating and controlling the establishment and colonization of RCG. Any application of herbicides would follow BMPs and conditions of all permits from NOAA Fisheries, Oregon DEQ, and DSL. There may be short-term, localized impacts to water quality and non-target vegetation following application of herbicides targeting invasive species, examples include a temporary increase in turbidity associated with from water runoff from herbicide application or the localized loss of vegetation immediately adjacent to invasive species where coverage of herbicide overlaps spatially. There is an expectation that the composition of vegetation communities in the CSR project site will transition to increased coverage of native species and, once established, native species would be able to out-compete or shade out RCG.

4.4. Fish and Wildlife

Many of the existing ponded areas and wetlands provide aquatic habitat for waterfowl and local, isolated fish populations. However, many of these areas lack a native riparian canopy and shrub layer, reducing overall habitat quality. There is evidence of beaver activity and presence in several locations west of Tide Creek and riverward of the existing levee. Recent research has shown the synergistic benefits for fish and other wildlife from beaver activity in tidally influenced habitats (Hood 2012). While unknown in the project area, native freshwater mussels are present in Merrill Creek, a tributary to Deer Island Slough upstream of the CSR project site (Allard et al. 2015). Freshwater mussels, including western pearlshell mussels (*Margaritifera falcata*), are thought to be long-living invertebrates and commonly exceed 100 years of age. Many freshwater mussel species are imperiled throughout North America. In addition, western pearlshell mussels are extremely slow growing and show little movement (if any) between sites, suggesting that movement into an area is dependent on external factors, including host fish transporting mussel larval as parasites into new areas or water currents transporting larvae downstream.

Site visits have documented the presence of several piscivorous birds in the project area, including cormorant ssp. (*Phalacrocorax sp.*), hooded mergansers (*Lophodytes cucullatus*), belted kingfisher (*Megaceryle alcyon*), and pied-billed grebes (*Podilymbus podiceps*), which indicates that fish communities are present, but specific species and densities are unknown. Fish ingress and egress in the project area has been functionally restricted following construction of the railroad and Columbia River Levee; any fish communities present on the site are presumably isolated from the Columbia River. However, recent fish surveys and monitoring by the Tidal Freshwater Monitoring project (funded by BPA and the Corps, conducted by the Pacific Northwest National Laboratory (PNNL)) found abundant juvenile Chinook (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and chum (*O. keta*) throughout the lower Columbia River; juvenile steelhead (*O. mykiss*) were found in lower densities throughout the lower river. Because the CSR project site is isolated from tidal waters, juvenile salmonids are unable to access and benefit from the off-channel habitats currently present in the CSR project area. Results from fish surveys in adjacent waterways (Deer Island Slough and Tide Creek south of the CSR property) included 20 taxa of fish, where threespine stickleback (*Gasterosteus aculeatus*) and sculpin were the most abundant fish species; no salmonids were detected in the Deer Island Slough adjacent to the project site during the fish surveys (USFWS 2009, 2010a).

Threatened and Endangered Species – NOAA Fisheries

The ESA, as amended, provides for the conservation and recovery of endangered and threatened species and the ecosystems upon which they depend. The U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries share joint jurisdiction for the administration of ESA-listed species. Under Section 7 of the ESA, federal agencies are required to evaluate the effects of actions they fund, permit, or authorize, and consult with the USFWS or NOAA Fisheries to ensure federal actions do not jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Critical habitat is defined as specific geographic locations critical to the existence of listed species.

Species under the jurisdiction of NOAA Fisheries include 13 ESUs of salmonids found in the Columbia River adjacent to the CSR project site, listed in Table 4. In 2005, critical habitat was designated for all Columbia River salmon and steelhead ESUs, with the exception of lower Columbia River coho. Critical habitat for lower Columbia River coho was designated in 2013.

Table 4: NOAA Fisheries ESA-listed Species

Species	Federal Status	Critical Habitat Status
Chinook salmon (*Oncorhynchus tshawytscha)*		
Snake River spring/summer	Threatened 70 Federal Register (FR) 37160	Designated 58 FR 68543
Snake River fall	Threatened 70 FR 37160	Designated 58 FR 68543
Upper Columbia River spring	Endangered 70 FR 37160	Designated 70 FR 52685
Estuary	Threatened 70 FR 37160	Designated 70 FR 52685
Upper Willamette River	Threatened 70 FR 37160	Designated 70 FR 52685
Steelhead (*O. mykiss*)		
Snake River	Threatened 70 FR 37160	Designated 70 FR 52685
Upper Columbia River	Threatened 74FR 42605	Designated 70 FR 52685
Middle Columbia River	Threatened 57 FR 14517	Designated 70 FR 52685
Estuary	Threatened 62 FR 43937	Designated 70 FR 52685
Upper Willamette River	Threatened 62 FR 43937	Designated 70 FR 52685
Chum Salmon (*O. keta*)		
Columbia River	Threatened 70 FR 37160	Designated 70 FR 52685
Sockeye Salmon (*O. nerka*)		
Snake River	Endangered 70 FR 37160	Designated 58 FR 68543
Coho Salmon (*O. kisutch*)	Threatened 70 FR 37160	Designated 81 FR 9251
Pacific eulachon (*Thaleichthys pacificus*)	Threatened 75 FR 13012	Designated 76 FR 65323
Southern Distinct Population Segment (DPS)	Threatened 75 FR 13012	Designated 76 FR 65324
Green sturgeon (*Acipenser medirostris*)		
Southern DPS	Threatened 71 FR 17757	Designated 73 FR 52088
Bull Trout (*Salvelinus confluentis*)		
Columbia River DPS	Threatened 63 FR 31647	Designated 75 FR 63898
Coastal Cutthroat Trout (*O. clarki clarki*)	Species of Concern	None
Pacific lamprey (*Lampetra tridentata*)	Species of Concern	None

In addition to the 13 ESUs listed above, coastal cutthroat (*O. clarki*) could be present in the lower Columbia River near the project site. ODFW has documented the presence of coho, steelhead, coastal cutthroat trout and Pacific lamprey in off-channel habitats near the CSR project site (USFWS 2009). The lower Columbia River and estuary are important areas for anadromous fish migrating to spawning areas and for juveniles migrating downstream to the ocean. Adult ESA-listed anadromous salmonids use the lower Columbia River and estuary as a corridor to migrate upstream to spawning habitats throughout much of the Columbia River Basin. Adults actively migrate and are not expected to use the area adjacent to the CSR project site for resting or feeding, although individuals could spend time in the estuary to physiologically acclimate to freshwater, especially if they find cool water areas during warmer summer months. Chum, coho and Chinook salmon, and steelhead populations spawn in tributaries to the Columbia River, and chum and Chinook salmon spawn in the mainstem Columbia River in appropriately sized gravel. Spawning is not expected to occur in the CSR project site because the site lacks the appropriate spawning habitat and substrate.

The lower Columbia River and estuary provide overwintering, foraging, and rearing habitat for juveniles before they enter the ocean environment. Juvenile salmonids, particularly those with ocean-type life histories (e.g., subyearling or early life-stage Chinook salmon [i.e., Lower Columbia River, Snake River, Upper Willamette River ESUs] and chum salmon), rear in the shallow water and nearshore habitats in the lower Columbia River estuary for up to several months before moving out into the ocean (Simenstad et al. 1982, Bottom et al. 2001, Williams 2006). Rearing occurs primarily in low-energy, shallow off-channel habitats year-round. The majority of juvenile salmonids out-migrate in mid- to late winter, late spring and early summer, although fall Chinook salmon typically have a more extended outmigration period than other Columbia Basin salmonids and commonly out-migrate in late summer as well.

In addition to Pacific salmonids, the Southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) and the Southern DPS of Pacific eulachon (also known as Columbia River smelt) (*Thaleichthys pacificus*) are both listed as threatened under the ESA and may be present in the Columbia River near the CSR project site. The Southern DPS of green sturgeon was listed in July 2006 and the Southern DPS of Pacific eulachon was listed in March 2010. Both species have designated critical habitat in the mainstem Columbia River, but critical habitat does not include aquatic habitats present on the CSR project site. Furthermore, green sturgeon and eulachon do not currently have access to aquatic habitats in the project area (like salmonids), nor are habitat conditions suitable in the project area to support individuals of either species.

Green sturgeon is a widely distributed, marine-oriented sturgeon found in nearshore waters from Baja California to Canada, spawning in the Sacramento, Klamath and Rogue rivers in the spring. Spawning occurs in deep pools or holes in large, turbulent river mainstreams. Two DPSs have been defined, a Northern DPS with spawning populations in the Klamath and Rogue rivers and a Southern DPS that spawns in the Sacramento River. While the southern DPS was listed as threatened in 2006, the northern DPS remains a species of concern. Critical habitat for Southern DPS was designated in 2009 and includes all tidally-influenced areas of the Columbia River to approximately RM 46 and up to MHHW and includes adjacent coastal marine areas [74 Federal Register (FR) 52300]. The CSR project site does not fall within range of critical habitat designation for the Souther DPS of North American green sturgeon.

Information from fisheries-dependent sampling suggests that green sturgeon only occupy large estuaries during the summer and early fall in the northwestern U.S. Commercial catches of green sturgeon peak in October in the Columbia River estuary, and records from other estuarine fisheries (Willapa Bay and Grays Harbor, Washington) support the idea that sturgeon are only present in these estuaries from June until October. Green sturgeon enter the Columbia River at the end of spring with their numbers increasing through June, and the greatest numbers are caught in the estuary between July and September. The majority of green sturgeon were caught in the lower reaches of the Columbia River based upon harvest information from 1981-2004. There are no known spawning populations in the Columbia River and its tributaries.

NOAA Fisheries listed the Southern DPS of Pacific eulachon (smelt) as threatened in March 2010. This DPS consists of populations spawning in rivers south of the Nass River in British Columbia, Canada, to and including the Mad River in California. The Columbia River and its tributaries support the largest known eulachon run. The major and most consistent spawning runs return to the mainstem Columbia River (from just upstream of the estuary at RM 25 to immediately downstream of Bonneville Dam) and in the Cowlitz River.

Eulachon typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through early summer. Spawning occurs in January, February, and March in the Columbia River. Spawning occurs at temperatures from about 39° to 50°F (4° to 10°C) in the Columbia River and tributaries over sand, coarse gravel, or detrital substrates. Shortly after hatching in late spring, the larvae are carried downstream. Shortly after emergence from their egg, eulachon are dispersed by estuarine and ocean currents into the ocean, indicating short rearing time in the estuarine environment. Juvenile eulachon move from shallow nearshore areas to deeper areas over the continental shelf, becoming widely distributed in coastal waters.

Essential Fish Habitat

The Magnuson-Stevens Fisheries Conservation and Management Act of 1976 (16 U.S.C. 1801 *et seq*.) regulates Essential Fish Habitat (EFH) for the conservation and management of highly migratory species. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Waters include aquatic areas and their associated physical, chemical, and biological properties used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities. "Necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 C.F.R. §600.10 (2010)). Relative to the CSR project site, the Columbia River mainstem supports EFH for Pacific Coast Salmon, but EFH is not currently present in the CSR project site.

Threatened and Endangered Species – USFWS

Threathened and endangered species found in or near the CSR project site which are under the jurisdiction of USFWS are listed in Table 5 and include the Columbia River population of bull trout, which was listed as threatened under the ESA in 1998. In addition, it is unknown if Columbian white-tailed deer (*Odocoileus virginianus leucurus*) are present in the project vicinity, but they are known to occur in Columbia County, Oregon. The deer are closely associated with bottomland, riparian habitats in the lower Columbia River estuary; however, no critical habitat has been designated for this species. Streaked horned larks (*Eremophila alpestris strigata*) were listed as threatened under the ESA in October 2013, and critical habitat was designated in select locations within the Columbia River. Streaked horned larks prefer open habitats with sparse vegetation, typical of highly disturbed areas where vegetation succession occurs following disturbance. These areas are currently found on sites in the Columbia River used by the Corps for the placement of dredged materials. The closest location with known streaked horned larks is Sandy Island, immediately across the river from the CSR project site. The Western DPS of yellow-billed cuckoos (*Coccyzus americanus*) was listed as threatened under the ESA in November 2014. Cuckoos use wooded habitats associated with riparian areas along streams and marshes, but it is believed to have been extripated from Oregon and Washington as a breeding species for the past 90 years (USFWS 2014).

