Lower Columbia Estuary Partnership

Action Effectiveness Monitoring and Research (AEMR) – Results Review

Science Workgroup
Meeting June 28, 2022

Sarah Kidd (she/her), PhD
Senior Scientist – Research Lead

Sneha Rao (she/her), MSc
Research Scientist – UAV specialist

Ian Edgar (He/Him)
Research Scientist – Tableau specialist

Research Partners

THANK YOU

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

Bonneville Power Administration

Washington Department of Fish and Wildlife

OHSU

Cowlitz Indian Tribe

Columbia Land Trust

Oregon Fish & Wildlife

crest Columbia River Estuary Study Taskforce

University of Washington 1861

U.S. Fish & Wildlife Service

Pacific Northwest National Laboratory

Schott & Associates, Inc.

Institute for Applied Ecology

April Silva, CREST

Overview

- Action Effectiveness Monitoring and Research Status
    - Programmatic AEMR
- 2020-2021 Results Highlight
- Group Discussion: ERTG Site Revisits

Columbia Estuary Ecosystem Restoration Program (CEERP) Objectives:

1. Increase the capacity (quality) of estuarine and tidal-fluvial ecosystems
2. Increase the opportunity for access by aquatic organisms to and for export of materials from shallow water habitats
3. Improve ecosystem realized functions for juvenile salmonids

Action Effectiveness Monitoring Research Program

AEMR = Selected sites (Level 2) receive Full Habitat surveys – Pre, 1, 3, 5 and 10 yrs. post-restoration – *Methods* here

All sites (Level 3) receive Basic Hydrology and Sediment Accretion Monitoring Years 1-5, 10 yrs. post-restoration

- ✓ **Habitat Structure, Hydrology, Soils, Sediment Accretion** - Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)
- ✓ *Spot Check of* **Macroinvertebrate Community** - Jeff Cordell, Jason Toft, Kerry Accola (UW)
- ✓ *Spot Checks at Year 5 and 10 Post* - **Fish Community and Occurrence** - (NOAA) Regan McNatt, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax
- ✓ Critical Field, Lab Support, UAV pilot - April Silva, Narayan Elasmar (CREST)

Level 2 & 3 Overarching question: How are restoration sites developing over time compared to reference wetlands (ideal) and goal (planned) conditions?

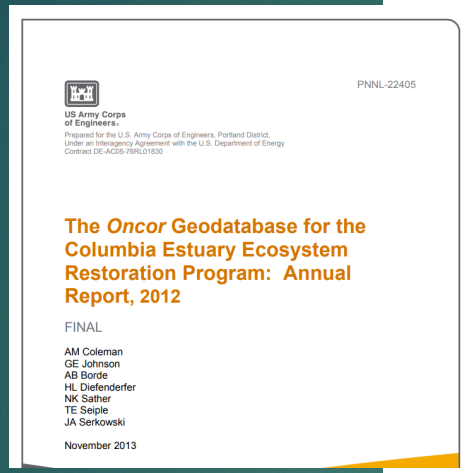
Wallooskee, Year 3, Cowlitz Tribe

Common Goals

- **Plant community development**
  - *Native plant community recovery*
- **Tidal hydrology**
  - *No longer restricted by dikes or tide gates*
- **Sediment and channel dynamics**
  - *Tidal wetland sediment erosion/accretion and channel and floodplain development and maintenance (SLR, Carbon dynamics, etc.)*
- **Macroinvertebrate and Salmonid food web dynamics**
  - *Conditions which foster salmonid utilization and sustainable food web interactions (such as flux of detritus and macros into the mainstem)*

Need for a proper Data Management System

RIP Oncor 2011-2018



PNNL-22405

US Army Corps of Engineers

Prepared for the U.S. Army Corps of Engineers, Portland District, Under an Interagency Agreement with the U.S. Department of Energy Contract DE-AC05-76RL01830

The *Oncor* Geodatabase for the Columbia Estuary Ecosystem Restoration Program: Annual Report, 2012

