Columbia-Pacific Passage Habitat Restoration

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Columbia-Pacific Passage Habitat Restoration

Data Sources:
Project Footprints - CREST
Rip rap - CREST
Aerial Photo - NAIP 2013

Projection:
NAD 1983 State Plane

Landscape Connectedness
Columbia-Pacific Passage Habitat Restoration

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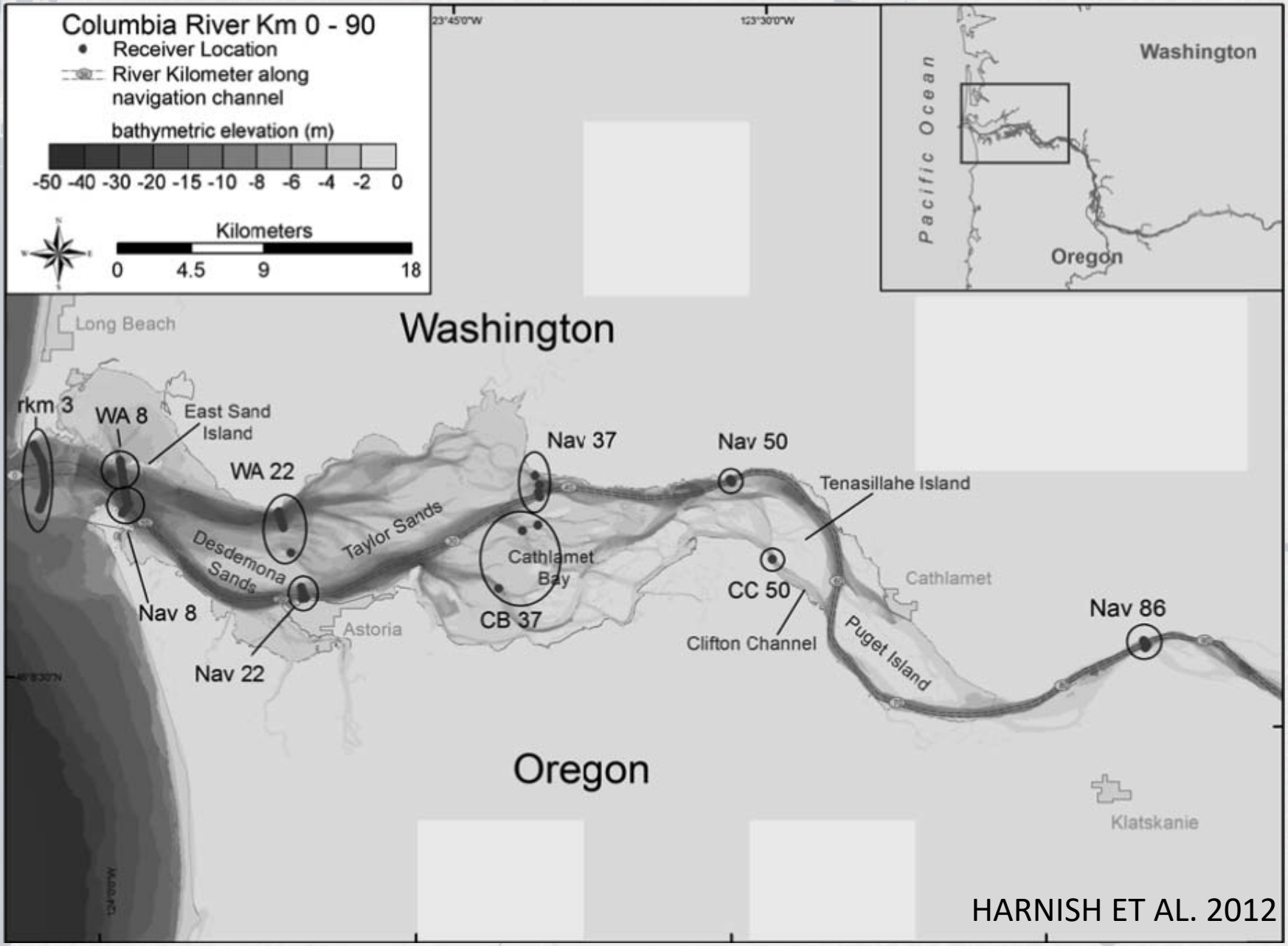
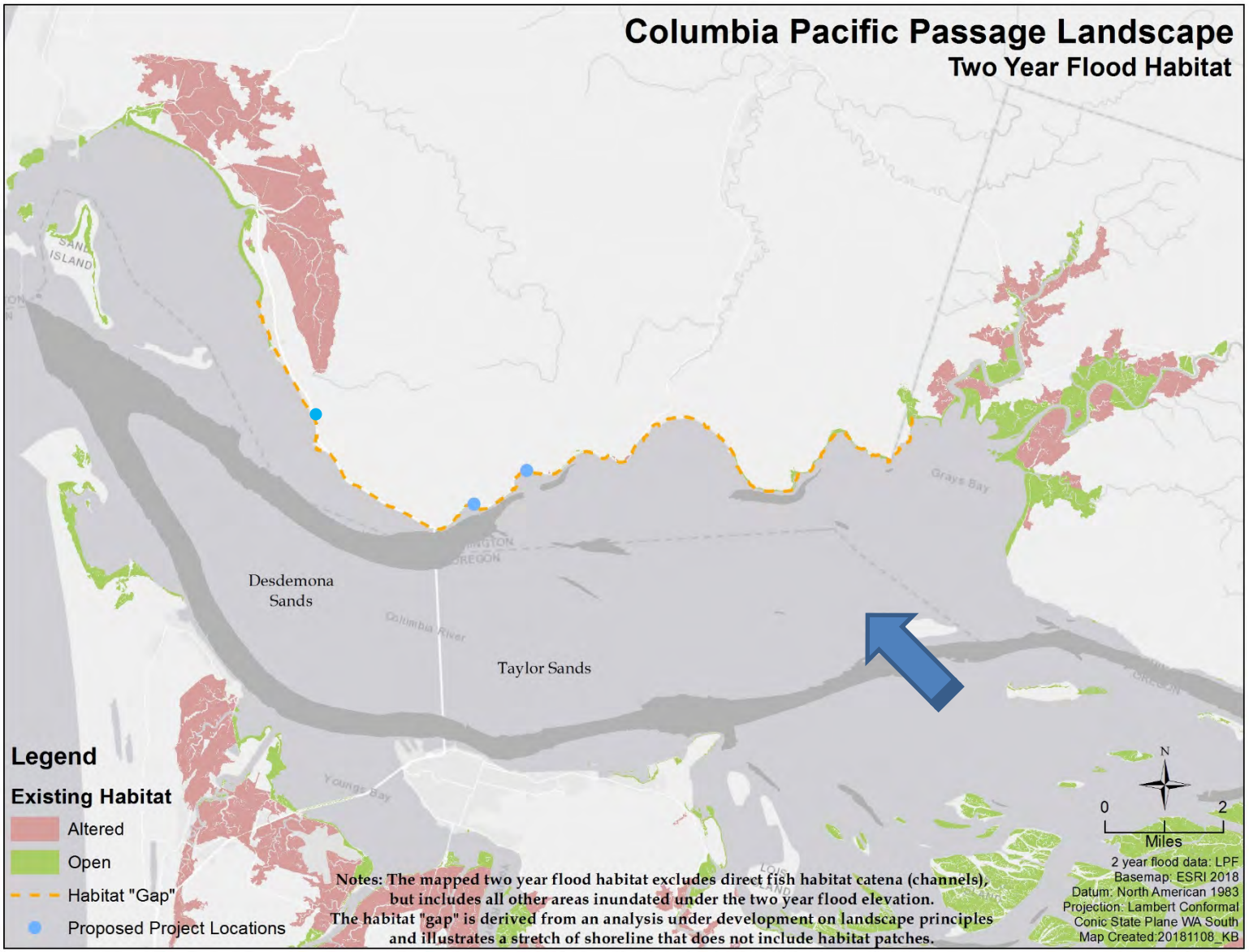
Migratory Pathway