Table 5: USFWS ESA-listed Species

Species	Listing Status	Critical Habitat
Bull trout (*Salvelinus confluentus*)	Threatened 63 FR 31647	Designated 75 FR 63898
Columbian white-tailed deer (*Odocoileus virginianus leucurus*)	Endangered 32 FR 4001	None

Streaked horned lark (*Eremophila alpestris strigata*)	Threatened 78 FR 61451	Designated 78 FR 61506
Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened 79 FR 59991	Proposed 79 FR 48547

Bull trout

At this time, the occurrence of bull trout in the lower Columbia River appears to be incidental and bull trout are not present in Tide Creek or waters adjacent to CSR. Four distinct life history patterns of bull trout have been identified: anadromous, adfluvial, fluvial, and resident. Habitat in the Columbia River is presently considered to be used sparingly for foraging, overwintering, and migration of adfluvial fish. Bull trout are dependent on cool water and their movements are limited by the availability of cool water.

Because habitat has been degraded in many basins and bull trout populations in these basins may be depressed, fish may utilize less optimal habitat including waters that anadromous salmon could occupy. Although bull trout prefer cold waters and nearly pristine habitat, they may occur in lower quality habitats because of their ability to seek out appropriate habitat niches (USFWS 2010b). The main environmental factor limiting distribution of bull trout is water temperature, wherein bull trout prefer cold water and avoid streams with high summer temperatures. Among the many factors that contributed to bull trout decline in the Columbia River Basin include: 1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow, and temperature regimes, and impeded migratory movements; 2) degradation of spawning and rearing habitat in upper watershed areas, particularly alterations in sedimentation rates and water temperature resulting from past forest and rangeland management practices and intensive development of roads; and 3) the introduction and spread of non-native species, particularly brook trout *(Salvelinus fontinalis)* and lake trout *(Salvelinus namaycush).* These trout compete with bull trout for resources and brook trout hybridize with bull trout (Federal Register 2002).

High quality bull trout habitat is typically characterized by cold temperatures, abundant cover in the form of large wood, undercut banks, and boulders, clean substrate for spawning, interstitial spaces large enough to conceal juvenile bull trout, and stable channels (USFWS 2010b). The Columbia River downstream of Bonneville Dam does not typically achieve water temperatures suitable for bull trout. Bull trout are piscivorous and frequent areas with overhead cover and coarse substrate and have been observed overwintering in deep beaver ponds or pools containing large woody debris (USFWS 2010b; Federal Register 2002).

Critical habitat for USFWS ESA-listed species is identified in terms of the Primary Constituent Elements (PCEs) that are necessary to support and maintain a species, including space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species historic geographic and ecological distribution. Bull trout critical habitat includes the Columbia River mainstem downstream of Bonneville Dam to the ocean, along with other areas of the Columbia River Basin and bull trout PCEs include the following:

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporeic flows) to contribute to water quality and quantity and provide thermal refugia.

- Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, macroinvertebrates, and forage fish.
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.
- Water temperatures ranging from 2 to 15°C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range varies depending on bull trout life history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.

Columbia White-tailed Deer

The Columbian white-tailed deer is the western-most subspecies of white-tailed deer, and a species of concern in the lower Columbia River watershed. Research indicates that this species was once prolific throughout western Oregon and Washington, but it is now endangered due to habitat alterations by human activities such as agricultural practices, timber harvest, and development. Today, Columbian white-tailed deer exist in two isolated populations in the lower Columbia River counties of Oregon and Washington, as well as in Douglas County in the Umpqua River Basin in southern Oregon (USFWS 1983). Both populations of Columbian white-tailed deer inhabit riparian regions including island habitats. The deer prefer tidal spruce environments characterized by densely forested marshlands with a range of vegetation cover including mature conifer stands, tall shrubs, and deciduous trees (USFWS 1983). There are no known occurances of Columbian white-tailed deer occupying the CSR project site.

Streaked Horned Lark

According to the USFWS (2010b), the streaked horned lark once occurred from British Columbia, Canada, south to northern California and was a common summer resident in larger and smaller valleys on the west side of the Cascade Mountain range, wintering in eastern Washington, Oregon, and Northern California. Streaked horned larks have also been reported on islands in the lower Columbia River. The species is associated with bare ground or sparsely vegetated habitat and are known to nest in grass seed fields, pastures, fallow fields, and wetland mudflats, and can also be found in and along gravel roads and adjacent ditches. Nesting begins in late March and continues into June and consists of a shallow depression built in the open or near a grass clump and lined with fine dead grasses. The streaked horned lark feeds on the ground, and eats mainly weed seeds and insects.

Streaked horned larks are present on Sandy Island, adjacent to the CSR project site and have been observed foraging at the dredged material placement site at Deer Island. However, no individuals have been documented on the CSR project site and instances of occurances are unlikely due to a lack of suitable habitat characteristics at the project site.

Yellow-billed Cuckoo

The best available information for Western DPS of yellow-billed cuckoos concludes the species has declined by several orders of magnitude over the past 100 years, and that the decline is continuing, isolating birds into smaller populations at core breeding areas. The decline is

primarily the result of habitat loss and degradation which have impacting the size, extent, connectivity, and quality of riparian vegetation within the range of the cuckoo. In 2014, the USFWS determined that no critical habitat was present in Oregon or Washington and as a result, no critical habitat was proposed for designation in this region.

The yellow-billed cuckoo is a riparian obligate species, historically found in parts of 12 states west of the Continental Divide, including: Oregon, Washington, Idaho, Montana, Wyoming, Colorado, Nevada, Utah, California, Arizona, New Mexico, and Texas. Approximately 350-500 pairs are estimated to breed north of the Mexican border where habitat requirements include extensive riparian forests dominated by mature, structurally diverse trees and a vegetative understory consisting of shrubs and smaller trees. The last confirmed breeding records in Oregon are from the 1940s and observations of individual birds in 2009, 2010, and 2012 near the Sandy River Delta and its confluence with the Columbia River were the first confirmed sightings west of the Cascade Mountains since 1977. However, these observations did not coincide with suitable habitat and it is assumed the individuals were migrants and not nesting in the area. The yellow-billed cuckoo was historically considered rare in the Pacific Northwest and the available data suggests that if yellow-billed cuckoos still breed in Oregon and Washington, the numbers are extremely low with pairs numbering in the single digits.

Environmental Consequences

No Action Alternative

Implementing the No Action Alternative would result in no changes to fish and wildlife in the CSR project area. Terrestrial and aquatic vegetation may experience natural succession, but it is anticipated that invasive species, namely RCG, would continue to dominate the landscape and limit overall biodiversity and habitat quality. The diversity of fish and wildlife currently using the CSR project site would not change from current conditions. Habitat types would continue to be disconnected from the mainstem Columbia River, limiting access and opportunity for fish and other aquatic organisms. No additional habitat opportunities, such as foraging and rearing for estuarine and riverine dependent fish and wildlife species would benefit from implementing the No Action Alternative.

Proposed Action

By implementing the Proposed Action, the restoration of low-energy, off-channel habitats in the CSR project site would alleviate some ecological stressors influencing opportunities for salmon and steelhead to feed, rear, and find refuge from the higher-energy environment of the lower Columbia River and estuary. In addition, the restoration of degraded off-channel areas facilitates prey production and macrodetrital inputs to the Columbia River, supporting the broader ecosystem and increasing structural complexity and overall biological heterogeneity. Activities associated with the Proposed Action include active restoration of tidal connection and fish access to 345 acres of historically tidal wetlands and floodplain habitat. Over 36 acres of tidal channel networks would be restored and excavated to support fish and wildlife habitat, specifically for juvenile salmonid foraging and rearing habitat. Excavation would also create areas of marsh and wetland habitat, supporting a variety of vegetation species and increasing the overall diverse macroinvertebrate prey inputs into the CSR project site and the Columbia River. Restoration efforts to reestablish and maintain vegetation in these areas would increase cover and shade near the aquatic edge, increasing the potential for high quality habitat to support existing birds and wildlife. In addition, reconnecting the floodplain to the mainstem of the Columbia River and increasing the linear extent of edge habitat would provide a regular

exchange of water, nutrients and organic materials to further supplement productivity throughout the project area.

Following implementation of the Proposed Action and restoring surface water connectivity with the Columbia River, the CSR project site would be accessible to juvenile salmonids, providing long-term benefits to these fish. Most construction activities would occur in areas isolated from the Columbia River where salmonids are present, but there could be short-term adverse impacts during the final phase of construction when the existing levee would be fully breached. Short-term wildlife displacement in the CSR project site could occur from noise and activity associated with project construction. Where construction activities could impact nesting birds, construction activities would be timed to occur outside of active breeding season. Other precautionary measures would include completing in-water work during the period recommended by NOAA Fisheries and ODFW, and conducting fish salvage prior to beginning work would further ensure that the least amount of aquatic wildlife would be displaced. Prior to construction, wetland areas would be surveyed for amphibians and other terrestrial fauna and an attempt would be made to move individuals to other suitable locations to lessen potential short-term adverse impacts. Adverse long-term impacts to wildlife currently utilizing the CSR project site would be offset by the overall net improvements to high quality riparian habitat and tidal channels in the project area.

4.5. Water Quality

The Oregon DEQ is required to regularly assess water quality and report to the U.S. Environmental Protection Agency (EPA) on the condition of the State's waters. As required by CWA Section 303(d) and 33 U.S.C. § 1313(d), Oregon DEQ and Washington Department of Ecology (DOE) identify waters which do not meet water quality standards for beneficial uses; the summary report is commonly referred to as the 303(d) list.[8] The 303(d) list is used to identify where regulations are needed to improve water quality to better meet state and national standards. The Columbia River was designated in 2004 as w*ater quality limited* and placed on the CWA's 303(d) list for temperature, potential hydrogen (pH), polychlorinated biphenyls (PCBs), arsenic, dichlorodiphenyl trichloroethane (DDT), polynuclear aromatic hydrocarbons (PAHs)(Oregon DEQ 2010, Corps 2011a). Furthermore, the entire Columbia River is subject to an EPA total maximum daily load (TMDL) for dioxin for the beneficial uses of "anadromous fish passage," "drinking water," and "resident fish and aquatic life" (Oregon DEQ 2010, Corps 2011a).

Measurements of pH reflect the relative acidity and alkalinity, which can be influenced by human activities, primary production (photosynthesis), and local geologic conditions. Primary production is influenced by temperature, and aquatic organisms adapted to cold-water systems (cutthroat and bull trout, for example) are sensitive to even minor increases in temperatures, especially when spawning. Increased concentrations of nutrients (phosphorous and nitrogen) and pesticides can limit plant growth and at high levels be toxic to plants and animals. High levels of nutrients can also trigger algae blooms, which can lead to lower DO concentrations, starving fish and wildlife of much needed oxygen. Fecal coliform concentrations and heavy metals (arsenic, mercury, etc.) can directly affect human health and some species of fish and aquatic wildlife.

[8] Beneficial uses include domestic and industrial water supply; irrigation and livestock watering; fishing, boating, and water contact recreation; fish and aquatic life, wildlife, and hunting; aesthetic qualities; and hydropower, commercial navigation, and transportation.

While a targeted water quality assessment for the CSR project site has not been conducted, information from studies on nearby streams and off-channel habitats can be used to describe potential water quality concerns in Tide Creek and other aquatic habitats on the project site. In 2009, USFWS contributed habitat restoration efforts in the lower Columbia River and estuary by monitoring biological and physical attributes of Deer Island Slough and Tide Creek (the constructed channel flowing into Deer Island Slough before emptying into the Columbia River south of the CSR project site) (USFWS 2009). Temperature, depth, dissolved oxygen (DO) and conductivity, as well as pH, turbidity, depth, and percent shade were recorded to evaluate water quality conditions in the waterways. Summer stream temperature is a primary water quality concern, when many stream reaches designated as critical habitat for salmonids exceed water quality standards for temperature. As temperatures increase, DO concentrations decrease, creating environments that are stressful and at times lethal for fish and aquatic organisms. For juvenile salmonids, 16.8° celcius (C) is the upper threshold above which individuals experience sub-lethal effects from elevated water temperatures.

USFWS monitoring results documented that temperatures in Deer Island Slough remained below the upper threshold until mid-May, at which time temperatures rose to and exceeded 16.8°C by mid-May and early summer, indicating off-channel habitats in the project area may become water quality limited for juvenile salmonids during the summer months. Water quality on the project site has degraded following the loss of connectivity and lack of circulation resulting from of disconnection from the Columbia River and stagnation of wetlands and off-channel waterways, resulting in low DO concentrations and higher instantaneous water temperatures.