FINAL

AM Coleman
GE Johnson
AB Borde
HL Diefenderfer
NK Sather
TE Seiple
JA Serkowski

November 2013

71+ Sites across the lower Columbia

Level 3 AEMR Data

Hydrology
- 6+ million datapoints

Sediment Accretion
- 8000+ datapoints

Level 2 AEMR Data

Vegetation and Soil
- 50,000+ datapoints

Other

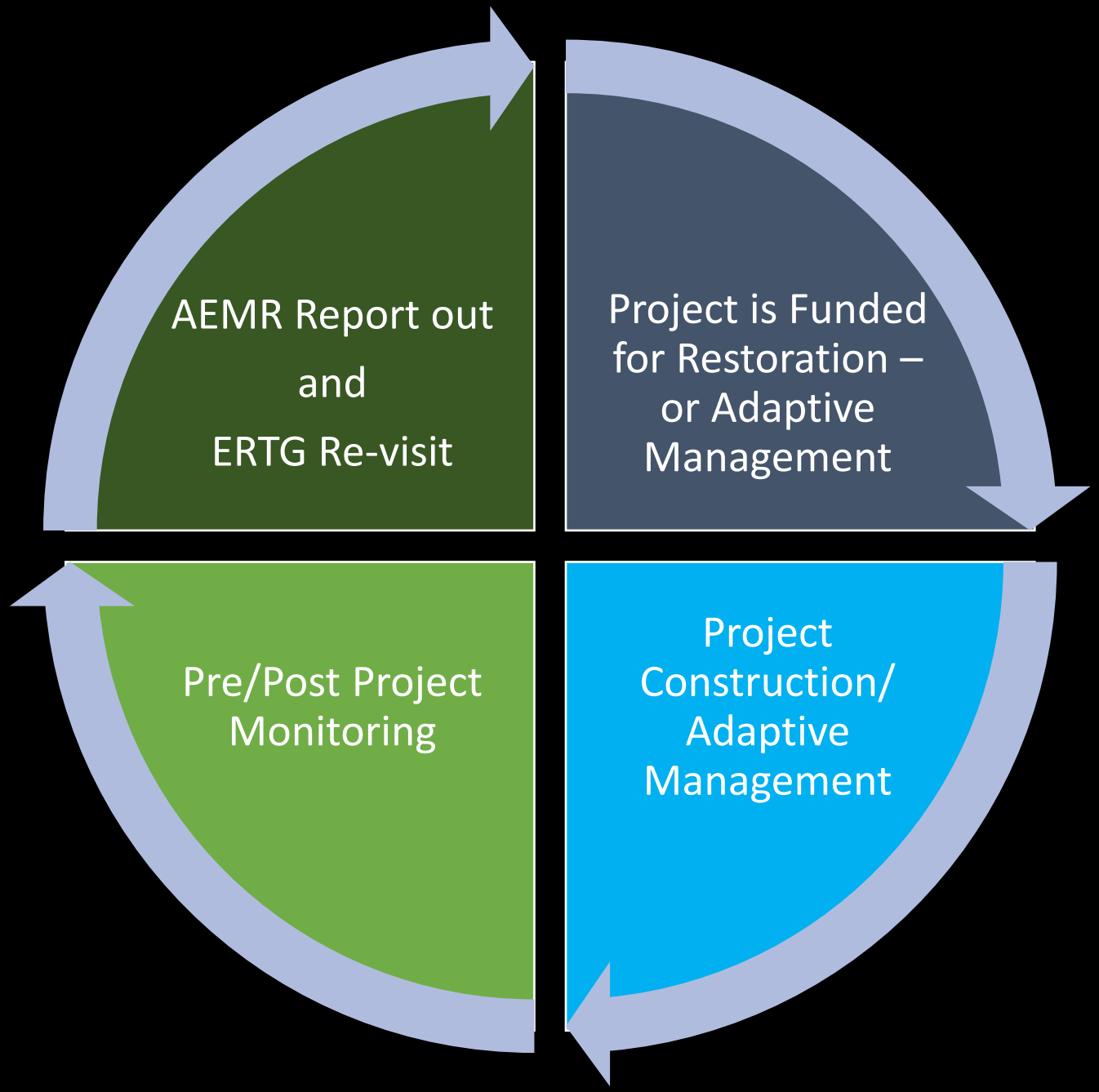
Macros, Fish, Biomass, drone, etc.

Where are we in the process

- Wallooskee – published Tableau Dashboard highlighting results on Level 2 & 3 metrics. Also took this opportunity to create the following models:
    - Plant Community Assessment
    - Salmonid Habitat Access and Opportunity
    - Overall Salmon Habitat Assessment
- In Process –
    - Finalizing Dashboards for 2020 and 2021 Level 2 sites. Brief results presented here.
    - Transitioning EMP Data (Hydrology, Veg, Macro and Fish) into Tableau
    - EMP 2022 and AEM 2022 reports
    - Updating Monitoring Protocols Draft

Expert Regional Technical Group (ERTG) Re-Visits

- **Recommendations**
  - Phase re-visits to coincide with AEMR report outs and data collection
    - Provides adequate time for data gathering and reporting
  - Adaptively update monitoring based on project uncertainties
    - as defined by ERTG and Project Sponsors
  - What are the various uncertainties going into each project and where is that project data found?
    - Can we connect the dots – with data collected vs. questions?



Adaptive Management Trigger Table

- What metrics can we monitor?
- What data do we already have?

✓Recommend providing more quantitative guidelines on all metrics being evaluated

Attachment 3: Post-Construction Assessment Grading Criteria

ERTG SEC Post-Construction Assessment Criteria (DRAFT)

DRAFT 11/11/21, 'Based on ERTG Scoring Criteria (matrices from file "ERTG Scoring Criteria Matrix 051420.xlsx"
Matrices below based on ERTG Doc #2020-02, Feb 2020. The original scoring criteria were ERTG Doc #2010-02.
The Assessment Criteria cover the same five factors as the Scoring Criteria:
Certainty of Success, Habitat Access, Habitat Capacity-site scale, Landscape-scale elements, and Habitat Capacity-matrix
EDITED for post-construction assessment
Bolded blue font implies potential for the ERTG to set quantitative levels

Certainty of Success (site-scale)	A	B	C	D	F
Restoring natural process or landform	Fully	Largely	Partially	Partially	Not evident
Self-maintaining	Obviously well self-maintaining	A fair amount of self-maintenance evident	Some self-maintenance evident	Self-maintenance not apparent and not likely	Intervention required
Risk of detrimental effects	None evident and no potential	None evident but potential exists	Very small amount evident	Small amount evident	Definitely evident

Habitat Access (site-scale)	A	B	C	D	F
Hydrologic site-scale connectivity	Full	High	Moderate	Low	Minimal to none
Site access for juvenile salmonids	Fully restored	Significantly increased	Modestly increased	Barely increased	Clearly no increase

