



Steigerwald Reconnection Project Revegetation Efforts

everything, everywhere, all at once

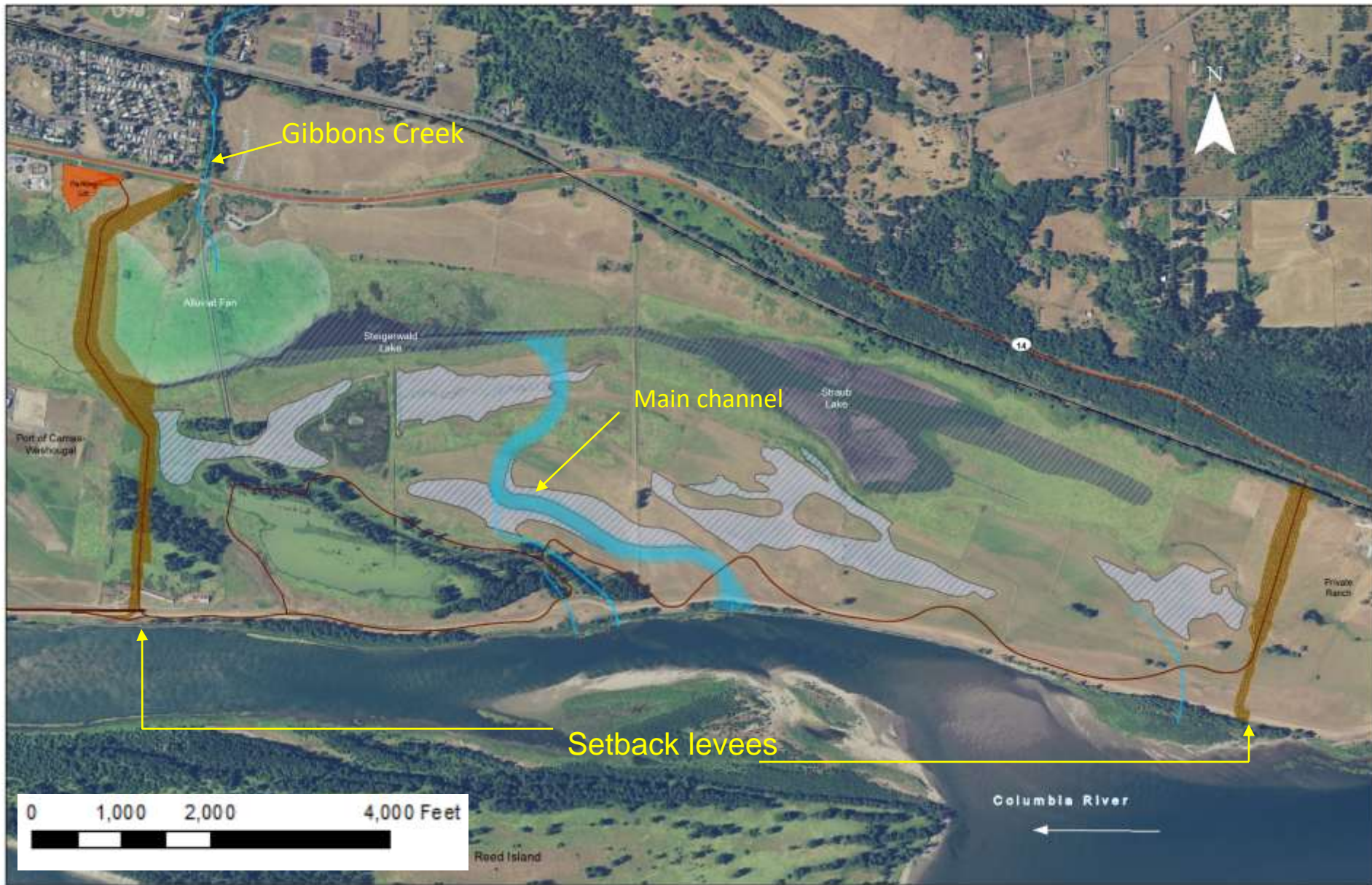




- Planting Approach & Considerations
- Challenges
- Wapato & Wetland seeding
- Cottonwood poles
- CO₂ Emissions Mitigation