HARNISH ET AL. 2012

Habitat Connectivity



Vision

Improved survival conditions for migrating salmon.

Reconnection of fragmented landscapes in the LCRE through a series of hydrologically connected habitats that compose migratory stepping stones to off-channel wetland habitat in a stretch of the river devoid of such habitat opportunities.

Restore a series of resilient sites that will provide immediate benefits, capable of accommodating several projected climate change scenarios, while supporting the long-term trajectory of functioning tidal wetland habitat

Project Goals & Objectives

Goal 1: Minimize stress and predation risks during estuary migration by providing a series of habitat stepping stones in an area devoid of off-channel refugia.

Objectives:

- Remove three fish barriers over a ten year period to facilitate survival during migration, softening the shoreline along SR401 and re-establishing hydrologic connectivity to patches of historical off-channel habitat within the Lower Columbia River Estuary
- Increase channel habitat complexity with a strategic grading plan and the installation of cobble riffles, pools, and large woody debris to provide deeper pools/matrix habitat that provide suitable low-tide refugia
- Facilitate movement and survival between habitat patches by reducing physiological stresses including salinity stress as the salt wedge moves with the tide, and thermal stress

Goal 2: Increase opportunities for estuary feeding and residency to increase growth before ocean entry by restoring the connection to floodplain habitats and planting a diverse range of native species appropriate to the site(s).

Objectives:

- Restore the connection to over 100 acres of tidal floodplain habitat to enhance nutrient exchange processes
- Enhance foraging interface and prey production through native wetland vegetation planting
- Enhance and manage vegetation consistent with re-introduced hydrologic regime to compete against future infestation by invasive plant communities, restore long-term processes of large wood recruitment, and channel margin habitat

Goal 3: Integrate climate resilience into restoration design.

Objectives:

- Determine hydraulic freeboard calculations for appropriate conveyance under projected SLR scenarios
- Incorporate deliberate planting plans that select native species assemblages capable of accommodating changes in salinity and inundation
- Implement strategic site excavation/grading to ensure gradual slopes for plants to adjust alongside SLR
- Restore sediment accretion processes capable of combating the loss of shallow water habitats

Project Actions Overview

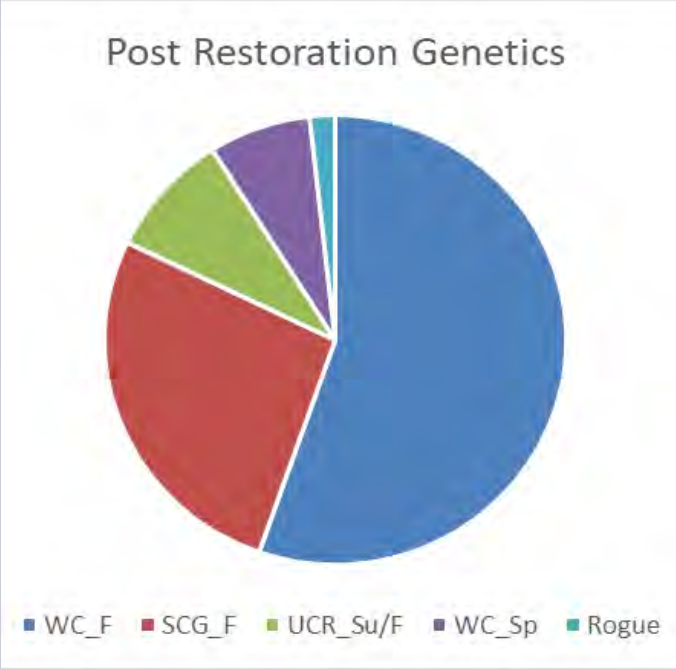
Project actions seek to improve fish access and site function while integrating climate resilience into restoration design for the Columbia River and nearshore environment.