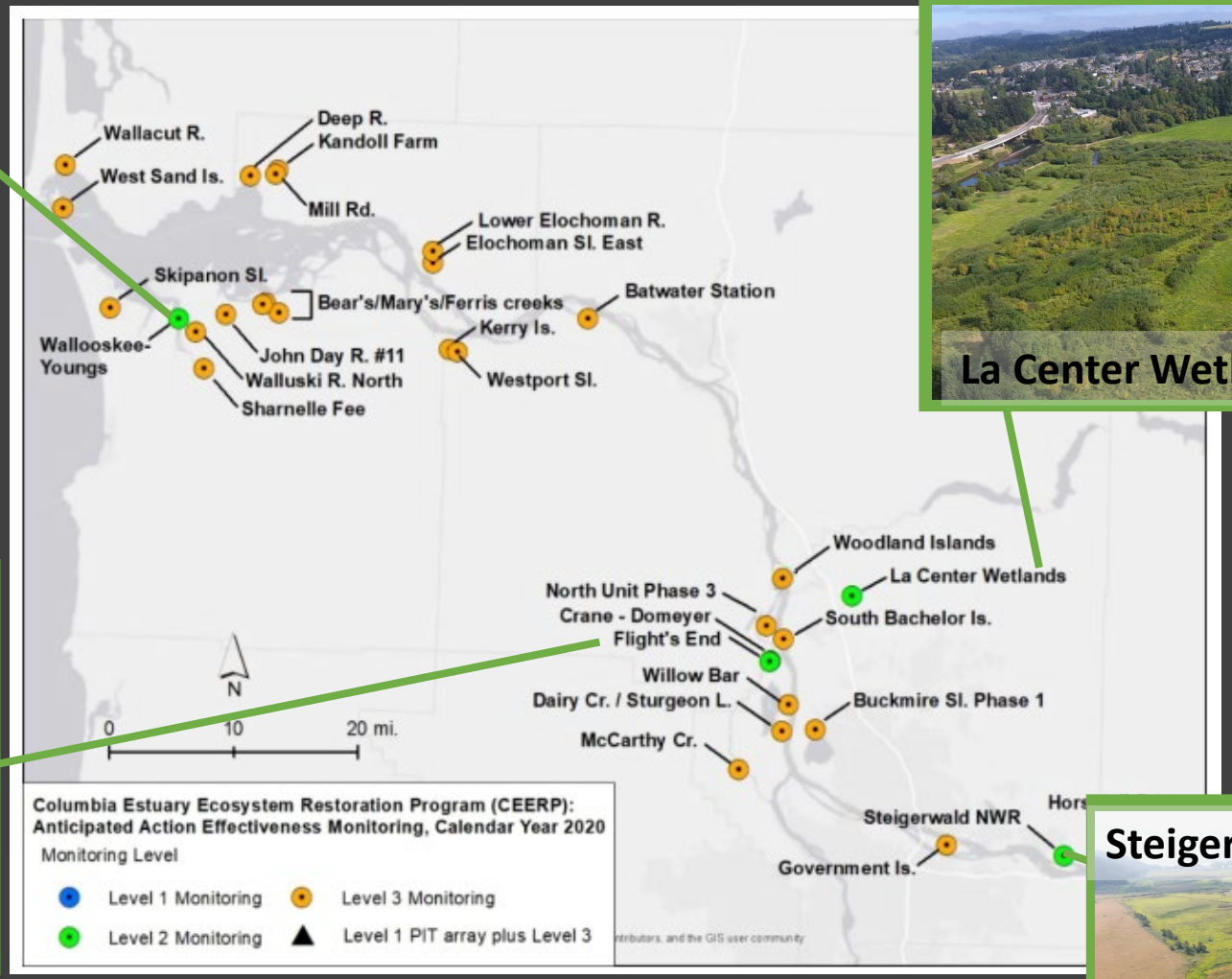
Habitat Capacity (site-scale)	A	B	C	D	F
Habitat complexity and diversity	Excellent	Very good	Moderate	Moderate to low	Little
Natural disturbance regime and ecosystem functions	Well-developed	Very good	Not ideal	Moderately developed	Poorly developed
Channel and edge network	**Extensive**	**Very good**	**Some**	**Little**	**None**
Prey resource production and export	Excellent	Very good	Moderate	Moderate to low	Little
Invasive species or nuisance predators	None present	Minimal amount present	Some present	Moderate amount present	Large amount present
Water quality/ temperature	**Excellent**	**Very good**	**Moderate**	**Moderate to low**	**Poor**
Site size	Large (> 100 ac)	Relatively large (30-100 ac)	Relatively large (30-100 ac)	Small (< 30 ac)	Small (< 30 ac)

Scappoose Bay, 2019

Overview 2020: Action Effectiveness Monitoring and Research

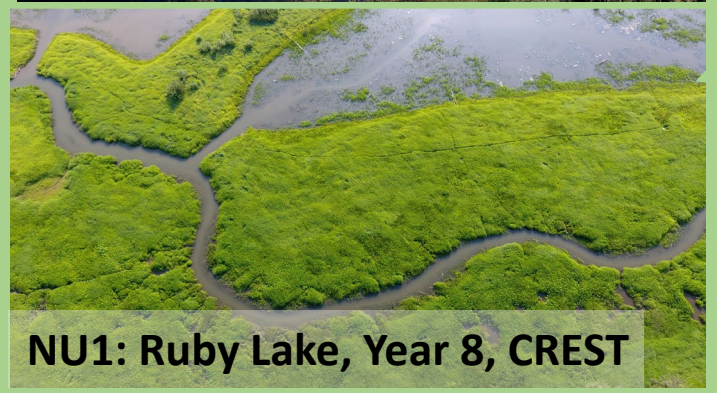
- Looking great! Abundant native recovery