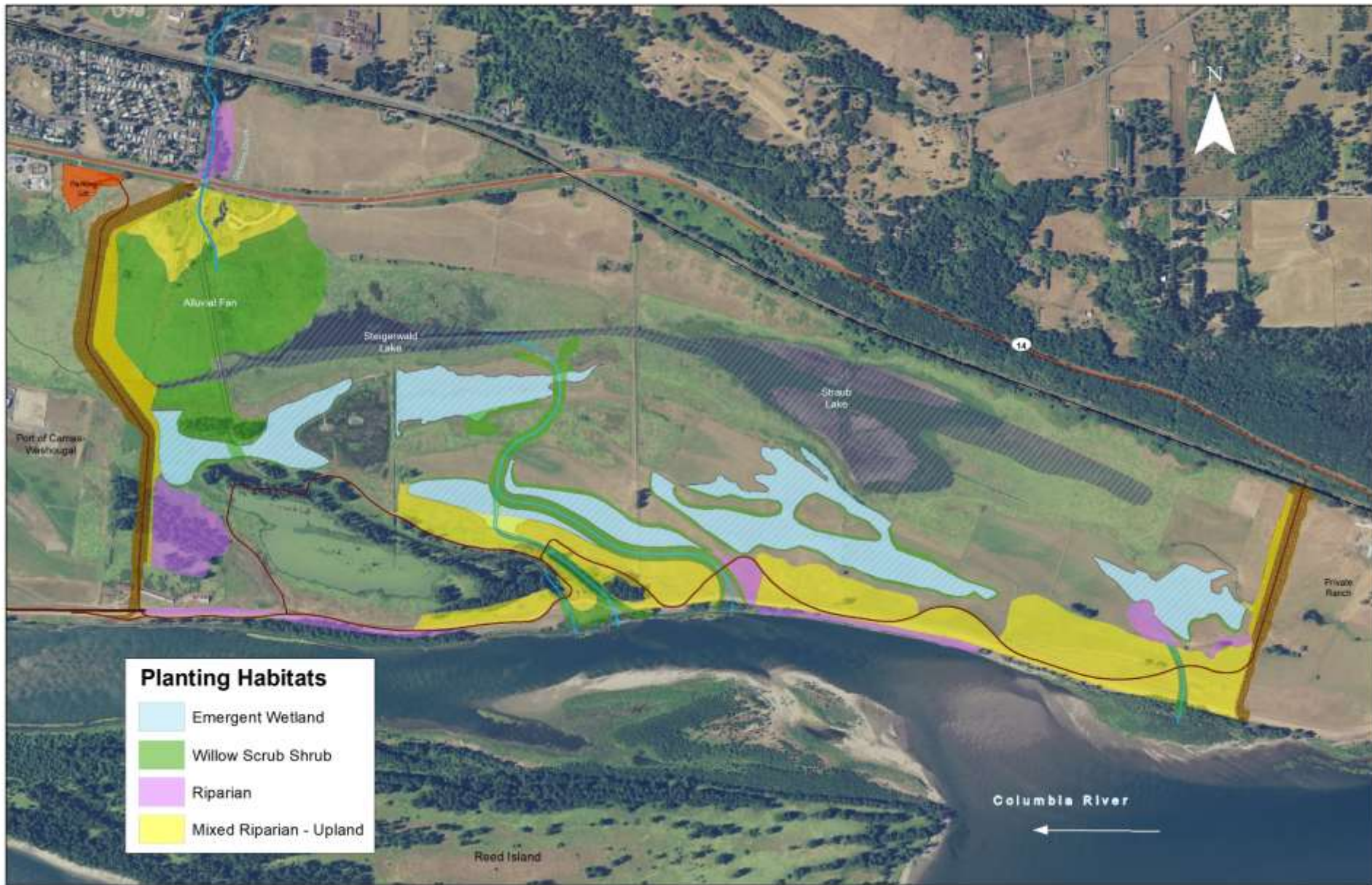


Steigerwald Project footprint



Planting across 252 ac of riparian & 102 ac of wetland habitats

EVERYWHERE



Reveg Phases

Hydroseeded >300 acres (17,000 lbs of seed)

Site Prep



HydroSeed



Planting



Plant Establishment



- Timing critical: hydroseed early-mid September
- Is fertilizer always necessary?

By the numbers...