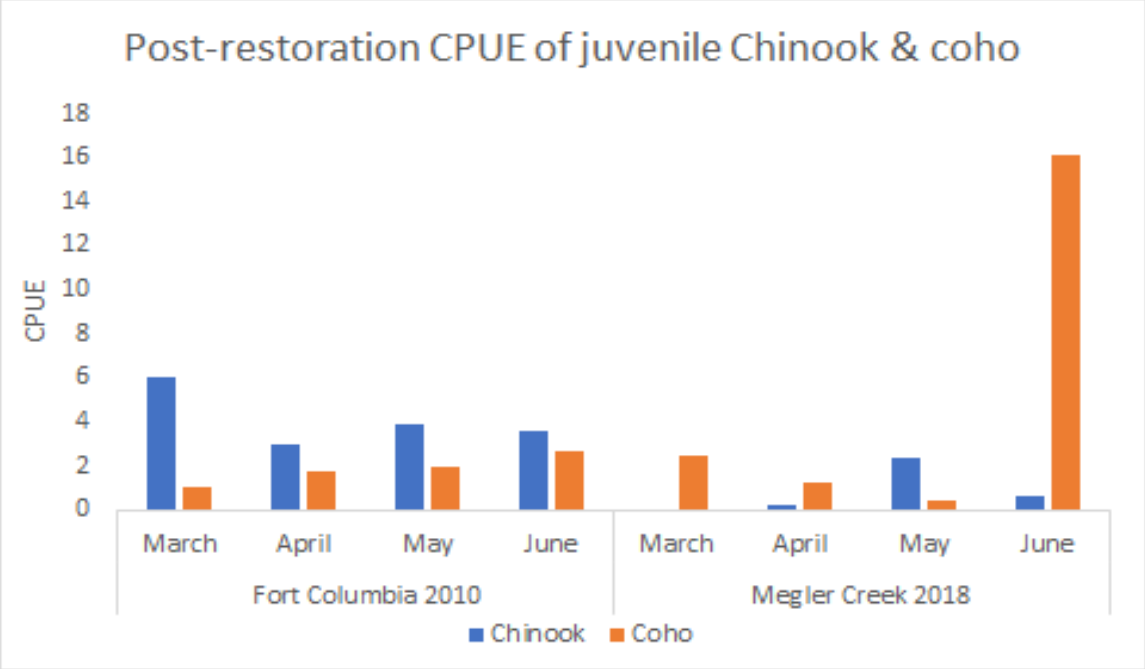
- Restore hydrologic connectivity by removing three fish barriers, creating larger fish friendly openings along the mainstem Columbia River
- Restore topographic diversity to resemble pre-roadway gradients promoting gradual slopes and tidal connectivity to vegetated tidal wetlands
- Incorporate a dense native planting and seeding plan utilizing species that are adaptable with broad inundation and salinity tolerances
- Install a suite of restoration treatments to fulfill multiple objectives including; near bank roughness, energy dissipation, promote habitat diversity and channel complexity

Fort Columbia Project Actions

Megler Creek

Megler Creek Project Actions


Post Restoration Genetics
WC_F
SCG_F
UCR_Su/F
WC_Sp
Rogue


Post-restoration CPUE of juvenile Chinook & coho
CPUE
18
16
14
12
10
8
6
4
2
0
March
April
May
June
March
April
May
June
Fort Columbia 2010
Megler Creek 2018
Chinook
Coho