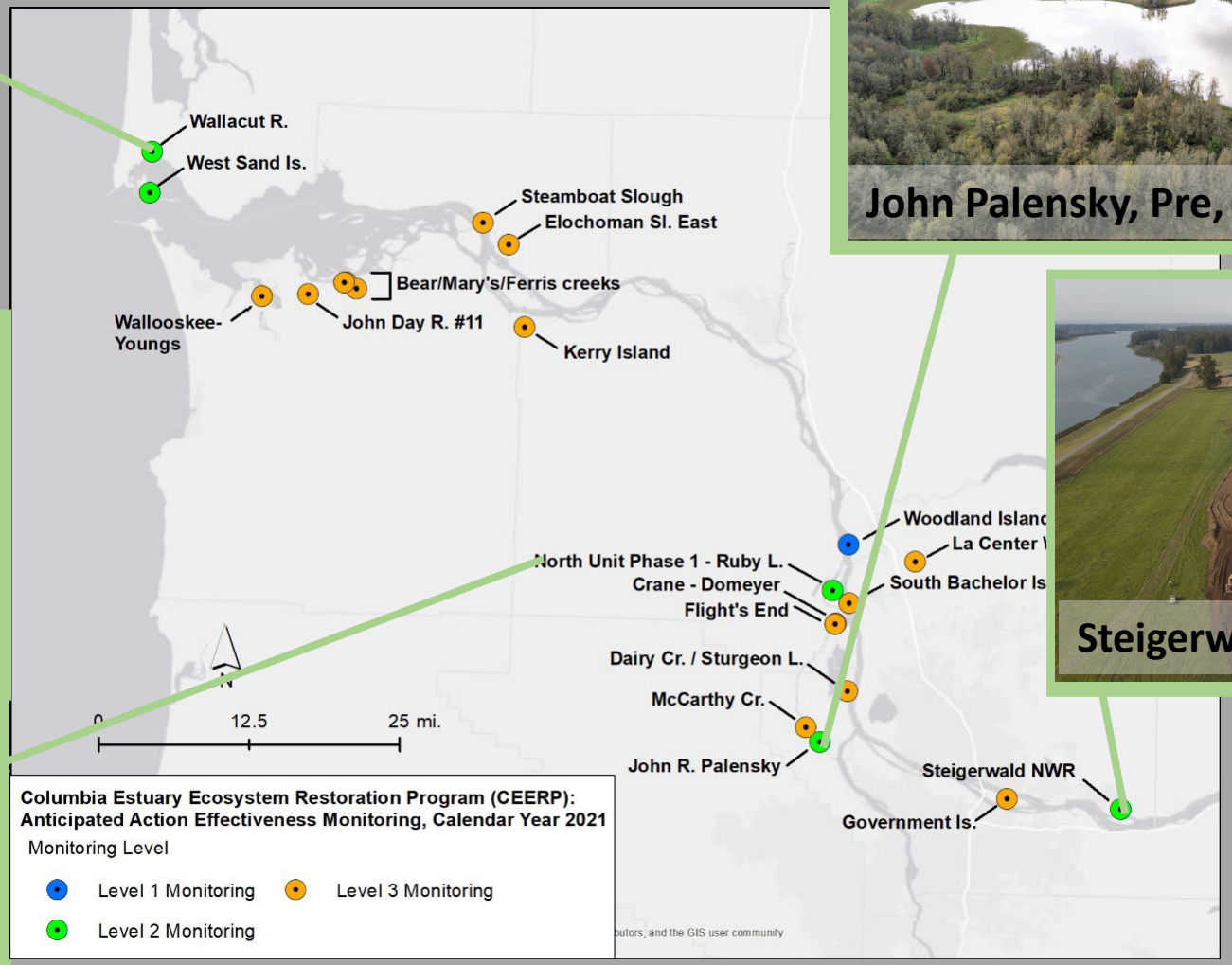
- Progress slow and hard to access due to heavy mowing



- Shrub-scrub plantings doing well
- Low marsh zones dense with Wapato
- Reed canarygrass abundant in high marsh

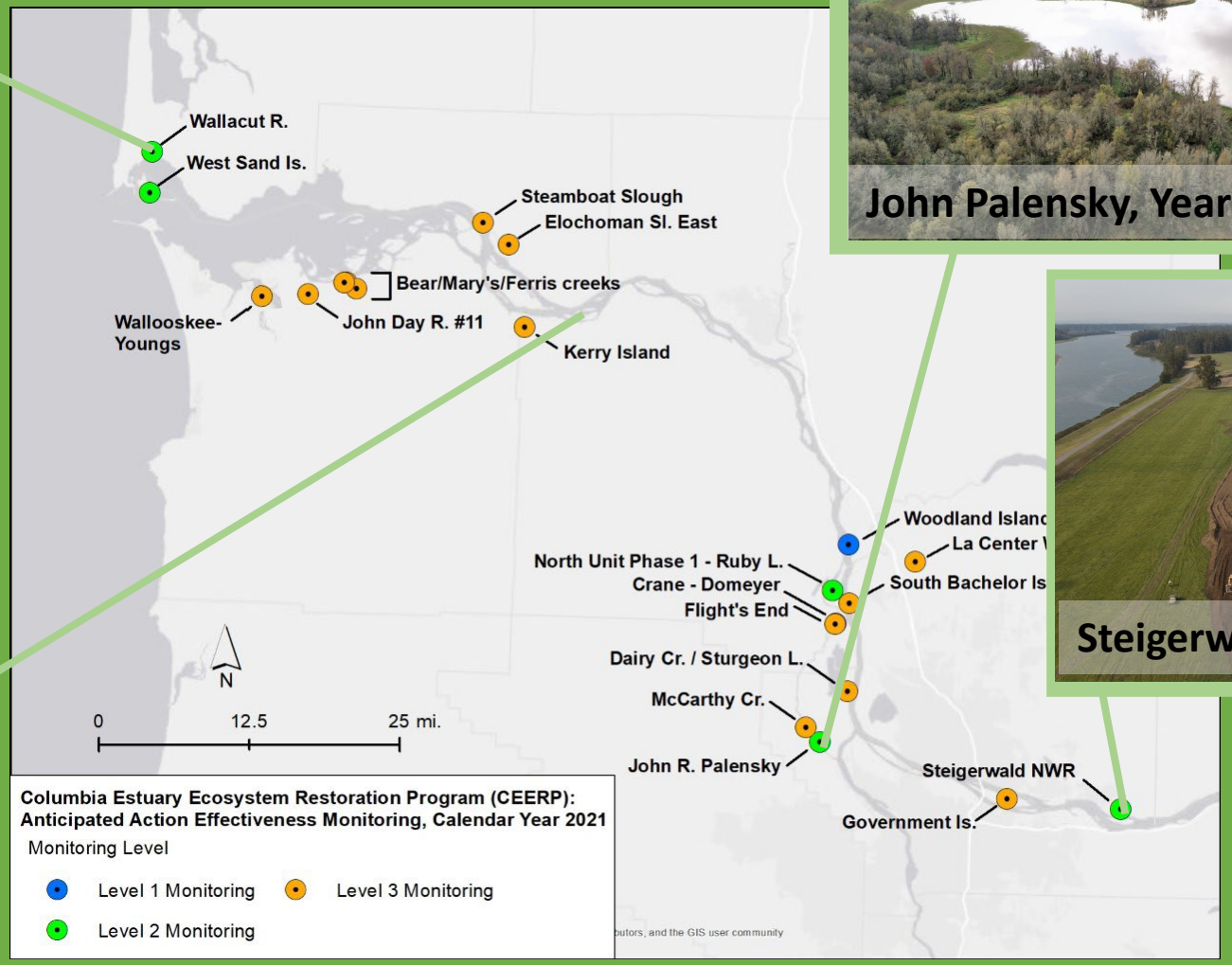
Planning 2021: Action Effectiveness Monitoring and Research