Environmental Consequences

No Action Alternative

The No Action Alternative would not alter the existing surface water hydrology or drainage patterns of water in Tide Creek or wetlands in the CSR project site. Other areas within the site would remain disconnected from riverine or tidal flows and therefore continue to experience degraded water quality. Under this alternative, the existing degraded water quality levels would persist on the CSR project site, providing poor habitat quality for fish and aquatic wildlife.

Proposed Action

While the Proposed Action is not intended to improve water quality or expected to exceed State water quality standards in the project area, implementing the Proposed Action would likely influence water quality parameters in off-channel habitats in the CSR project site, but not influence water quality in the Columbia River, including the TMDL for dioxin. Floodplain wetlands provide water quality benefits by filtering potentially harmful nutrients and pesticides from stormwater runoff. Therefore, restoring the natural estuarine wetland functions at CSR would have long-term, positive impacts on water quality by increasing the pollutant filtration component of the floodplain. Reconnecting the proposed project area to direct surface water connection with the Columbia River would improve overall water quality in the project area by increasing tidal flushing and improving circulation and groundwater exchange, resulting in increased water exchange to improve DO concentrations and lower water temperatures (USFWS 2009). Indirect effects from improving circulation and overall water quality include moderation of temperature during the summer, when temperatures often exceed thresholds tolerable to sensitive aquatic fish and wildlife, thereby supporting improved habitat conditions for fish and wildlife during stressful seasonal events.

In addition to the beneficial effects of implementing the Proposed Action, there could be some temporary, localized adverse effects to water quality on the CSR project site during construction. Short-term impacts include increased turbidity and erosional processes resulting from construction activities and temporary loss of vegetation. These effects would be minimized through the use of proper BMPs and erosion control methods.

4.6. Air Quality and Noise Pollution

The Oregon DEQ and EPA regulate air quality in the project area. Under the Clean Air Act, the EPA has established the National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants: carbon monoxide (CO), ozone, particulate matter, lead, sulfur dioxide, and nitrogen dioxide. Oregon DEQ, which is responsible for maintaining compliance with the NAAQS in Oregon, has established State Ambient Air Quality Standards (SAAQS) that are at least as stringent as the NAAQS.

For each of the six criteria pollutants, the NAAQS and SAAQS are defined as a maximum concentration above which adverse effects on human health may occur. Geographic areas in which the ambient concentrations of a criteria pollutant exceed the NAAQS are classified as nonattainment areas. Federal regulations require states to prepare statewide air quality planning documents called State Implementation Plans (SIPs) that establish methods to bring air quality in nonattainment areas into compliance with the NAAQS and to maintain compliance. Nonattainment areas that return to compliance are called maintenance areas. No part of the project area is a designated as a nonattainment or maintenance area for criteria pollutants (DEQ 2013).

The lower Columbia River climate is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. Along the lower elevations of the immediate coast, normal annual precipitation is between 65 to 90 inches. Occasional strong winds strike the Oregon Coast, usually in advance of winter storms. Wind speeds can exceed hurricane force, and in rare cases have caused damage to structures or vegetation. Damage is most likely at exposed coastal locations, but it may extend into inland valleys as well. Such events are typically short-lived, lasting less than one day. The prevailing winds along the Lower Columbia River comes from the east out of the Columbia Gorge during the fall and winter months (October to March), and from the west off of the ocean during the spring and summer months (April to September).

Noise is generally defined as unwanted sound and is a fluctuating pressure wave. It is measured in terms of the sound pressure level expressed in decibels (dB). Existing sources of noise in the project area originate from vessel traffic in the Columbia River and traffic associated with Hwy 30. Receptors of this noise include landowners and fish and wildlife in the vicinity of the area. The CSR project site is not classified by Columbia County as a "noise sensitive" property.

Environmental Consequences

No Action Alternative

If no action were taken, there would be no impact to air quality and no construction noise would be generated. Consequently, there would be no changes to existing conditions under the No Action Alternative.

Proposed Action

Project construction may result in short term increase of regulated air pollutants from construction equipment; however, these emissions would not exceed the air quality standards and SAAQS. There also would be temporary and localized increases in noise levels from construction equipment; however, these impacts would be minor and temporary in nature (construction is scheduled to occur during the spring, summer and fall months of 2017 and 2018). Construction-related noise would cease following implementation of the Proposed Action Alternative, after the levee is fully breached, and material is disposed.

4.7. Cultural Resources

Cultural resources include things and places that demonstrate evidence of human occupation or activity related to history, architecture, archeology, engineering, and culture. The Oregon State Historic Preservation Office (SHPO) cultural resources database and archives were examined by Corps archaeologists in March 2012 for information regarding the presence of documented archaeological sites, historic sites and structures, historic properties, and other relevant cultural features within the CSR project site. At that time, there were no records of documented archaeological sites within the project area and no record of previous archaeological surveys having been conducted within the area proper. The nearest documented archaeological surveys consisted of three overlapping linear surveys of a fiber optics line and two pipeline projects located west of the project area.

Initial reviews of historic General Land Office and Donation Land Claim (DLC) maps, historic aerial photographs and historic background research into the area's history, coupled with reconnaissance-level pedestrian surveys conducted by Corps archaeologists in July 2015, revealed that an undetermined number of the standing, "above ground" structures (i.e. house, barn, various outbuildings) in the existing farm complex located immediately west of Tide Creek are likely more than 50 years old. Similarly, an undetermined number of historic linear features (i.e. levees and berms, constructed drainages, irrigation channels, diversion canals with associated tide gates, fence lines, railroad grades, roads) are likely present in selected locations throughout the project area. These structures and features, if constructed more than 50 years ago, are considered "historic" and may be eligible for listing on the National Register of Historic Places (NRHP).

All "historic" structures, historic era sites, prehistoric archaeological sites and culturally-significant properties located within the project area would need to be formally assessed and evaluated for NRHP eligibility. To be determined eligible, each identified historic structure, historic site, archaeological site, and all other significant cultural resources must be evaluated for their characteristics, integrity and historic significance to determine if they meet the NRHP's criteria for eligibility. Intensive archaeological survey and cultural resource assessments of the project area and its cultural resources began in February 2016 and are expected to continue through June 2016. The Corps is currently completing historic background research, conducting systematic pedestrian surveys and subsurface testing throughout the project area, documenting all identified above ground and below ground cultural resources within the project area, and evaluating all documented cultural resources for historic significance and eligibility for inclusion on the NRHP.

Preliminary findings suggest that at least four cultural resources are located within the project area which may be considered potentially eligible for inclusion on the NRHP. These include the existing levee, which was constructed in 1942; the Peacher DLC farmstead, a farm complex of early-20th Century buildings and structures located immediately west of Tide Creek in the

west-central portion of the project area; the John H. Jones DLC, a subsurface assemblage of early-20th Century homestead remains and debris located near the north-central portion of the project area; and an early-20th Century railroad grade stretching north-south along the project area's westside boundary (the Portland & Western Railroad). While each of the four historic site areas meet the 50-year-old 'rule of thumb' for eligibility to the NRHP, all require further evaluation and assessment to determine whether any retain significant historic qualities and meet any of the necessary criteria for NRHP eligibility. Those evaluations are expected to be completed by June 2016. An undetermined number of additional historic features and structures may also be present within the project area and require further assessment. Those assessments and evaluations are expected to be completed by June 2016.

To date, no evidence of Native American villages, archaeological sites, or traditional use areas has been uncovered along Tide Creek or within the broader project area. However, ethnographic-era Native American settlements are known to have existed along this reach of the Columbia River and in the vicinity of Deer Island. Consultations with the Confederated Tribes of the Grand Ronde Community of Oregon (Grand Ronde), Confederated Tribes of Siletz Indians (Siletz) and Cowlitz Indian Tribe (Cowlitz) indicate that the project area lies within a broader area of traditional cultural significance. For this reason, much of the project area's southern and eastern portions are considered to have a relatively high probability for prehistoric site occurrence. Although much of the project area's topography has been heavily-reconfigured and transformed by numerous factors including multiple and repeated flood events, early-to-mid 20th Century settlement, land clearing, levee and irrigation channel construction, decades of mixed agricultural uses and livestock grazing, the Corps is continuing to work with the Tribes and Oregon SHPO to develop and implement appropriate cultural investigation strategies to ensure no undetected prehistoric cultural resources would be impacted within the project area.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, no ground distrubing activites would occur to adversely impact cultural or historic resources. Cattle grazing would be maintained as a mechanism to suppress weed growth, but these actions would not result in new or different impacts from those that occur under current conditions.

Proposed Action

The Corps has reviewed the Proposed Action under Section 106 of the National Historic Preservation Act (NHPA) and has determined that implementing the Proposed Action would have the potential to affect historic properties and cultural resources within the CSR project site. Potential effects from the Proposed Action are currently being inventoried for archaeological and historic resources. To date, the inventory has identified seven historic properties and one Traditional Cultural Property within the project boundary: several historic properties, including the levee, railroad grade, homesites, and remnants of a small incorporated community (of hunters). Evaluating the eligibility and a determination of significance is underway and expected to continue for several months.

Implementing the Proposed Action would have varying effects to the identified resources which are currently under evaluation, however, adverse impacts may include inundation, destruction or increased disturbance. Where excavation would occur, there is a potential for direct effects to cultural resources or artifacts via disturbance or destruction using heavy equipment. Following construction of the setback levee and modifications to the existing levee,

the CSR project site would experience increased inundation, fluctuating flows, currents, and water levels from the Columbia River, which may increase wave action, exposure, and repeated inundation indirectly impacting archeological sites present in the project area. Additional types of impacts that could occur include wind and water deflation of archeological deposits as changing underwater currents due to surface water level fluctuation can cause displacement of archeological material or slumping. Exposure of archeological sites may increase instances of looting and vandalism. The Corps plans to mitigate these potential impacts and is coordinating with the Oregon SHPO and affected Tribes pursuant to 36 C.F.R. § 800.12(b)(2).

4.8. Land Use and Utilities

The area in front of the levee is exposed to Columbia River flow on a regular basis. Reviewing aerial photography dating back to 1929 showed that this area has remained relatively stable over the past 80 years. Based on the historic aerial photography, there is no apparent erosion or accretion of sediment in this area. It is therefore expected that this area will remain stable into the foreseeable future. Land use prior to the acquisition of the CSR property principally consisted of managed agriculture and cattle grazing. As the current landowner, CLT granted a grazing lease on the property in April 2012 as an interim management strategy to manage invasive species on the project site. BPA reviewed and approved the grazing lease per the terms of the conservation easement, which can be amended or shortened as necessary to accommodate restoration activities.

Several utility lines currently exist within the CSR project site, including the railroad, two underground natural gas lines, an overhead BPA transmission line and an assortment of other utilities associated with private property including a fiber optic cable and power lines. One of the natural gas lines extends east-west through the project site; the other extends through the western portion of the site along a north-south alignment adjacent to Hwy 30. The BPA transmission line extends through the western portion of the site.

Environmental Consequences

No Action Alternative

Under the No Action Alternative, there would be no changes to current activities at the CSR project site and current land use practices would not change. Current cattle grazing and mowing practices are expected to be maintained to control non-native grasses on the property. Maintenance of the existing levee is expected to continue to be performed by the Deer Island Drainage Improvement Company into the foreseeable future. Aside from the seasonal clearing of vegetation, flood control degradation is not expected to occur. As such, there is not expected to be any significant change in the drainage network or the location of the low-lying, groundwater fed areas behind the levee. Access to the CSR project site and utility usage would not change under the No Action Alternative.

Proposed Action

Following implementation of the Proposed Action, cattle grazing would cease and non-native vegetation would be managed via mechanical and chemical methods. Maintenance of the setback levee constructed as a part of the Proposed Action would be transferred to the Deer Island Drainage Improvement Company for long-term maintenance and operations.

The CSR project site would be accessible via the current access road from Hwy 30 during the dry season. An additional access road would be provided from Hwy 30 on the setback levee,

providing access to the landowner, diking district, and utility companies for accessing the entire project site.