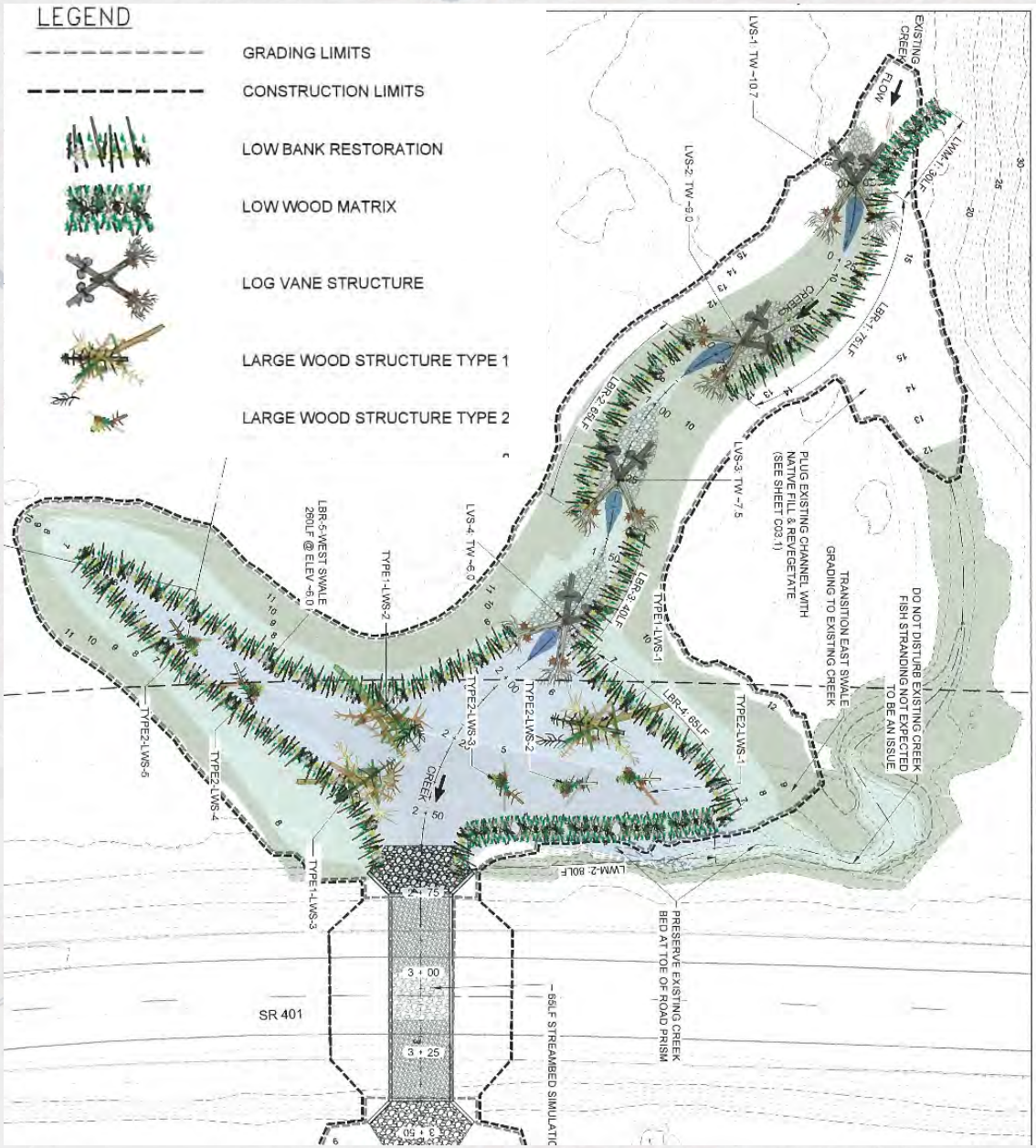
Fish Use

Megler Creek
Snorkel Surveys

Hungry Harbor – Historic vs. Existing Conditions

Hungry Harbor – Project Actions

- Replace a 60” damaged culvert with an 18’-span by 12’-rise stream simulation concrete box culvert.
- Remove approximately 6,500 CY of impounded sediment to restore pre-roadway gradients and tidal floodplain connectivity.
- Install a suite of restoration treatments to promote habitat diversity and channel complexity.
- Install native plantings to enhance the existing plant communities, increase wetland plant diversity, and provide a variety of prey resources.
- Enhance hydrologic connectivity, fish access, flux, and edge complexity to the floodplain.

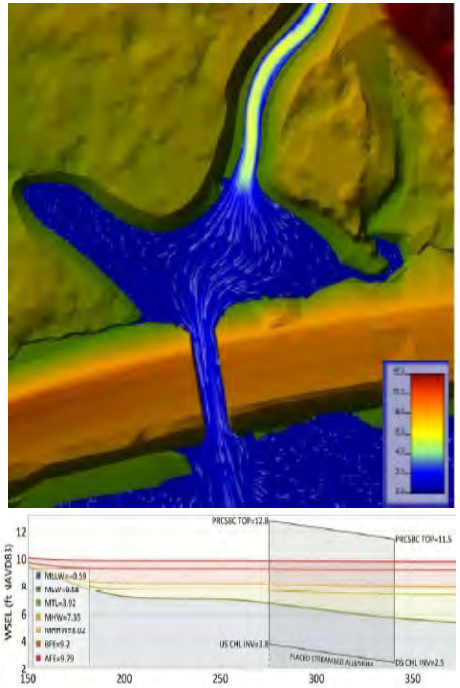


Climate Change Adaptability

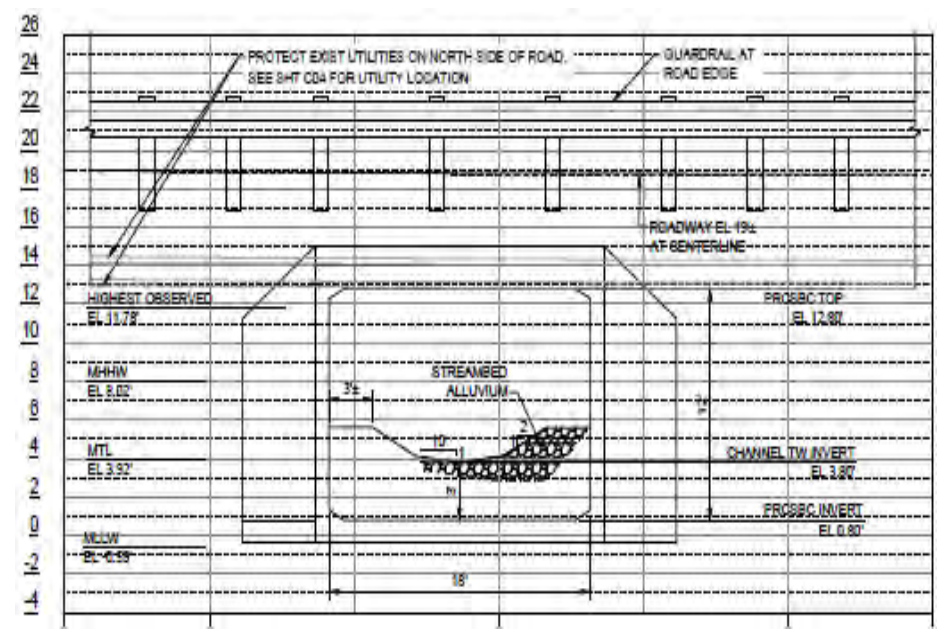
Climate change variations can affect watershed and estuarine systems in many ways. Two of the most common are sea level rise (SLR) and changes in the intensity and variability of hydrology and rainfall-runoff.