Planning 2022: Action Effectiveness Monitoring and Research

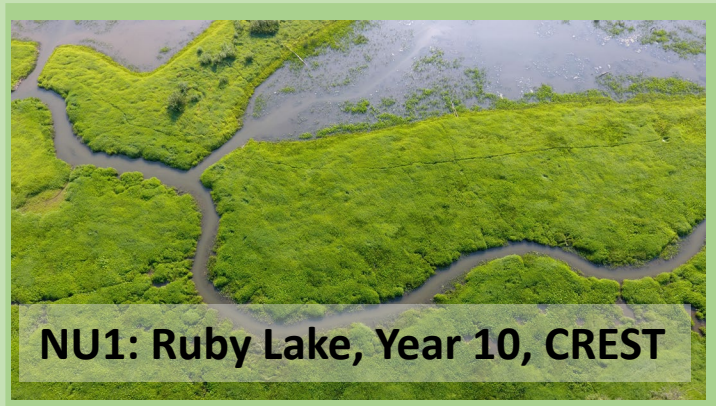
Dibblee, Year 10, CREST



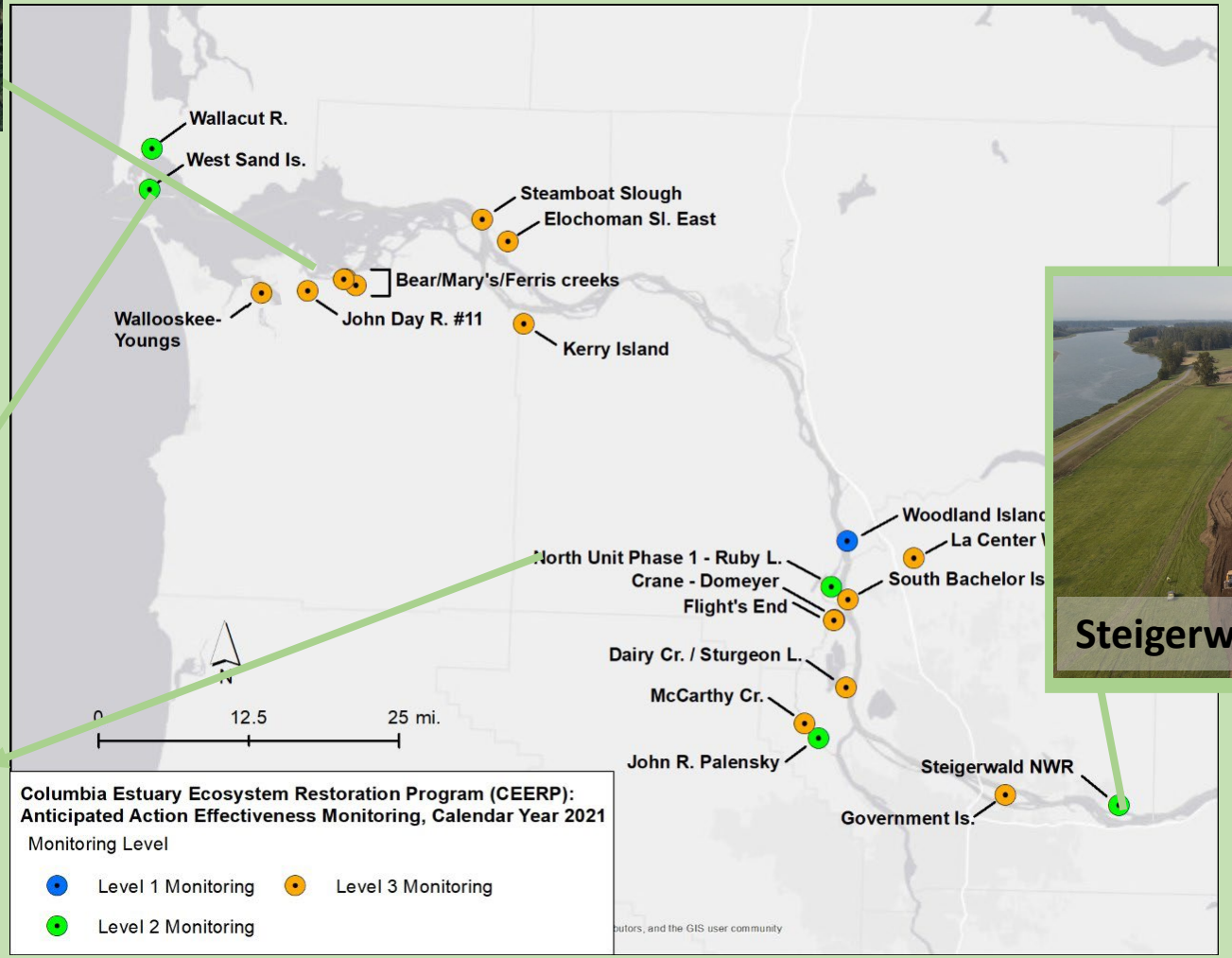
Planning 2023: Action Effectiveness Monitoring and Research