4.9. Socio-Economics

As communities grow and change, the challenge to balance fiscal, social, economic, and environmental goals is continually in question. Deciding how much and what types of development or changes can be accommodated without compromising the quality of life for residents is an important aspect to maintaining the human environment. A socio-economic impact assessment is designed to assist the decision making processes in promoting long-term sustainability, economic prosperity, community health, and social well-being by evaluating potential changes in demographics, housing, public services, recreational opportunities and even the aesthetic quality of the community that could result from implementation of a proposed project. Assessing these effects requires both quantitative and qualitative measurements of the impact of the proposed project. The opportunity for public comment on this draft EA helps to ensure the Action Agencies decisions are consistent with community values and ensures the decision making process addresses concerns about potential impacts.

The indicators used to measure the potential socio-economic impacts of the proposed ecosystem restoration project include:

- Changes in community demographics;
- Results of retail and housing market analyses;
- Demand for public services and recreational opportunities;
- Changes in employment and income levels; and
- Changes in the aesthetic quality of the community.

Deer Island is one of the few remaining large islands in the lower Columbia River that has remained largely undeveloped. The island contains sloughs and lakes interspersed with grassy marshes and pasture, and is regularly used by wintering waterfowl as well as bald eagles, purple martins, and a variety of other wildlife. Deer Island's population is 269 people, which has grown by approximately 10.25 percent since 2000. Deer Island is an unincorporated community and census-designated place in Columbia County and consists of 50.1 percent males and 49.9 percent females. Although the unemployment rate on Deer Island is 7.40 percent (the average U.S. unemployment rate is 6.30 percent), recent job growth is positive and Deer Island jobs have increased by 1.59 percent. The estimated median household income in 2013 was $54,992, compared to $50,251 for the state of Oregon. Compared to the rest of the country, Deer Island's cost of living is 9.20 percent higher than the U.S. average. The median home cost in Deer Island is $196,000 and home appreciation in the last year has been 12.20 percent and median gross rent in 2013 was $724.

The primary land use of the project area is agricultural, predominantly pasture lands for cattle grazing. The CSR project area is designated as “Agricultural Land” comprised predominately of Class I-IV soils as classified by the NRCS. Lands which are suitable for farm use take into consideration soil fertility, suitability for grazing, climatic conditions, existing and future availability of water for irrigation purposes, existing land use patterns, technological and energy inputs, and accepted farming practices. Recreational opportunities on the CSR project site are limited to radio-controlled aircraft, and fishing and boating on the Columbia River adjacent to the project area.

Environmental Consequences

No Action Alternative

Operation and maintenance of the dike and levee system components would not change in response to the No Action Alternative. Furthermore, it is anticipated that growth rates, community demographics, retail services and housing markets, the demand for public services and changes in employement and income levels would remain virtually unchanged from current conditions. Current land use practices would continue and county taxes generated by the diking district would increase according to inflation. Limited recreational opportunities would continue under the No Action Alternative, including radio-controlled airplanes, recreational fishing and boating on the Columbia River near the project site. Commercial fisheries would not be impacted by the No Action Alternative.

Proposed Action

High value farmlands and special-interest agriculture (nursery stock, berries, fruit, Christmas trees, etc.) would not be adversely impacted from implementing the Proposed Action. The Proposed Action constitutes a change in the type and intensity of use on a portion of Deer Island that would convert lands currently used for agricultural purposes to non-agricultural uses. As the land-owner for the CSR project site, CLT would be responsible for paying property state and Federal taxes associated with the property. Due to the acquisition of the conservation easement by BPA, agricultural practices would discontinue and no longer contribute to the area's existing agricultural economy. The diking district levies an annual fee to all land owners in the project area according to the acreage of lands they own that are protected by the Deer Island Levee. The dues collected as part of the annual fee are used to perform regularly maintenance of the levees and operation of the Deer Island pump station. Because the CSR property would be removed from the total acreage of lands protected by the levee, the property would not be subject to the diking district fees resulting in increased costs to individual land owners responsible for maintaining the levee and pump station.

Many of the ecological benefits resulting from ecosystem restoration projects are not traded on economic markets, and therefore do not cary price tags that could alert society to changes in supply or deterioration of underlying ecological systems that generate them. Clean air and water, security and public safety provided by close relationships with neighbords and an independent lifestyle tend to be highly valued by community residents and implementing the Proposed Action is not expected to substantially alter these parameters. Additionally, the Proposed Action is not anticipated to result in changes in the aesthetic quality of community life or a sense of cohesion among residents. Furthermore, the focal point or "common meeting place" for residents is not expected to shift to a new location due to implementation of the project features.

With regards to the socio-economic structure of Deer Island, implementing the Proposed Action would not substantively alter long-term demographics, public services, recreational opportunities, markets, employment and income or the aesthetic quality of Columbia County. Recreational fishing and boating on the Columbia River would continue and would not be impacted by construction of the Proposed Action. Similarly, commercial fishing interests would not be adversely impacted by active construction associated with implementing the Proposed Action. Fishing interests would benefit from the long-term benefits achieved from implementing the project, as habitat restoration is intended to support growth and survival of juvenile salmonidis contributing to increased adults returning to spawn in upstream tributaries. Work within waters of the U.S. would be restricted to the immediate CSR project site, reducing potential impacts to the Columbia River and recreational and commercial user

groups. It should be noted that Columbia County and the surrounding areas would likely benefit from increased economic activity associated with active construction services and products, as measured in a temporary increase in jobs, income, sales and gross regional products.

4.10. Climate Change

Climate is governed by incoming solar radiation and the associated greenhouse effects which influence short-term, seasonal, and long-term weather patterns. Greenhouse gases include (in the order of importance to the greenhouse effect): water vapor, carbon dioxide, methane, nitrous oxide and ozone. Anthropogenic activities, such as the burning of fossil fuels and the clearing of forests, adds additional greenhouse gases to the atmosphere and create a natural sink for carbon dioxide, intensifying natural greenhouse effects, and ultimately causing changes to global, regional, and local climates.

Executive Order 13514 and subsequent guidance from the CEQ (2011a and 2011b) led to development of Corps policy and planning documents: the *Climate Change Adaptation Policy Statement* and the *Climate Change Adaptation Plan and Report* (Corps 2011b, 2012, and 2013, respectively). The policy states, "mainstreaming climate change adaptation means that it will be considered at every step in the project lifecycle for all [Corps] projects, both existing and planned . . . to reduce vulnerabilities and to enhance the resilience of our water resource infrastructure." In its *2013 Climate Change Adaptation Plan*, the Corps identified four categories of climate change effects which have the potential to impact its national missions and operations (Corps 2013). These four categories include:

1. increasing air temperatures,
2. changing precipitation,
3. increases in extreme events, and
4. sea level change and associated tides, waves, and surges.

The potential impacts of climate change are expected to play an increasingly important role in determining the fate of wildlife species and the conservation value of habitats in the Columbia River. It is anticipated that climate change would exacerbate existing temperature, stream flow, habitat access, predation, and marine productivity issues (CIG 2004, ISAB 2007). According to the U.S. Global Change Research Program (USGCRP), average regional air temperatures have increased by an average of 1.5°F over the last century (up to 4°F in some areas), with warming trends expected to continue into the next century (2009). Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F (USGCRP 2009).

These changes would not be spatially homogeneous across the Columbia River. Rather, areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected than low-lying areas historically receiving little precipitation and contributing less to total stream flow. Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009). Precipitation trends during the next century are less certain than for temperature, but more precipitation is likely to occur during October through March and less during summer months and more winter precipitation is expected to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where stream flows are unregulated, the Columbia River freshet is expected to occur three to four weeks sooner (Snover et. al, 2013).

The earth's oceans are also warming, with considerable annual and decadal variability superimposed on the longer-term trend. Historically, warm periods in the Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (USGCRP 2009). Evaluation of future sea level rise is outlined in Corps guidance (Engineering Circular 1165-2-212 [USACE 2011]).

The regulations prescribe a method for defining three future projections of sea levels (lowest, expected, and highest) that are used to bound the estimate for sea level rise over time. The sea level projections (curves) are site specific and are derived based on the historical sea level trend (the local sea level change) blended with the eustatic change (the change in sea level due to changes in either the volume of water in the world oceans or net changes in the volume of the ocean basins). Curve #1 defines the lowest expected bound for sea level rise; Curve #2 defines a prudent expected trend; and Curve #3 defines the highest expected bound.

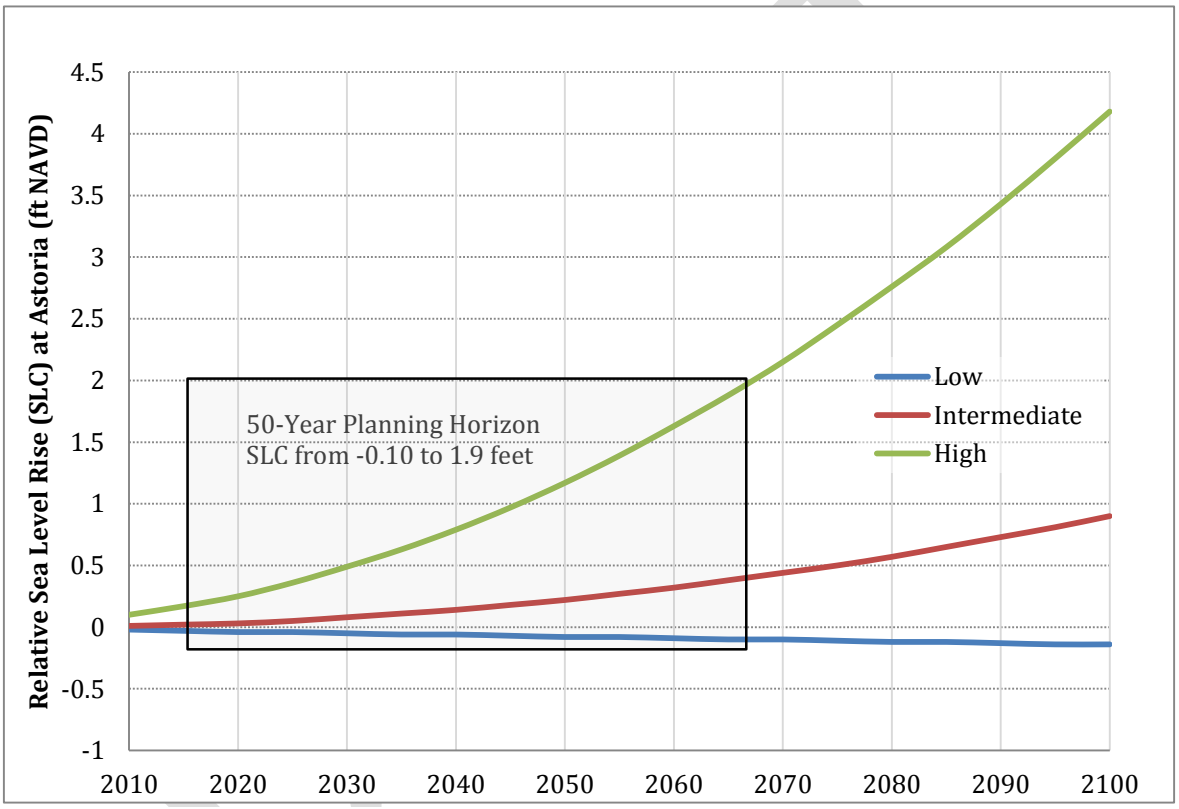

Figure 9: Sea level rise scenarios at Astoria, Oregon

The sea level projections shown in Figure 9 are based on sea level data from the National Ocean Service Station at Astoria, Oregon. Based on the Corps analysis of potential climate change, the degree of sea level change that may affect the CSR project site (RM 76.5) over the planning horizon (50 years, 2018 to 2068) could increase tidal water level elevations by 0 feet, 0.26 feet, or 1.32 feet, depending upon which of the three curves is applied.

Environmental Consequences

No Action Alternative

Climate change is widely recognized as a critical issue with potentially wide-ranging effects on water resources, fish and wildlife species and their habitats, and other natural resources. It has

also been suggested that the effects of climate change will exacerbate temperatures, the timing and magnitude of stream flow, habitat loss, isolation and degradation, invasive species, and drought. According to the USGCRP, the average regional air temperatures have increased by an average of 1.5°F over the last century (up to 4°F in some areas), with warming trends expected to continue into the next century (2009).