Climate change adaptation measures that apply to the estuarine creek confluences and the stream habitats associated with the CPP project include:

- Design bridge/culvert structure low chord or crown elevation considering expected SLR over expected structure lifespan (approximately 50 – 75 years)
- The size of the structure and restored creek channel should accommodate (mitigate effects of) anticipated increases in peak flows, and lower flows/depths associated with decreases in spring /summer base flows
- Design creek floodplain habitats that transition gently to higher elevations to accommodate higher tidal inundation expected from SLR
- Restored vegetation should be able to withstand variable salinity and self-adjust, i.e., wetland vegetation capable of advancing to higher elevations in response to increased tidal water levels and salinity levels during low Columbia River discharges (summer and fall)



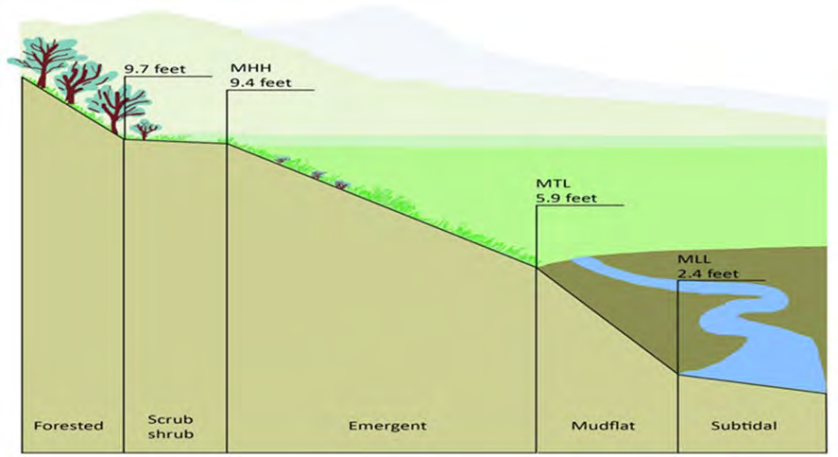
Tidal Datums & Key Elevations	Elevation (ft. NAVD88)
Typical Roadway Centerline Near Culvert[1]	19
1% Annual Exceedance Probability (AEP) Tide[2]	11.94
2% AEP Tide (Highest Observed)	11.78
5% AEP Tide	11.53
10% AEP Tide	11.32
20% AEP Tide	11.07
50% AEP[2]	10.65
Annual Flood Elevation	9.79
Federal Emergency Management Agency (FEMA) Base Flood Elevation[4]	9.20
Mean Higher High Water (MHHW)[3]	8.02
Mean High Water (MHW)[3]	7.35
Existing Culvert Invert Elevation (Landward Side / Columbia River Side)[1]	4.42 / 4.63
Mean Tide Level (MTL)[3]	3.92
Edge of tidal flat bench on Columbia River Side ~150 ft. South of SR 401 road prism	~3.0 – 5.0
Mean Low Water (MLW)[3]	0.58
Mean Lower Low Water (MLLW)[3]	-0.59
Lowest Observed Water Level	-4.44



Vegetation & Elevation

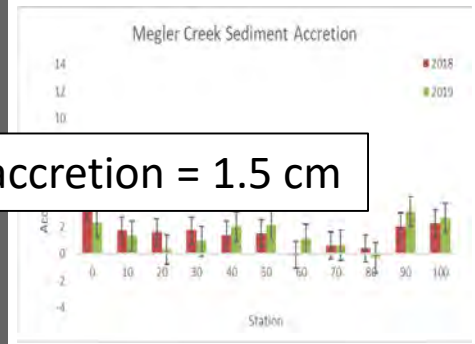
Restore topographic diversity to resemble pre-roadway gradients promoting gradual slopes and tidal connectivity to vegetated tidal wetlands.