Svenson Island, Year 1/Pre, CLT

West Sand Island, Year 2, CREST



NU1: Ruby Lake, Year 10, CREST



Steigerwald, Year 1, LCEP

Research Question: What is the progress of native plant community restoration?

La Center Phase 1 – 2020, Year 5

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La Center Phase 1 – 2020, Year 5

Major Drivers of Plant Community Distributions and Recovery:

- **Flooding Frequency and Duration** *(site elevations and hydrology)*
- **Salinity** *(flood waters and soil)*
- **Soil Conditions** *(flooding, scrape down, existing conditions)*
- **Existing Plant Community** *(resistance to change, Reed canarygrass, Common Rush, etc.)*
- **Available Seed Bank**
- **Ongoing Management** *(such as grazing, mowing, plantings, and spraying herbicides)*

Wallooskee, 3 years (2020) Post-Restoration

COWLITZ INDIAN TRIBE
The Forever People

Project Summary

The Wallooskee restoration site is in Youngs Bay, near the City of Astoria in Oregon (Columbia RM 16, Reach A) .

The 200-acre tidal reconnection restoration project was funded by BPA and is currently owned and managed by the Cowlitz Indian Tribe. The overall goal for this project was to restore full tidal reconnection and provide juvenile salmonid access.

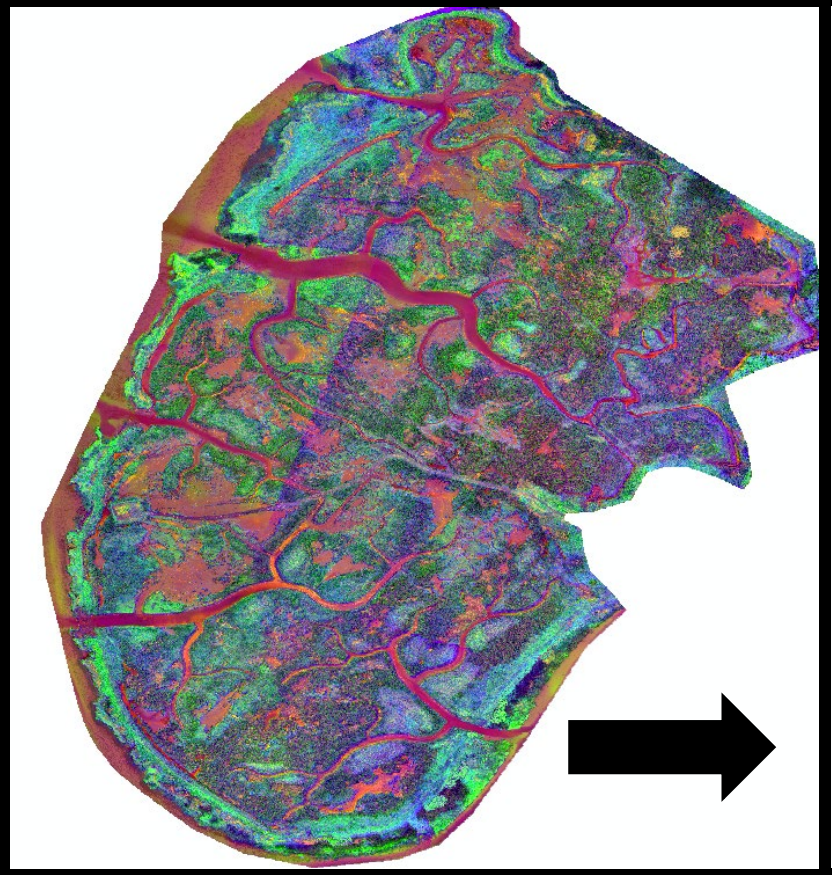
Dr. Sarah Kidd, with the Lower Columbia Estuary Partnership, has been conducting restoration effectiveness monitoring at this site in partnership with the Cowlitz Indian Tribe since 2013.

In July of 2017, tidal flooding was restored throughout the wetland through the removal and lowering of levees that bordered the site. Additional channel enhancements were conducted in areas to expand channel density and access to wetland habitat.

UAV Imagery Modelling Methodology

Establishing a new method for Synthesizing and Evaluating Habitat Data integrating existing data collection methods and UAV drone imagery

- Multispectral Drone with RGB and Near Infrared Sensor
- Pix4D processing and ArcGIS image classification
- Datasets also include vegetation classification, elevation and hydrology
- Provide more robust habitat condition assessments
- Set the stage for modeling habitat shifts from climate change and future restoration efforts