The effects of climate change under the No Action Alternative may result in changes in temperature, precipitation, and sea levels at the CSR project site. As described, the annual mean temperatures in the lower Columbia River are likely to rise through the end of century (an increase of anywhere from 3 to 10° F). Seasonal variations are likely to result in summertime warming to be greater than the current mean annual temperatures. Furthermore, precipitation patterns are likely to change in the Columbia River watershed (from the source to the mouth and all contributing watersheds). Annual precipitation amounts would likely be about the same; however, winter and fall would likely be wetter and summer times would be drier. The Columbia River flow regime would also likely change, wherein forecasts predict unregulated freshets could arrive on average four weeks earlier. Intense hydro-regulation of the Columbia River makes anticipating the exact form and duration of future freshets difficult to estimate.

In general, conditions within the study area are not anticipated to appreciably degrade during the period of analysis, nor are they expected to markedly improve. However, the indirect effects of these actions on resources in the CSR project vary and include higher winter stream flows, impacting sensitive watersheds and fish and wildlife. Earlier peak stream flows could alter the duration and frequency of seasonal inundation and incidental flooding from the Columbia River. Invasive species would persist throughout the site. Lower stream flows and warmer water temperatures during summer would further degrade conditions for aquatic wildlife during the summer months when water is scarce. Poor water quality conditions could increase the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of aquatic habitats, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

Proposed Action

The Corps' guidance indicates that projects should incorporate the direct and indirect physical effects of future sea level change across the life cycle of the project. The Corps conducted an analysis of climate change impacts under the Proposed Action and comparisons between the No Action Alternative and the Proposed Action indicate that climate change impacts would be very similar; however, implementation of restoration features provide an overall net benefit and increases the resilience of fish and wildlife habitat experiencing changing climatic conditions. Overall, potential sea level rise would increase the spatial extent of inundation on the CSR project site, increasing opportunities for rearing and foraging habitat, damping adverse impacts to water quality, and increase water storage capacity of wetland features.

Due to their dependence on groundwater exchange and surface water connection, wetlands in the CSR project site are sensitive to changing water levels in the Columbia River. A rise as minimal as a 0.5 foot in elevation has the potential to impart rapid successional changes to fringe and shoreline habitat. However, due to the complexity of the interactions, it is difficult to quantify the future effects. Potential effects from increased water depth (which increases the potential area of inundation throughout the CSR project site) include changes in velocities

during the tidal cycle, the duration of inundation, water circulation across the site, water temperatures in tidal channels during low flow conditions and sediment loads.

Physical changes in water surface elevations could indirectly affect fridge habitat, altering the quantity of wetland and shoreline habitats, indirectly affecting nutrient availability, foraging opportunities, refugia from increased temperatures and predators. Despite these potential impacts, it is assumed that any adverse effects that climate change might have across the project area during the planning horizon would be negligible and effects to any aquatic or terrestrial habitat would less than when compared to the No Action Alterantive described above.

5. CUMULATIVE EFFECTS

This section analyzes the potential cumulative impacts that may occur following implementation of the Proposed Action when considered with other past, present, and reasonably foreseeable future actions. Cumulative effects are defined as, "the impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts can result from individually minor actions, but which can collectively have a measurable impact over a period of time in a specific geographic area.

Noting that environmental impacts may result from many diverse sources and processes, CEQ guidance observes that "no universally accepted framework for cumulative effects analysis exists," while noting that certain principles have gained acceptance and "the list of environmental effects must focus on those that are truly meaningful." *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997). Assessing cumulative impacts may involve assumptions and uncertainties because data on the environmental effects of other past, present, and reasonably foreseeable actions are often incomplete or unavailable. As a result, impacts on resources often must be expressed in qualitative terms or as a relative change. For this analysis, potential cumulative impacts were assessed using guidance from CEQ.

The proposed temporal boundary for analyses of cumulative impacts is the early 1900s, when authorization and construction of the Columbia River Levee occurred and to the extent that it has had lasting effects contributing to cumulative impacts of the CSR project site. The reasonably foreseeable nature of potential future actions helps define the forward-looking temporal boundary. While ongoing restoration activities in the Columbia River could continue for many more years and could contribute to cumulative impacts during that timeframe, it would be speculative to consider actions beyond what is reasonably foreseeable. Given this limitation, the forward-looking temporal boundary has been established at 2 years, which is a reasonable timeframe by which the future actions could be anticipated and completed relative to the Proposed Action.

The geographic boundaries and cumulative effects vary for each resource, but the boundary for this analysis has been limited to the Columbia River adjacent to the project area between Kalama, WA and St. Helens, OR. Analogous to the resources evaluated in Chapter 4, only those resources which could reflect a measurable, cumulative impact in the Columbia River watershed were evaluated in this analysis. Resources excluded from analysis include: geology, topography, soils, air quality, and noise. Furthermore, this analysis uses the same measurable threshold(s) to assess the social and environmental impacts for both the No Action Alternative

and the Proposed Action. In general, effects of a particular action or group of actions would be considered to have a measurable cumulative impact if one of the following conditions are met:

- Effects of several actions occur in a common location;
- Effects are not localized and contribute to effects of an action in a different location;
- Effects on a particular resource are similar in nature or affect the same specific resource element; and
- Effects are long-term or permanent.[9]

It should be noted that this EA used a framework for assessing cumulative effects, and relied upon assumptions and uncertainties because specific data on the environmental effects of other past, present, and reasonably foreseeable future actions is often incomplete or unavailable. As a result, the potential impacts on resources are expressed in qualitative terms or as a relative change from current conditions.

5.1. Past Actions

The CEQ issued a memorandum on June 24, 2005 regarding analysis of past actions. This memorandum states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions" (CEQ 2005). Past actions relevant to the cumulative analysis in this document are those that have previously taken place and are largely complete, but that have lasting effects on one or more resources that would also be affected by implementing the Proposed Action. For these past actions, CEQ guidance states that consideration of past actions is only necessary to better inform agency decision-making. Typically, the only types of past actions considered are those that continue to have present effects on affected resources.

Past actions are summarized below and their effects, which have resulted in the existing conditions, as described in Section 5.4.

- Construction, maintenance and periodic reconstruction of pile dikes, levees, and bridges in, over, or adjacent to the Columbia River between RM 70 and 80;
- Construction and on-going maintenance dredging of the Kalama Turning Basin for the Port of Kalama
- Continued use, maintenance, and operation of the FCRPS multi-purpose dams in the Columbia River and Willamette River basins;
- Continued human use and modification of the Columbia River estuary, the surrounding area, and tributaries feeding into the river up until the passing of the CWA. This included clearing for timber harvest and agricultural development, urban development of towns and cities near the shoreline, highways and railroads, and power and utility lines; and,
- The Corps' annual maintenance dredging and placement activities associated with the Columbia River Federal Navigation Channel.

[9] By definition, short-term impacts tend to dissipate over time and cease to contribute to the cumulative effects as the effects subside or become inconsequential.

The existing conditions in the Columbia River watershed include the past construction and current operation and maintenance of dams and reservoirs along the entire river. This construction fundamentally changed the character of the watershed, moderating flood flows during the winter by strategically storing and releasing water to minimize flooding. In addition to flood control, the dams and reservoirs function maintain downstream flows throughout the summer via the strategic release of water to supplement downstream inflows. Specific to the CSR project site, construction of flood protection levees and drainage channels altered interaction of river flows with the project site and anthropogenic site use (agriculture and cattle grazing) introduced non-native species which have become widely established and dominate the vegetation communities.

5.2. Present Actions

Present actions are those that are currently occurring and also result in impacts to the same resources as would be affected by the Proposed Action. Present actions generally include on-going use activities and recently completed development or construction. In the CSR project site, present actions include maintenance and operation of the Columbia River Levee and associated water control structures (tide gates, culverts, pump stations, etc.), the on-going operation and maintenance of the FCRPS dams and reservoirs, regulation of the Columbia River, maintenance dredging of the Columbia River Federal Navigation Channel and the upland placement of dredged materials on adjacent sites, and land use practices associated with agriculture and cattle grazing in and adjacent to the project area.

5.3. Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions are those actions that are likely to occur and affect the same resources as the Proposed Action. For a future action to be considered "reasonably foreseeable" there must be a level of certainty that it would occur. This level of certainty is considered met with the submission of a formal project proposal or application to the appropriate jurisdiction, approval of such a proposal or application, inclusion of the future action in a formal planning document, or other similar evidence. For future actions in the proposal stage, the action also must be sufficiently defined in terms of location, size, design, and other relevant features to allow for meaningful consideration in the cumulative analysis. Present and reasonably foreseeable future actions include many of the same operational and maintenance activities described in the above list. To determine whether there are other present and future actions reasonably certain to occur in the project area, Corps studies of the area were reviewed, outstanding Corps regulatory permits were reviewed for proposed large-scale actions, and county planning offices queried.

The following actions were identified as being reasonably certain to occur over the next ten years:

- Steigerwald National Wildlife Refuge, Ecosystem Restoration
- Streaked horned lark habitat restoration at Sandy Island
- Development and growth at Port of Kalama, including the Kalama Manufacturing & Marine Export Facility

5.4. Cumulative Effects Summary

The following section analyzes the potential cumulative impacts for each of the environmental resource categories in which the implementation the Proposed Action might contribute to

cumulative impacts when considered with other past, present, and reasonably foreseeable actions. Resources determined not to have the potential to result in cumulative effects were not addressed in this analysis, including geology, air quality, and noise. Since the environmental analyses for the above-listed activities are not complete or do not include quantitative data, cumulative impacts are addressed qualitatively. The No Action Alternative serves as the reference point against which cumulative effects are measured and the analysis uses the same thresholds to measure the effects of the No Action Alternative and the Proposed Action in association with past, present and reasonably foreseeable future actions. Table 6 provides a summary of cumulative effects by resource category.

Table 6: Cumulative effects summary for the No Action Alternative and the Proposed Action

	No Action Alternative	***Proposed Action***
Hydrology and Hydraulics	The No Action Alternative would not create conditions that would alter hydrology or hydraulic conditions on the CSR project site. The No Action Alternative, combined with past, present and reasonable foreseeable future actions would not intensify effects to hydrology and hydraulics at the CSR project site or the lower Columbia River and estuary when compared against the No Action Alternative by itself.	The Proposed Action would result in changes to hydrology on the CSR project site due to the restoration of tidal inundation to the site from the Columbia River, restoring hydrologic connectivity with off-channel habitats and the historic floodplain. The Proposed Action, combined with past, present and reasonably foreseeable future actions would alter hydrology and hydraulics in the vicinity of the CSR project site. However, considering the extent of hydrologic modification throughout the Columbia River, cumulative effects resulting from implementation of the Proposed Action would be extremely modest in the geographic context of the lower Columbia River and estuary.
Geography, Topography and Soils	The No Action Alternative would not create conditions that would alter the physical landscape and topography of the CSR project site. The No Action Alternative, combined with past, present and reasonable foreseeable future actions would not intensify effects to geography, topography or soils when compared against the No Action Alternative by itself.	The Proposed Action would result in the construction of a setback levee, excavation of tidal channel and marsh habitat, altering the topographic landscape of the CSR project site and groundwater exchange, resulting in changes to geography, topography and soils in the CSR project area. The Proposed Action, combined with past, present, and reasonably foreseeable future actions would result in cumulative impacts to geography, topography and soils in the CSR project area as a result of changing the landform and altered physical characteristics of the project site.
Vegetation, Wetlands and Aquatic Habitats	Under the No Action Alternative, invasive species would continue to dominate plant communities at the CSR project site. Wetlands and other aquatic habitats would remain disconnected from the Columbia River, reducing overall habitat quality. The No Action Alternative, combined with past, present and reasonably foreseeable future actions would not change vegetative communities in the project site and aquatic	In addition to revegetating the CSR project site with native plant species, the Proposed Action would restore conditions that promote the propagation and establishment of native plant communities such that plant communities could out-compete with non-native species, increasing overall biodiversity on the project site. Furthermore, implementation of the Proposed Action would improve wetland and aquatic habitat condition by restoring hydrologic connectivity with the Columbia River, restoring