- Vegetation establishes on specific elevations
- Elevation linked with hydrology drives vegetation distribution and channel morphology
- Knowledge of vegetation elevations can improve restoration success
- Unique vegetation because it encompasses the transition between the saline and freshwater tidal regimes of the CRE

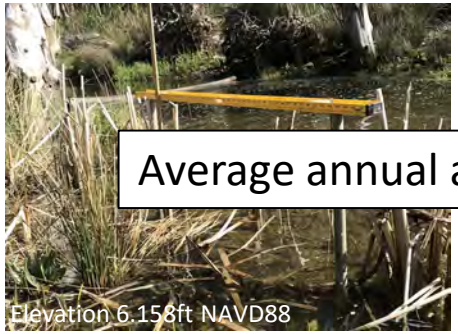


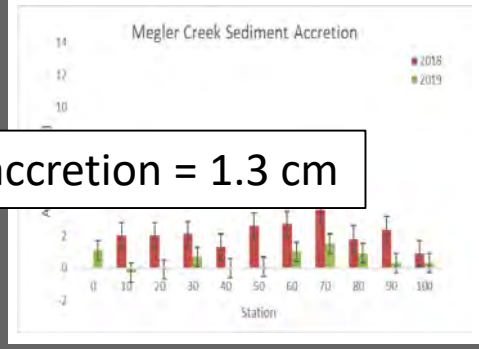
Vegetation communities defined by Johnson et al. 2010

Benefit of restored function and processes



Average annual accretion = 1.5 cm





Average annual accretion = 1.3 cm

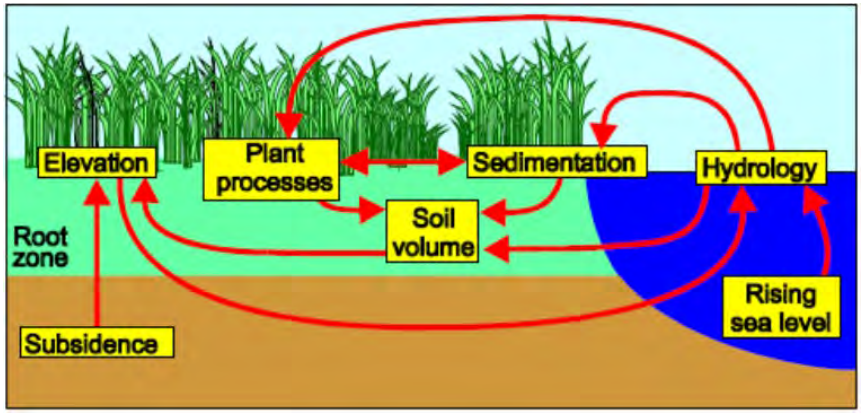
Climate Resilience.

Example: sediment accretion processes capable of combating the loss of shallow water habitats due to SLR.

Multiple factors to consider:

- Elevation
- Vegetation
- Hydrology
- Soils
- Projected SLR rates

Floodplain marsh habitat provides many ecosystem services such as prey production, carbon storage, storm protection, and foraging and rearing habitat for fish species