*plants installed
(2019 - 2023)*

Bareroot trees & shrubs	461,000
Willow cuttings	164,350
Cottonwood poles	14,750
TOTAL	640,100

- 14 tree species
- 23 shrub species
- >360 lbs specialty wetland seed
- >4000 wapato tubers



Volunteer & students installed
29,063 plants to date



Species Considerations

High tolerance to hydrologic fluctuations

Common	scientific	indicator status
Spirea	<i>Spiraea douglasii</i>	FACW
Nootka / swamp rose	<i>Rosa nutkana / pisocarpa</i>	FAC
Snowberry	<i>Symphoricarpos alba</i>	FACU
Oregon ash	<i>Fraxinus latifolia</i>	FACW



Emerald ash borer



Oregon Ash substitutes:

- Cottonwood
- Willows
- Crabapple
- Oregon white oak



Species Considerations

Climate Resilient?

Common	scientific	indicator status
Ponderosa Pine	<i>Pinus ponderosa</i>	FACU
White Alder	<i>Alnus rhombifolia</i>	FAC
Incense Cedar	<i>Calocedrus decurrens</i>	FACU
Black Oak	<i>Quercus kelloggii</i>	FACU
OR Myrtle / CA Bay	<i>Umbellularia californica</i>	FAC



Ponderosa Pine



OR Myrtle



Black Oak

Assisted migration riparian candidates to consider??

- Box Elder
- CA Walnut
- CA Sycamore



Challenges... *Everything, Everywhere, All at Once*

Scale

**Site
Access**

**Hydrologic
Swings**

**Clay
Soils**



Herbivory

**Extreme
Weather**

Compaction

Weeds

Engineers



Winter 2021/2022: 352,000 plants installed across 170 ac



- Multiple Nurseries
- 2 Plant Coolers
- 2 Reveg contractors

Reefer cooler onsite



R Franco Restoration



Ash Creek Forestry Management

Limited Access



Main trail under construction during winter 2022



Marooka to the rescue





Planting Substrate



Sand & silt soils best for levee construction



Heavy clay soils on site



Lots of big equipment = compaction

Decompaction via Ripping



3 Ripping tines ~18" deep



Loosened Planting furrows



Climatic & Hydrologic Extremes

- Spring 2022 wettest on record, freshet ~7 year event
- Summer 2021 & 2022 among hottest & driest on record



June 2022 Freshet



Help

Sept 2022



Gorge winds are not always celebrated



Gibbons Creek main outflow channel



Construction completed in September 2021



November 2021



December 2021



June 2022

Gibbons Creek main outflow channel



July 2022



September 2022



October 2022



Wetland Seeding

Specialty Wetland Seed

Common	Scientific	total
Soft stem Bulrush	<i>Schoenoplectus tabernaemontanii</i>	82
hardstem bulrush	<i>Schoenoplectus acutus</i>	99
Narrow leaved burreed	<i>Sparganium emersum</i>	30
Giant burreed*	<i>Sparganium eurycarpum</i>	30
Small Fruited bulrush	<i>Scirpus microcarpus</i>	14
Awl fruited sedge	<i>Carex stipata</i>	5
Wapato*	<i>Sagittaria latifolia</i>	31
		365 lbs

* Collected on site



Many wetlands seeds float

Distributed wetland seed across 102 acres



Pre-mixing seed & soil



Seed mud balls

Playing in the Mud...





Wapato (*Sagittaria latifolia*)

- Culturally significant & important first food
- Perennial plant grows edible, starchy tubers
- Footprint has declined in the Columbia Basin
- Valuable to a range of wildlife



Vegetative growth initiated from tuber in spring



Chinook Nation Wapato blessing at Steigerwald

Tuber Harvest



1 plant can produce MANY tubers



Tubers ready for harvest in late fall

Planted over 4000 Wapato tubers



Plant ~6" deep in soil, growing tip pointing up



Growing Tip



Are my fingers still attached?

Wapato Tuber Growth Investigation



- Planted tubers in wetted pots in winter
- Excavated tubers in summer



No growing tip...no observed growth



Every severed tuber with growing tip...**Grew!**

A Happy Wetland Story...