	habitats would remain disconnected from the Columbia River, maintaining the degraded status of habitat in the CSR project site and lower Columbia River and estuary.	functional ecosystem processes in the project area support aquatic environments. The Proposed Action, combined with past, present and reasonably foreseeable future actions would result in beneficial effects to plant communities. The extent and abundance of non-native species would be reduced following chemical and mechanical management actions and tidal inundation would support native plant species. Wetlands and off-channel aquatic would increase in quantity and quality, increasing overall habitat available to fish and wildlife in the vicinity of the CSR project site. While much of the historic floodplain and off-channel habitats for the Columbia River would remain inaccessible to fish and wildlife, the Proposed Action would provide a modest uplift to spatial extent and distribution of wetlands in the lower Columbia River and estuary given the widespread extent and the long-term challenges with invasivies species management in the basin.
Fish and Wildlife	The No Action Alternative would not alter conditions supporting fish and wildlife at the CSR project site. Currently, conditions are largely dominated by human uses and wildlife use of the site is limited to fragmented fringe habitats. Fish use in waterways is limited and does not provide access to fish or other aquatic organisms from the Columbia River. When combined with past, present, reasonably foreseeable future actions, the No Action Alternative would not change fish and wildlife populations or alter habitat conditions support populations in the CSR project site or the lower Columbia River and estuary.	Impacts to fish and wildlife resources from implementing the Proposed Action include the creation, restoration, or conversion of habitats through excavation, filling and construction, replacement of non-functioning water control structures and the removal of unnecessary structures. The Proposed Action would restore fish access to the CSR project site from the Columbia River, providing rearing and foraging habitat for fish and other aquatic organisms, including ESA-listed salmonids and freshwater mussels. Tidal inundation of the CSR project site would support increased diversity of habitat types in the project area, increasing the number and types of fish and wildlife populations that could use and benefit from the project area. The Proposed Action, in combination with past, present and reasonably foreseeable future actions, would result in beneficial effects to fish and wildlife populations on the CSR project site and throughout the lower Columbia River and estuary. Beneficial cumulative effects include the restoration of natural structure and function, supporting ecosystem processes that benefit fish and wildlife including water quality improvements, primary production, nutrient exchange, the production of prey sources leading to increased growth and survival of fish and wildlife.
Water Quality	The No Action Alternative would not alter current conditions influencing water quality in the CSR project site or the lower Columbia River and estuary. When combined with past, present, and reasonably forseeable future actions, the No Action Alternative would not benefit water	The Proposed Action would restore vegetation communities in the project area, supporting the development of a healthy riparian zone providing increased shade to stream channels, lowering water temperatures and filtering sediments from runoff to improve overall water quality.

	quality and over time may result in further degradation to water quality. Non-native vegetation would continue to dominate the CSR project site, necessitating chemical or mechanical management actions to limit the spread of invasive species. These actions could result in the introduction of herbicides into waterways, increased turbidity, and high water temperatures from a non-functioning riparian canopy. Summer water temperatures would remain high and could increase beyond the lethal limits for many species seeking cool water refugia. In addition, the continued use of cattle to manage non-native vegetation on the project site could result in increased erosion of stream channels, degrading water quality where vegetation cannot filter nutrients and sediments out of runoff.	A number of ongoing or planned actions in the Columbia River focus on improving water quality, including operational or structural changes based on regulatory standards and the implementation of more stringent non-point source pollution standards by the Oregon DEQ. These actions and stricter controls on foreseeable future projects are anticipated to provide long-term, cumulative benefit to the water quality in the lower Columbia River. These benefits may be masked by increased development in or near the project area, increasing impervious surfaces and associated runoff into the watershed. However, the identified present and future actions are required to adhere to local, state, and federal surface and stormwater control regulations and best management practices, which are designed to limit negative impacts to surface waters from both construction and ongoing operations. Compliance of present and future projects with these regulations, which are subject to change based on regional assessments, would minimize adverse cumulative impacts to water quality. As such, there is a *de minimus* degree of effects between the No Action Alternative and the Proposed Action for cumulative water quality effects.
Air Quality and Noise Pollution	The No Action Alternative would not influence air quality conditions in the CSR project site or the lower Columbia River and estuary. Air quality in the region is not limited and there are no anticipated changes to these conditions in the future. Combined with past, present and reasonably foreseeable future actions, the No Action Alternative would not result in cumulative impacts to Air Quality or Noise Pollution in the CSR project area or throughout the lower Columbia River and estuary. Sources of noise pollution include Hwy 30, boat and ship traffic on the Columbia River, both of which may increase in response to reasonably foreseeable future actions. However, the extent to which noise may increase is not expected to result in measurable impacts to the project area.	Implementation of the Proposed Action is not expected to result in long-term changes to air quality or noise pollution in the project area. When combined with past, present and reasonably foreseeable future actions, the Proposed Action is also not expected to result in long-term changes to air quality or noise pollution in the CSR project area or the lower Columbia River and estuary. Air quality in the vicinity of the project area is susceptible to winds, and does not typically stagnate and produce air quality concerns. Likewise, noise pollution is limited to Hwy 30 and the Columbia River, both of which are not expected to experience a measurable change in use or pollution resulting from increased used. As a result, there would be no cumulative effects to air quality or noise pollution from implementing the Proposed Action.
Cultural Resources	The No Action Alternative would not alter the current condition of the CSR project site, resulting in no changes to cultural or historic resources in the CSR project area. The No Action Alternative, when combined with past, present and reasonably foreseeable future actions, would not result in changes to cultural or historic resources in the CSR project area. Land use activities would remain unchanged, posing no potential risk or harm to any resources present in the project area.	The final determination of cumulative impacts to cultural and historic reosurces will be complete following the conclusion of archaeological surveys in the CSR project site to identify and document cultural and/or historic resources.

Land Use and Utilities	The No Action Alternative would not result in changes to land uses on the CSR property or utilities in the project area. Land use is currently agricultural and these activities would continue without alteration. When combined with past, present and reasonably foreseeable future actions, the No Action Alternative would not result in cumulative impacts to land uses and utilities in the CSR project area or the lower Columbia River and estuary.	Implementing the Proposed Action constitutes a change in the type and intensity of use on a portion of Deer Island that would convert lands currently used for agricultural purposes to non-agricultural uses. Additionaly, as a result of constructing the Proposed Action, coordination with multiple utilities is needed to maintain proper use and function of the utlitiy, including timing construction activities with the Portland & Western Railroad to minimize interruptions to rail service, coordination with natural gas pipelines to ensure safety and continued usage of the pipelines. When combined with past, present and reasonably foreseeable future actions, the Proposed Action results in cumulative impacts to land use in the CSR project area and utilities. Future projects would be required to comply with local land use and shoreline plans, many of which provide policies to guide management and planning of land activities that may affect the Columbia River and associated tributaries. Compliance of future development with these plans, BMPs and applicable conservation measures would minimize cumulative adverse impacts to land uses and utilities resulting from implementing the Proposed Action.
Socio-Economics	The No Action Alternative would not result in changes to growth rates, community demographics, retail services and housing markets, the demand for public services and changes in employement and income levels in the vicinity of the CSR project site or the lower Columbia River and estuary. When combined with past, present and reasonably foreseeable future actions, the No Action Alternative is not expected to result in cumulative impacts to socio-economic parameters in the project area. Land uses would remain unchanges, resulting in no changes to how the CSR project site affects the local economy or communities in Oregon and Washington.	The Proposed Action is not expected to result in changes to demographics of the surrounding area, or changes to growth rates, public services or other parameters of socio-economics. However, implementing the Proposed Action is expected to result to changes to the tax base for the diking district as a result of a reduction in the amount of lands protected by the levee, but no corresponding reduction in the fees associated with maintaining the levee and operation of the pump station at Deer Island Slough. The Proposed Action in association with past, present and reasonably foreseeable future actions is expected to result in cumulative impacts to the local economy resulting from changing the land use designation of the CSR project site as well as a changing the tax basis for the diking district. As a result, there would be some cumulative impact to the local economy, but it is difficult to speculate the full range of socio-economic implications resulting from implementation of the Proposed Action.
Climate Change	The effects of climate change under the No Action Alternative may result in changes in temperature, precipitation, and sea levels at the CSR project site and throughout the lower Columbia River and estuary. When combined with past, present and reasonably foreseeable future actions, climate	Similar to the No Action Alternative, the effects of climate change following implementing the Proposed Action is expected to result in changes to air and water temperatures, precipitation, and sea levels at the CSR project site and throughout the lower Columbia River and estuary. However, implementing habitat restoration actions at the CSR project site, including the restoration

	change under the No Action Alternative is expected to result in changes to habitat quality, hydrology and hydraulics as a function of water surface elevations and groundwater, air temperature impacting vegetation growth and survival, and water quality.	hydrologic connectivity and the excavation of wetland and off-channel tidal networks is expected to add resilience to the project are to combat the adverse impacts of climate change through the moderation of sea level rise across diverse habitat types. Additionally, as water temperatures increase during the summer months, riparian vegetation would provide increased shade to stream channels, moderating the effects of increase air and water temperature for heat-stressed fish and wildlife. Similarly, the restoration of tidal inundation to the project site would facilitate regular tidal exchange with the Columbia River, introducing cooling waters to the CSR project site to minimize stagnation. While climate change is expected to adverse impacts across the region, implementing the Proposed Action is expected to dampen the adverse effects to fish and wildlife and the habitat supporting them. As such, there is cumulative benefit from implementing the Proposed Action for the potential effects from climate change influencing the CSR project site and the impacts throughout the lower Columbia River and estuary.

Determination of Cumulative Impacts

The Columbia River has been substantially altered from the 1800s by early settlement, timber harvest and fishing, agriculture, population growth, and the commercial/industrial and residential developments and the resulting introduction of non-native species. Addditionally, rivers and streams have been physically altered and fish and wildlife resources have been impacted by habitat alteration and loss. Changes in public expectations concerning how resources are managed began in the 1970s, and today, the protection of unique ecosystems, such as coastal estuaries, has increased with stricter environmental laws and regulations.

This cumulative effects analysis considered the effects of implementing the Proposed Action Alternative against the No Action Alternative in association with past, present, and reasonably foreseeable future actions by the Corps and other parties in and adjacent to the project area. It is unlikely that cumulative adverse impacts would result for the resources identified above because adverse impacts would be minimized through the Corps proposed conservation measures described in Section 3.5. Additionally, all projects would be required to avoid, minimize, and mitigate any measurable impacts through the current environmental review and regulatory process (i.e. monitoring and mitigation are required for new development projects that impact environmental resources), leading to the conclusion that there would likely be no resulting cumulative adverse impacts resulting from the implementation of this project. The required regulatory review also results in coordination between many of the resource agencies and between those agencies proposing action(s).

Provided the analysis of cumulative effects described aboe, the Proposed Action in associated with past, present, and reasonably foreseeable future actions is expected to result in long-term beneficial cumulative impacts to water quality, vegetation, wetlands and aquatic habitats, all of which support fish and wildlife populations in the CSR project area and throughout the lower Columbia River and estuary.

6. STATUS OF ENVIRONMENTAL COMPLIANCE

The laws outlined below provide environmental standards for operation and maintenance activities at Corps civil works projects, associated lands, and out-grants, and are related to environmental stewardship. The following discussions demonstrate how the Proposed Action complies with these environmental laws and Executive Orders.

6.1. National Environmental Policy Act of 1969

Under NEPA (42 U.S.C. § 4321 *et seq.*), federal agencies are required to identify significant environmental resources likely to be affected by proposed activities as well as make an assessment of the impacts to those resources and consider a full range of alternative actions. Environmental considerations are required to be fully integrated into the decision-making process. The analysis of impacts to the environmental baseline in response to the proposed alternatives, and in consideration of the laws and Executive Orders described herein, this EA furthers the requirements of the NEPA, as amended, as discussed within this document.

After the public comment period for this EA, the Action Agencies will consider the project's anticipated impacts and their level of significance. Assuming the consideration of effects results in no extraordinary or extenuating conditions warranting additional analysis, the Action Agencies would issue a Finding of No Significant Impact (FONSI), with the recommendation that an environmental impact statement is not required.

6.2. Bald and Golden Eagle Protection Act of 1940

This Act (16 U.S.C. § 668 *et seq.*) provides for the protection of bald and golden eagles by prohibiting the taking, possession and commerce of such birds, except under certain specified conditions. Projects involving forestry practices, use of aircraft (or other motorized equipment), blasting and other work may result in loud or intermittent noises if they occur within 1000 feet of an active or alternate nest time during the breeding season (January 1 through August 15) and could disrupt breeding activity.