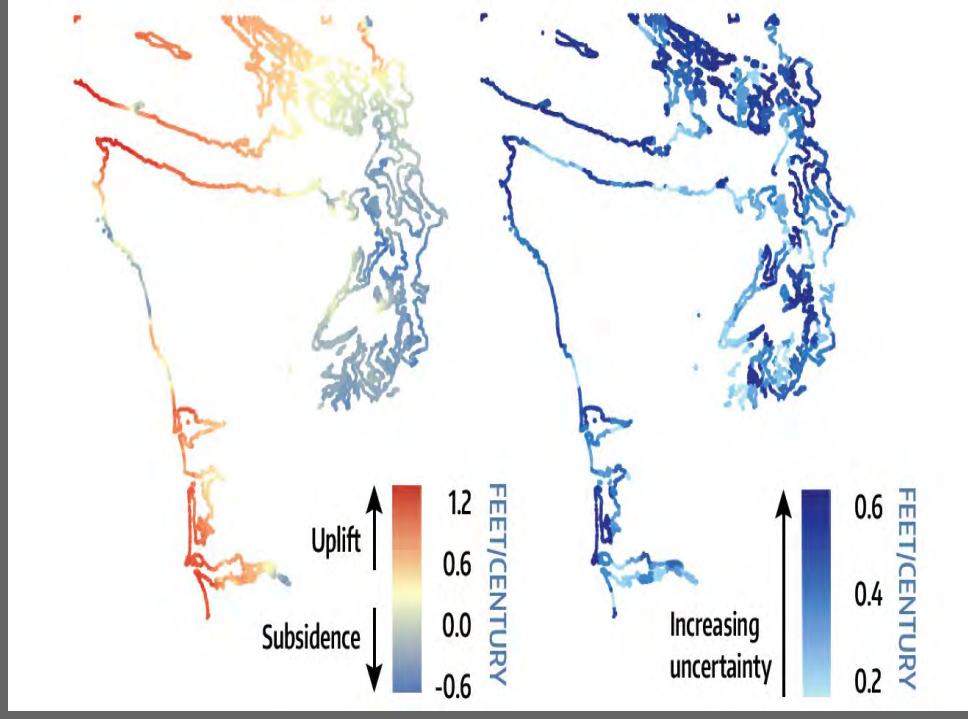
USGS https://www.nwrc.usgs.gov/factshts/fs91_97.pdf

Relative Sea Level Rise Projections

The Washington Coastal Resilience Project (WCRP) is an effort to rapidly increase the state's capacity to prepare for coastal hazards, such as flooding and erosions that are related to sea level rise.

The RSL Projection is expressed in terms of the "probability of exceedance" for 2100 (2090-2109) under two different greenhouse gas scenarios (RCP 4.5 ["Low"] and RCP 8.5 ["High"]; van Vuuren et al., 2011). Projected changes are assessed relative to contemporary sea level, which is defined as the average sea level over the 19-year period 1991-2009.

- Data for 171 locations along the Washington State shoreline
- Vertical land movement estimate and uncertainty (1 standard deviation) for this location: 0.7 ± 0.1 feet/century.
- Seismic Activity could interrupt vertical land movement. Projections for the CPP site are -1.5 to -5.1 ft.



PROJECTED RELATIVE SEA LEVEL CHANGE FOR 2100
(feet, averaged over a 19-year time period)

Location	Vertical Land Movement Estimate	Greenhouse Gas Scenario	Central Estimate (50%)	Likely Range (83-17%)	Higher magnitude, but lower likelihood possibilities		
					10% probability of exceedance	1% probability of exceedance	0.1% probability of exceedance
CPP (46.2N, 123.9W)	0.7 ± 0.1	Low	0.9	0.3-1.5	1.8	3.4	6.7
		High	1.3	0.7-2.1	2.4	4.1	7.6

www.wacoastalnetwork.com/wcrp-documents.html
Miller et al. 2018

Summary

The Columbia- Pacific Passage Habitat Restoration project seeks to improve fish access and site function while integrating climate resilience into restoration design for the Columbia River and nearshore environment.

Opportunities for floodplain reconnection within the lower estuary are extremely limited due to historical and ongoing modifications to the shorelines and adjacent floodplains.

With over 80% of yearling and subyearling salmonids utilizing the north shore of Columbia River from rkm 37 to rkm, the relative number of salmon that a proposed project within this area might support directly (by accessing the site) and indirectly (by exporting prey and organic material from the site) is high.

Thank you!

Lower Columbia Fish Recovery Board – Since 1998

Washington State Recreation and Conservation Office

National Park Service

Pacific Marine & Estuarine Fish Habitat Partnership

Bonneville Power Administration

Lower Columbia Estuary Partnership

Washington State Parks

U.S. Fish & Wildlife Service – Department of the Interior

The Nature Conservancy

Washington State Department of Transportation

GreenWood Resources – A Resource That Lasts Forever

Department of Ecology – State of Washington

ESA

Tetra Tech

Thompson Bros Excavating, Inc

National Oceanic and Atmospheric Administration – NOAA – U.S. Department of Commerce

crest – Columbia River Estuary Study Taskforce

Washington Department of Fish and Wildlife

Washington Coast Restoration and Resiliency Initiative

Washington State Department of Natural Resources