Preliminary Outcomes Included

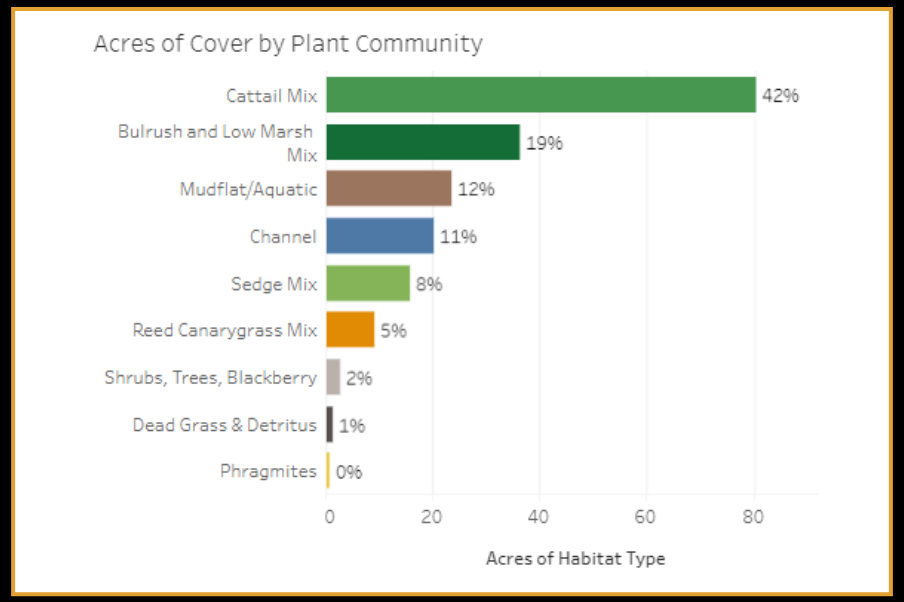
- >15 plant community and land cover classifications made across the 200 acres of wetland
- <0.25m^2 resolution
- High accuracy

Models created

- Site Wide Plant Community Model
- Salmonid Habitat Access and Opportunity Model
- Overall Salmonid Habitat Quality

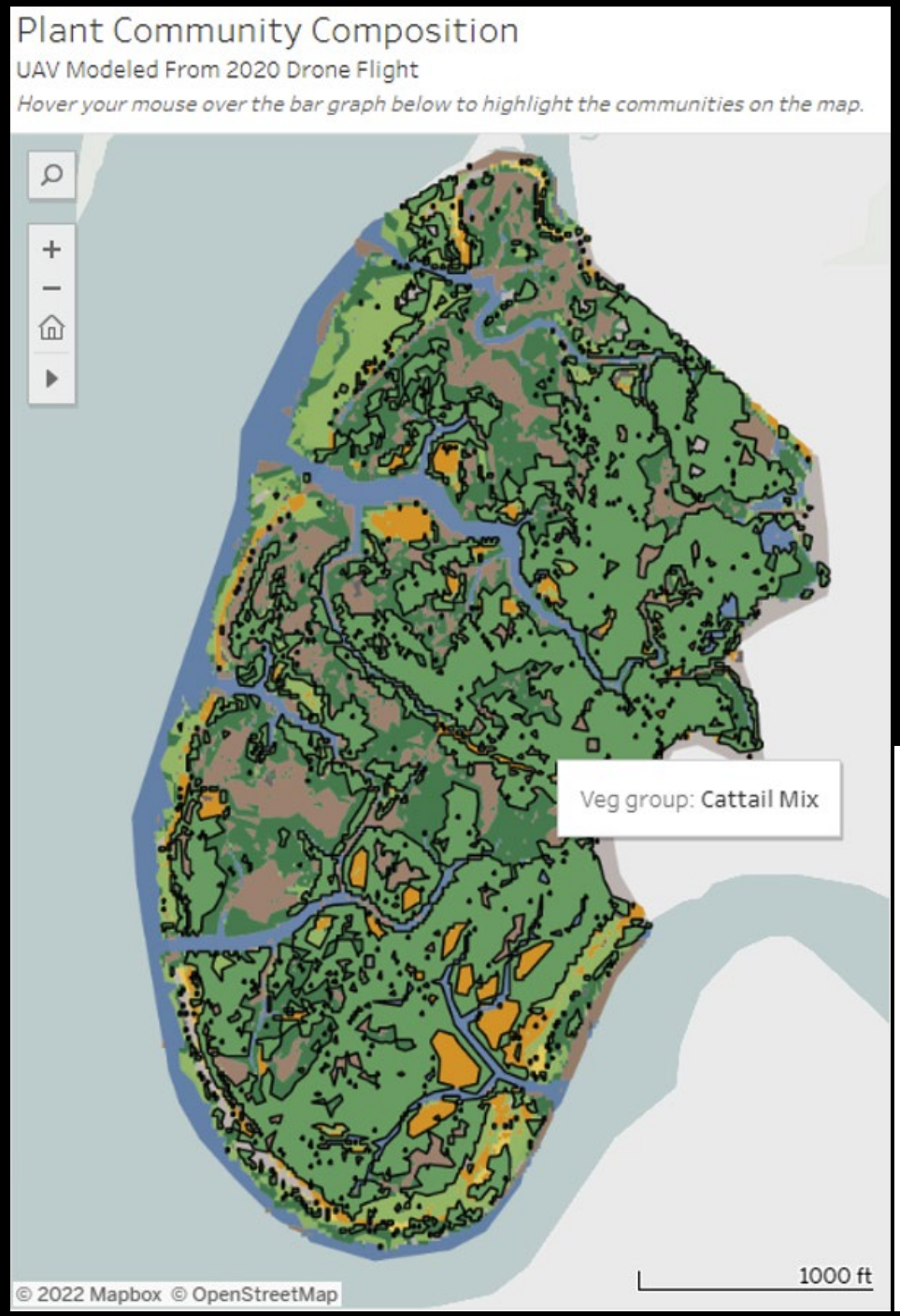

Cattail Mix
Reed canarygrass
Cattail & Bulrush Mix
Sedge/Carex Mix
Bulrush Mix
Spikerush Mix


Cattail Mix
Reed canarygrass Mix
Cattail Mix
Reed canarygrass Mix
Carex Mix
Bulrush Mix
Phragmites
Bulrush Mix