The USFWS, National Bald Eagle Management Guidelines (May 2007), and the Corps eGIS Information Portal were aids in evaluating project impacts to bald eagles and known nest locations. Although bald eagles are generally known to occur in the CSR project area, no bald or golden eagles are likely to be impacted during project construction. No active nests are known to be present in the CSR project area. Therefore, no adverse effects to eagles are anticipated and the management guidelines would be followed if any eagle nests are identified during the design or construction phases.

Generally, the proposed restoration activities can be classified as Category A activities. Category A activities include: building construction, 1 or 2 stories; construction of roads, trails, canals, power lines, or other linear utilities; agriculture or aquaculture; alteration of shorelines and wetlands; installation of docks or moorings; and water impoundment projects. If nests are constructed or identified, buffers of 660 feet should be maintained around nests if the construction work is visible from the nest; buffers of 330 feet should be maintained around nests if the construction work is not visible from the nest. Following discovery of an eagle nest in or near the CSR project site, the Corps would coordinate with USFWS personnel to ensure compliance with the Bald and Golden Eagle Protection Act.

6.3. Clean Air Act of 1970

The Clean Air Act (42 U.S.C. § 7401 *et seq.*) established a comprehensive program to preserve, protect and enhance air quality throughout the United States based on permitting of stationary sources of air pollution emissions, restricting the emission of toxic substances from stationary and mobile sources, establishing NAAQS and noise pollution standards. All federal actions resulting in the emission of air pollutants must comply with all federal, state, interstate, and local requirements for control and abatement of air pollution in the same manner and extent as any non-governmental entity, unless the activity is explicitly exempted by the EPA.

The Proposed Action does not involve the release of regulated substances, nor does it involve the use of an incinerator, open burning, or the release of hazardous substances or chemicals. All motorized equipment used for construction activities would not result in excess levels of noise pollution, emissions, or greenhouse gas emissions. Equipment would be required to meet State air quality standards, and any low-level noise pollution emitted during the proposed activities would be temporary, localized, and of short-term duration. For these reasons, the Proposed Action is in compliance with this Act.

6.4. Comprehensive Environmental Response, Compensation, and Liability Act of 1980

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. § 9601 *et seq.*) was designed to clean up uncontrolled or abandoned hazardous waste sites, as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. CERLCA also established a method to assign liability to parties responsible for the release of hazardous wastes and polluted sites. This Act also established a trust fund to pay for their cleanup to reduce associated dangers to public health and the environment.

The proposed restoration project does not occur within the boundaries of a designated Superfund site as identified by the EPA, or the State of Washington for a response action under CERCLA. Furthermore, the CSR project site is not included on the National Priorities List. Several sediment samples were obtained, and the samples were within background levels for the area. There was no evidence of contamination found at the site. For these reasons, the Proposed Action is in compliance with this Act.

6.5. Clean Water Act of 1972

The CWA (33 U.S.C. § 1251 *et seq.*) established the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977. The CWA makes it unlawful to discharge any pollutant into navigable waters, unless a permit is obtained.

Section 401(a)(2)– Requires certification from the state that a discharge to waters of the U.S. will not violate the states' water quality standards. The EPA retains jurisdiction in limited cases. The Corps seeks a state Water Quality Certification per 33 C.F.R. § 336.1 (a)(1) when its activities result in a discharge.

Section 402(a)(1) – Authorizes the EPA, or states to which the EPA has delegated authority, to permit the discharge of pollutants under the National Pollutant Discharge Elimination System (NPDES) program for all land disturbances over an acre in size.

Section 404 – Authorizes the Secretary of the Army to permit the discharge of dredged or fill material into waters of the United States at specified disposal sites based on section 404(b)(1) guidelines. The Corps does not permit itself but complies with all applicable substantive legal requirements including the section 404(b)(1) guidelines.

Construction of the Proposed Action would result in discharges to waters of the U.S., requiring a certificate from Oregon DEQ for compliance with the state's water quality standards. The Corps intends to use Nationwide Permit 27 for compliance with Sections 401 and 404 of the CWA.[10] Furthermore, per the wetland delineation that was performed for the CSR project site, the field investigation identified approximately 132 acres of wetlands and approximately 26 acres of open waters within the boundaries of the CSR site. All of the wetlands and waters indentified onsite are considered jurisdictional (i.e., triggering review) under Section 404 of the CWA due to their direct hydrological connection to the Columbia River or adjacency to the Columbia River, Tide Creek, or Deer Slough. The Corps is currently seeking a removal/fill permit from the Oregon DSL for the discharge of materials into waters of the state.[11]

Section 402 of the Act requires a NPDES permit for construction disturbance over one acre from large and small construction activities (USACE 2013). The Corps would use General NPDES Permit 1200-CA for compliance with Section 402 of the Act.

6.6. Endangered Species Act of 1973

The ESA (16 U.S.C. § 1531 *et seq*.), as amended, was enacted to protect and conserve endangered and threatened species (sub-species and DPS, included) and critical habitat. Requirements of the Act ensure activities authorized, funded, and carried out by federal agencies are not likely to jeopardize the continued existence of any listed species or result in adverse impacts to designated critical habitat of a listed species. The USFWS and NOAA Fisheries share responsibility for the administration of ESA listed species.

The Corps is in consultation with NOAA Fisheries for ESA-listed species and preliminary discussions have indicated the Proposed Action is consistent with the Corps' Standard Local Operating Procedures for Endangered Species (SLOPES), version 5 programmatic BiOp. Additional coordination and consultation is on-going and the Corps anticipates completion of consultation in June 2016.

Based on the information presented in Section 4.4, due to a lack of presence in the project area and timing of specific project elements during construction, the Proposed Action is highly unlikely to affect ESA-listed species under USFWS' jurisdiction, including Columbian white-tailed deer. Waters in the Columbia River are generally too warm for bull trout, especially during the summer months when construction activities would occur. Furthermore, construction activities impacting potentially suitable nesting habitat for migratory songbirds would be timed to occur outside of the breeding season, eliminating potential impacts to larks and cuckoos. For these reasons, the Corps has determined

[10] Additional information about Nationwide Permits, conditions, and definitions can be found at: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/NationwidePermits.aspx.

[11] Additional information about jurisdiction over waters of the state and permit requirements can be found at https://www.oregon.gov/dsl/PERMITS/Pages/index.aspx.

implementing the Proposed Action would have ***no effect*** to bull trout, Columbian white-tailed deer, streaked horned larks, or the Western DPS of yellow-billed cuckoos.

6.7. Farmlands Protection Policy Act of 1994

The Farmland Protection Policy Act (15 U.S.C. § 1539-1549) directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The purpose of this act is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses.

As discussed in Section 4.9, the Proposed Action would result in conversion of agricultural land to non-agricultural uses. This conversion, however, is neither unnecessary nor irreversible. The conversion is necessary to restore endangered fish populations in the lower Columbia River and estuary, and the land can be reversed to farmland again in the future if deemed appropriate by the Corps, BPA and the project sponsor. The Corps is coordinating with the NRCS to identify any prime or unique farmlands in the CSR project area and evaluate the land and complete a site assessment for compliance with the Act. The Corps anticipates completion coordination with the NRCS in June 2016, which will be documented in the final EA.

6.8. Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act (16 U.S.C. § 661 *et seq*.) directs federal agencies to prevent the loss and damage to fish and wildlife resources; specifically, wildlife resources shall be given equal consideration in light of new water-resource development programs. Consultation with the USFWS is required when activities result in the control of, diversion or modification to any natural habitat or associated water body, altering habitat quality and/or quantity for fish and wildlife. For the Corps, all coordination under this Act is in accordance with the *2003 Agreement between the U.S. Fish & Wildlife Service and the U.S. Army Corps of Engineers for Conducting Fish and Wildlife Coordination Act Activities*.

The Corps is currently coordinating with the USFWS and recommendations specific to the Proposed Action will be documented in the final EA.

6.9. Magnuson-Stevens Fishery Conservation and Management Act of 1976

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 *et seq*.) (MSA) is designed to actively conserve and manage fishery resources found off the coasts of the United States to support international fishery agreements for the conservation and management of highly migratory species. The MSA established procedures designed to identify, conserve and enhance EFH for fisheries regulated under a federal fisheries management plan. Federal agencies must consult with the NOAA Fisheries on all proposed actions authorized, funded or carried out by the agency which may adversely affect EFH.

Relevant fish resources pertinent to the project area include Pacific salmonids. The Columbia River is designated as EFH for salmonids, as it provides waters and substrate necessary for spawning, breeding, feeding, and growth to maturity.

The FCRPS 2014 BiOp provided conservation recommendations to avoid and reduce adverse effects to EFH (blocking habitat, modifying flows, and degrading water quality). The Proposed Action is consistent with methods to alleviate the lack of rearing habitat for

juvenile fish in the lower Columbia River and estuary and improve floodplain habitats. As a result, the Proposed Action meets RPA 36 and 37 and is compliant with this Act.

6.10. Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703 *et seq*.) makes it unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not. Under the MBTA, "migratory birds" include all birds native to the United States and the Act pertains to any time of the year, not just during migration.

The sequence of construction activities would be timed to minimize adverse impacts to migratory birds. Impacts to nesting habitat, including vegetation removal, would be timed to occur before or after the breeding season, reducing adverse impacts to nesting substrate or habitats supporting nesting birds. For these reasons, the Proposed Action is in compliance with this Act.

6.11. National Historic Preservation Act of 1966

This Act (16 U.S.C. § 470 *et seq*.) is designed to protect and conserve cultural resources and ensure that development does not harm or degrade them. Section 106 of the NHPA requires all Federal agencies to consider the potential effects of their projects and undertakings on historic properties eligible for or currently listed on the NRHP: http://www.cr.nps.gov/nr/. Historic properties are archaeological sites or historic structures or the remnants of sites or structures. To determine the potential effect of the project on known or unknown historic properties: the nature of the proposed activity and its effect on the landscape is evaluated; the likelihood that historic properties are present within a project area is assessed; an assessment is made as to whether the ground is disturbed by previous land use activities and the extent of the disturbance; and there is a review of listings of known archeological or historic site locations, including site databases and areas previously surveyed or listings of sites on the NRHP.

In compliance with the NHPA and its implementing regulations, the Corps initiated formal consultations regarding the project with the Oregon SHPO, the Grand Ronde, Siletz and Cowlitz on July 1, 2015. The intent of the consultations was to seek comments and concurrence on the proposed undertakings and the project's area of potential effect (APE), provide descriptions of initial findings and background research, describe actions being proposed to further identify and evaluate cultural resources located within the APE, and to seek any additional information or recommendations pertaining to the Corps' investigative methodology and the potential for locating additional cultural resources within the APE.

The Corps has since received Oregon SHPO concurrence on the APE determination and preliminary investigative methodologies, and both formal and informal consultation is ongoing with Oregon SHPO in regard to the project and implementation of systematic cultural resource assessments within the project area. Although no formal correspondence has been received from the Tribes regarding the project, informal discussions with the Grand Ronde have indicated no initial Tribal concerns with the planned work or cultural assessment strategies. Formal and informal consultations about the project are continuing with the Tribes.

The Corps anticipates completion of formal consultations with SHPO and the Tribes regarding the cultural findings, determinations of effect, and recommendations by August 5, 2016. In the event of an adverse effect determination to any eligible historic properties or

cultural resources, the Corps would conduct further consultations with SHPO and the Tribes to determine appropriate mitigation measures to identify ways to reduce, avoid or mitigate the expected adverse effects of the planned project undertakings. In the interim, the Corps is actively coordinating with Oregon SHPO and the Tribes on these undertakings, strategies and findings to ensure continued concurrence, cooperation, input and regulatory compliance on the project.

6.12. Executive Order 11988, Floodplain Management, 24 May 1977

This executive order requires federal agencies to evaluate the potential effects of proposed activities on floodplains and avoid possible long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Federal agencies are directed to develop alternatives to floodplain activities, where practicable, and identify what impacts (beneficial and adverse) are due to the action. Executive Order 11988 requires that the Corps document (1) reasons why the proposed action must be located in the floodplain; (2) facts considered in making the determination to locate the proposed action in the floodplain, including alternative sites and actions considered; (3) statement on whether the proposed action conforms to applicable State or local floodplain protection standards; (4) a statement on whether the action affects the natural and beneficial values of the floodplain; (5) steps taken to design or modify the proposed action to minimize potential harm to or within the floodplain; and (6) a general listing of involved agencies, groups and organizations. The reasons discussed below illustrate how the Proposed Action complies with requirements 1-6 outlined in this Executive Order.