Expanded Habitat Wetland - 3 years post construction

Cottonwood (*Populus trichocarpa*)

- Adapted to floods & floodplains
- Large wood, shade & roughness
- Provide aquatic & terrestrial habitat
- Fastest growing & largest hardwood in PNW



Pole added >5ft growth
in 1st growing season



Installed 14,750 Cottonwood poles



Cottonwood Pole Investigations

Monthly Pole Planting Study

- Planted ~30 poles/month (Nov –March) of varying diameters to depth of 24in
- Evaluated survivorship after 1st growing season
- No observed mortality or growth differences between the months

Pole Root Development



Monthly pole plots set up along slope above wetland



Excavated poles after 1 growing season



Some roots measured >24in long

- Lateral roots will follow rip lines
- Optimal planting depth dependent on ground water (~18-24in)



CO₂ Emissions Mitigation



Project Impacts



Earthwork

1.7 mil cubic yards of earth moved
429,491 gallons of diesel fuel



Concrete

1080 CY poured for floodwall, abutments,
footings



Steel

244,084 lbs for rebar structures
& two bridges

CO₂ released

9,706,496 lbs

4,068,360 lbs

583,360 lbs

14,358,216 lbs

Unaccounted: Vehicle site trips, electricity, imported large wood, gravel.

A Cruise on Queen Elizabeth II for perspective

At her cruising speed of 28.5 knots, she was the world's fastest ocean liner



0.0095 MPG (travels 50 ft per Gallon of Diesel)

1 Round trip London - New York (~6300 nautical miles) >>> **14,921,052 lbs. CO₂ emitted**

Carbon Capture

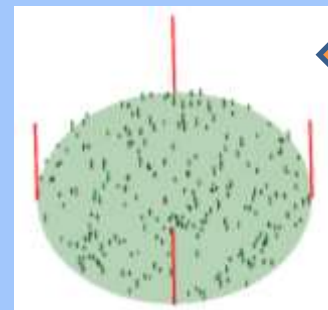
Tree Carbon Content

- generally assumed that CARBON comprises ~50% of the weight of oven-dry wood
- **1 lb of captured carbon = 3.7 lbs of CO₂ released**



Carbon Calculator Tools for Forest Growth

- allows you to “grow” trees and/or stands to a certain age, and calculates biomass and Carbon equivalent
- Species growth rates and forest stand interactions vary across models and may need to be adjusted
- Evaluated two models: **CREEC**
FVS



❖ Carbon Riparian Ecosystem Estimator for California (CREEC)

Matzek, Stella & Ropion, 2018

❖ Forest Vegetation Simulator (FVS)

US Forest Service

Planted: 100 cottonwood, 100 Pacific willow, 50 Alder planted per acre; 252 acres

Age	CO2 sequestered (lbs) across 252 ac planted	
	CREEC	FVS
5	15,108,355	1,832,634
10	32,271,313	6,093,433
15	44,458,664	18,436,501
20	51,744,670	36,394,333
30	59,195,705	86,261,214



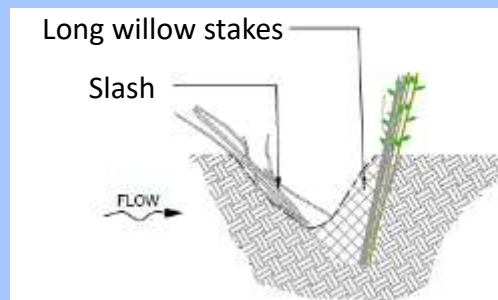
Carbon Sequestration Results Summary

- Steigerwald Project released ~ 14,500,000 lbs CO₂
- **Based on the two models used, plantings likely to capture equivalent carbon in 8-12 years.**



considerations...

- Reduce imported large wood
- Incorporate emission reduction strategies in design phase

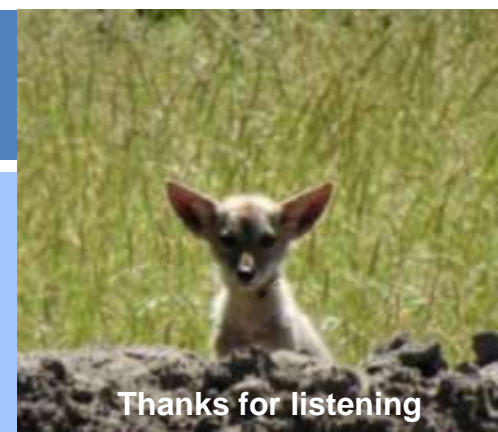


Floodplain roughness alternatives

Key Takeaways

everything, everywhere, all at once

- Be adaptive in your planting approaches and plan for multiple years
- Explore potential climate resilient, assisted migration species
- Incorporate soil decompaction specifications into your plans
- Understand your project site's soils
- Consider CO₂ emission reduction strategies during the design phase



Thanks for listening

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Gibbons Creek May 2023