1. To meet the goal and objectives of the action, habitat restoration must occur in the Columbia River floodplain for the project to successfully restore hydrologic connectivity and support rearing habitat for juvenile salmonids. Additionally, Section 536 requirements state that restoration activities cannot adversely impact adjacent property owners, consequently fill material associated with construction of the setback levee must be placed within the FEMA 100-year floodplain to protect adjacent properties from flooding.
2. The information considered in making the determination to locate the Proposed Action in the floodplain include flood zone designations by the Federal Emergency Management Agency (FEMA). FEMA designates flood zones based on the likelihood of the subject area being inundated by a 100-year flood event. FEMA designated the CSR project area as Zone AE (Special Flood Hazard Area) on Flood Insurance Rate Map (FIRM) panel 41009C0350D, effective November 26, 2010, for Columbia County, Oregon (see Figure 10). Although the area associated with the Proposed Action has been cut off from Columbia River fluvial processes since the early 20th century, the Columbia River Levee is not an accredited structure, and therefore all land behind the levee (landward) are mapped as part of the Columbia river 100-year floodplain. Because the CSR project site is located within the floodplain, all alternatives considered (see Section 3.3) were also located in the floodplain.
3. The Corps is actively coordinating with State and local floodplain administrators to ensure that the Proposed Action is consistent with the existing floodplain management guidelines. Since the existing levee has not been accredited, and since the area behind the Deer Island Levee is mapped as a Zone AE, detailed, 100-year floodplain, no revisions to the FEMA FIRM panel 41009C0350D are needed.

4. As described in Section 4 and 5, the Proposed Action is expected to result in beneficial impacts to natural resources in the CSR project area, including reconnection of 342 acres of historical floodplain and 95 acres of remnant wetlands with the Columbia River, providing juvenile salmonid foraging and rearing habitat. The CSR project area would experience periodic tidal flushing during seasonally high Columbia River stages in the winter and spring, providing structural and functional linkages the floodplain and the Columbia River, benefiting fish and wildlife in the lower Columbia River and estuary.

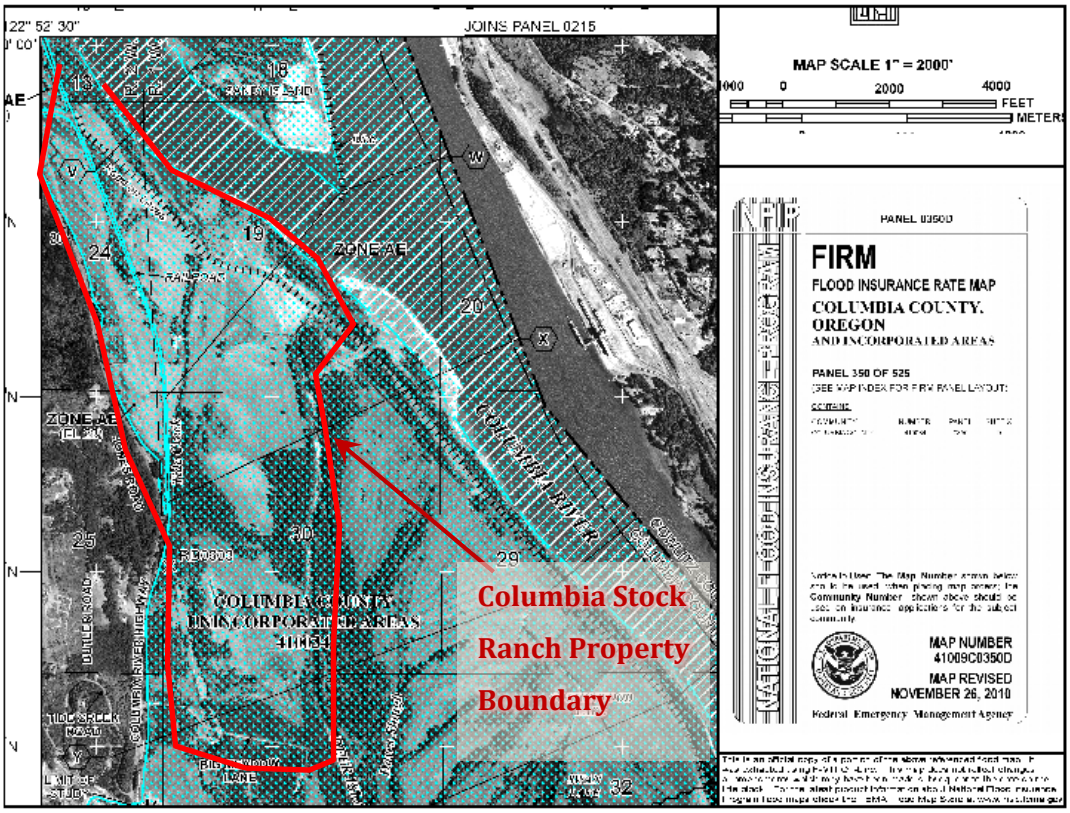

Figure 10: Columbia County, Oregon Flood Insurance Rate Map 41009C0350D

5. Multiple project elements were included in the Proposed Action to minimize potential adverse impacts to or within the floodplain, including the installation of tide gates for fish passage, inclusion of an overflow channel to lower water surface elevations to adjacent properties, the proposed installation of bridges under the railroad instead of culverts, and the removal of water control features across the project site.

6. Agencies and groups involved in the Proposed Action include the Corps, BPA and CLT. Following acquisition of the CSR property in 2012 (using funding provided by BPA), CLT granted BPA a perpetual conservation easement over the land. The Corps and BPA signed Memorandum of Agreement (MOA) on 26 November 2012, ensuring no future development would impede the natural evolution of floodplain processes on the CSR project site following implementation of restoration actions.

6.13. Executive Order 11990, Protection of Wetlands, 24 May 1977

The purpose of this executive order is to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In planning their actions, federal agencies are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

The Proposed Action would restore natural wetland conditions and tidal networks within the lower Columbia River and estuary. As a result, restoration of the CSR project site would enhance natural and beneficial values of wetlands, increasing the quantity and quality of wetlands in the project area. Consequently, the Proposed Action complies with Executive Order 11990.

6.14. Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 1971

This order ensures Federal agencies provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation. Federal agencies are directed to administer cultural properties under their control in a spirit of stewardship and trusteeship for future generations. Federal agencies shall initiate measures necessary to direct policies, plans and programs in a way that federally-owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people. In addition, Federal agencies are ordered to consult with the Advisory Council on Historic Preservation to institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural or archaeological significance.

The goals and objectives of the Proposed Action, as well as requirements of the Section 536 authority do not interfere with this Executive Order, and as a result, the Proposed Action is in compliance with this Executive Order.

6.15. Executive Order 12898, Environmental Justice, 11 February 1994

It is critically important to devote attention to the potential impacts of Corps of Engineer ecosystem restoration projects on vulnerable segments of the human population. The Corps is not aware of any social equity concerns. Demographic groups that are disproportionately affected by the proposed project, whether they are adolescents, the unemployed, women, members of groups that are racially, ethnically or culturally distinctive, or occupational, cultural, political or value based community groups should use the public comment period to make their concerns known to the Corps of Engineers. It is the belief and value of the Corps of Engineers that no category of persons, particularly those that might be considered more sensitive or vulnerable as a result of age, gender, ethnicity, race, occupation or other factors, should have to bear the cost of adverse social impacts.

No subsistence, low-income or minority communities would be affected by the Proposed Action because these populations do not occur in or directly adjacent to the CSR project area. As a result, no environmental justice communities would incur a disproportionate share of adverse social impacts resulting from implementation habitat restoration actions on the CSR project site. For this reasons, the Proposed Action is in compliance with this Executive Order.

6.16. Executive Order 13112, Invasive Species

This Executive Order established the National Invasive Species Council and required federal agencies (to the extent practicable) to identify actions that may spread invasive species and use relevant programs and authorities to prevent the introduction of invasive species; to research, monitor and otherwise control invasive species; to restore native species and habitat conditions in ecosystems that have been invaded; and promote public education on invasive species.

The Corps would minimize the spread of invasive species by ensuring all equipment used in construction of the habitat restoration elements in the CSR project site are clean and free of invasive species. For this reason, the Proposed Action is *in compliance* with this Order.

6.17. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000

The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions. This order requires federal agencies to formulate and establish "regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes". This consultation is meant to work towards a mutual consensus and is intended to begin at the earliest planning stages, before decisions are made and actions are taken.

The Corps initiated formal government-to-government coordination in October 2015 by sending letters to the Confederated Tribes of the Grand Ronde Community of Oregon, Condederated Tribes of the Siletz Indians, and the Cowlitz Indian Tribe. In addition, the Corps initiated government-to-government coordination with the four Columbia River treaty tribes in April 2016: the Confederated Tribes of Warm Springs, Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe. To date, no response has been received from any Tribe in response to the letter requesting coordination.

6.18. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, 10 January 2001

This executive order further strengthens the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, the Fish and Wildlife Coordination Act, the Endangered Species Act and the National Environmental Policy Act. Each Federal agency taking actions that have, or are likely to have, a measureable negative effect on migratory bird populations is directed to develop and implement a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations and resources.

The Department of Defense signed an MOU with the USFWS 31 July 2006, to comply with this Executive Order (http://www.dodpif.org/plans/migratory/mbtadod.php). The MOU states the DoD shall, among other things, "encourage incorporation of comprehensive migratory bird management objectives in the preparation of DoD planning documents (…including NEPA analyses)." This NEPA document analyzed the potential for migratory birds to be affected by the proposed action. No conservation measures were integrated into the proposed action because the construction activities have limited potential to affect migratory birds.

6.19. Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, 5 October 2009

This executive order requires that Federal agencies shall increase energy efficiency; measure, report and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse and storm-water management; eliminate waste, recycle and prevent pollution; leverage agency acquisitions to foster markets for sustainable technologies and environmentally preferable materials, products and services; design, construct, maintain and operate high performance sustainable buildings in sustainable locations; strengthen the vitality and livability of the communities in which federal facilities are located; and inform federal employees about and involve them in the achievement of these goals.

The proposed action is in compliance with this Order because all actions would be conducted in a manner as to prevent pollution and chemical spills by following BMPs.

6.20. Other Laws and Executive Orders

All actions involved in restoring and enhancing estuarine habitat at the CSR project site are confined to the Lower Columbia-Clatskanie watershed; the Lower Columbia-Clatskanie watershed is outside of the Oregon coastal zone and the project site is a floodplain area that is inaccessible to marine mammals, consequently having no effects to marine mammals during or after construction. No portion of the Columbia River is designated as a "wild and scenic river", therefore the project site does not warrant protections provided under the Wild and Scenic Rivers Act.

For these reasons, the following laws do not require further evaluation for impact or assessment for compliance:

- Coastal Zone Management Act, 1972
- Marine Mammal Protection Act, 1972
- Marine Protection, Research and Sanctuaries Act (Section 103), 1972
- Wild and Scenic Rivers Act, 1968

7. COORDINATION AND DISTRIBUTION

Public concerns identified through public comments would aid in determination of whether or not an EIS is necessary for the Proposed Action. If it is determined that an EIS is not required, a FONSI would be prepared and signed, concluding the NEPA process.

This draft EA and a draft FONSI are being issued for a 30-day public review period, beginning 25 April 2016 and ending 25 May 2016. The draft documents are available at the Corps' website: http://www.nwp.usace.army.mil/Media/Announcements.aspx.

A public notice was sent to all interested parties and stakeholders for the public review period, including the following agencies and user groups:

AT&T Corporation

Century Link

City of Columbia City, Oregon

City of Rainier, Oregon
City of St. Helens, Oregon
Columbia County, Oregon
Columbia Riverkeeper
Confederated Tribes of the Grand Ronde
Confederated Tribes of Siletz Indians
Cowlitz Indian Tribe
Deer Island Drainage Improvement Company (diking district)
MCI Fiber Optics
NOAA Fisheries, National Marine Fisheries Service
Natural Resources Conservation Service
Northwest Natural Pipeline
Northwest Pipeline
Oregon State Historic Preservation Office
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Geology and Mineral Industries
Oregon Department of Land Conservation and Development
Oregon Department of Parks and Recreation
Oregon Department of State Lands
Oregon Department of Transportation
Oregon Natural Resources Council
Oregon Water Resource Department, District #18 Watermaster
Portand & Western Railroad
State of Oregon, Governor's Office
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

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