Acres of Cover by Native Status
2020 - 3 yrs Post Restoration

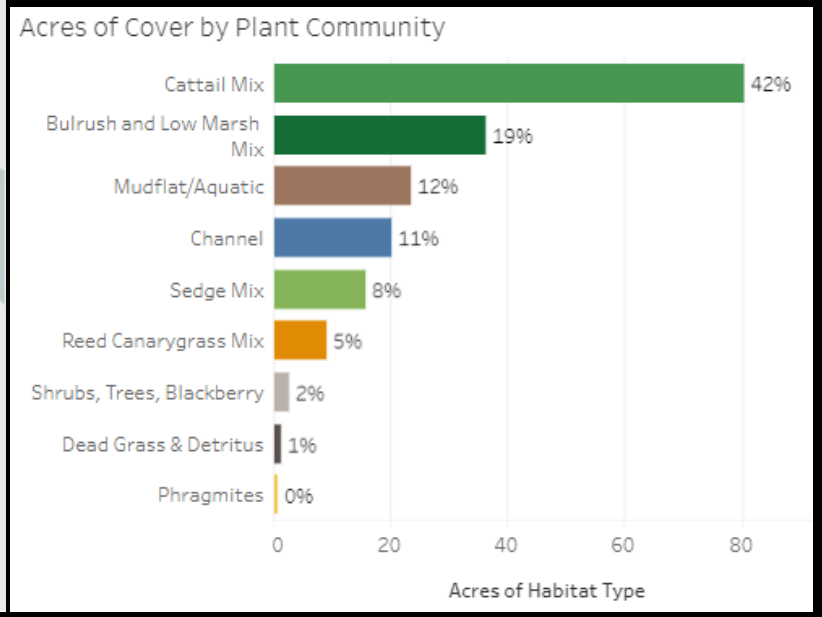
Channel and Mudflats	23%	47 acres
Native	69%	139 acres
Non-native	5%	10 acres
Riparian and Other	3%	7 acres



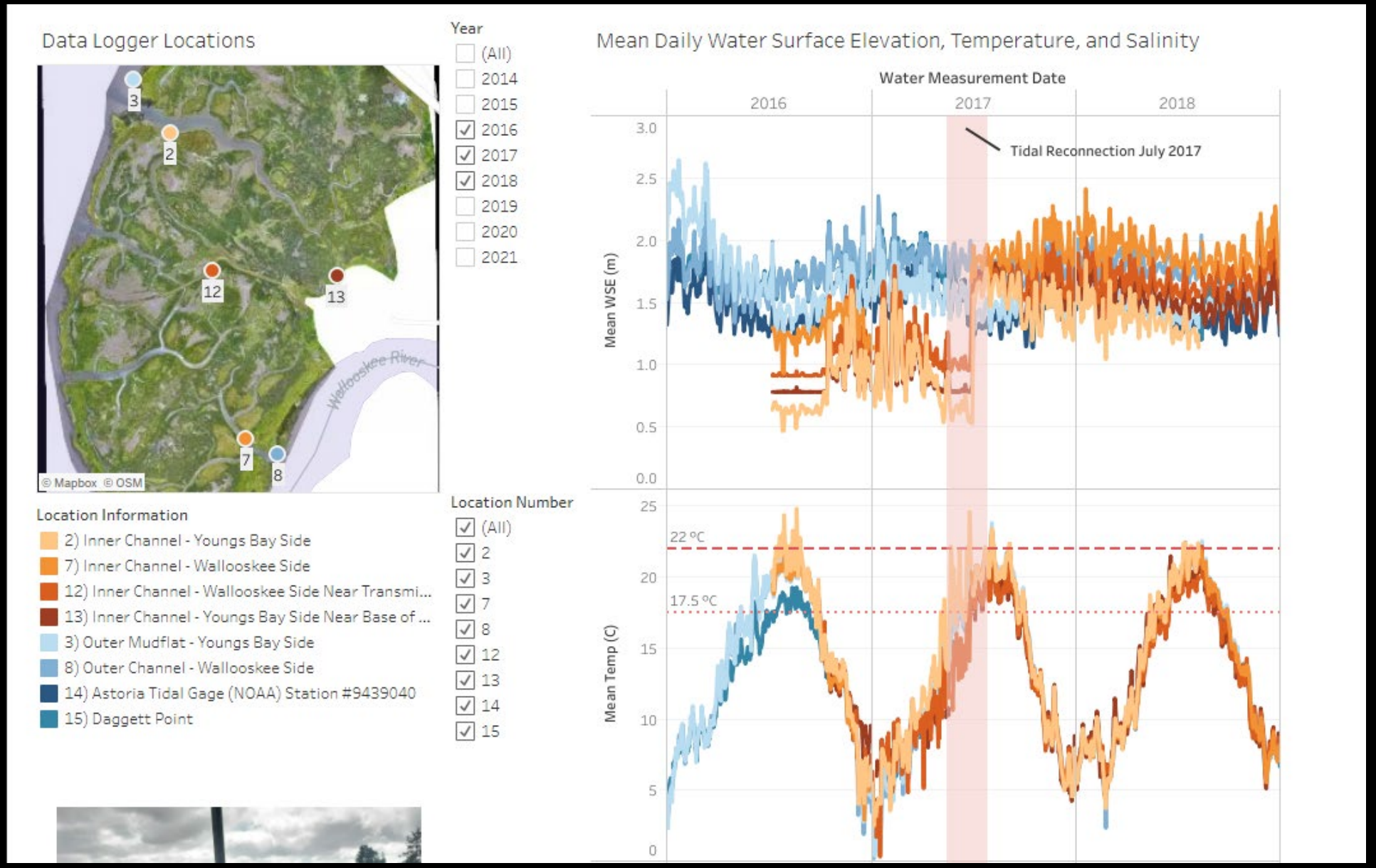
Plant Community Composition

Three years post restoration:

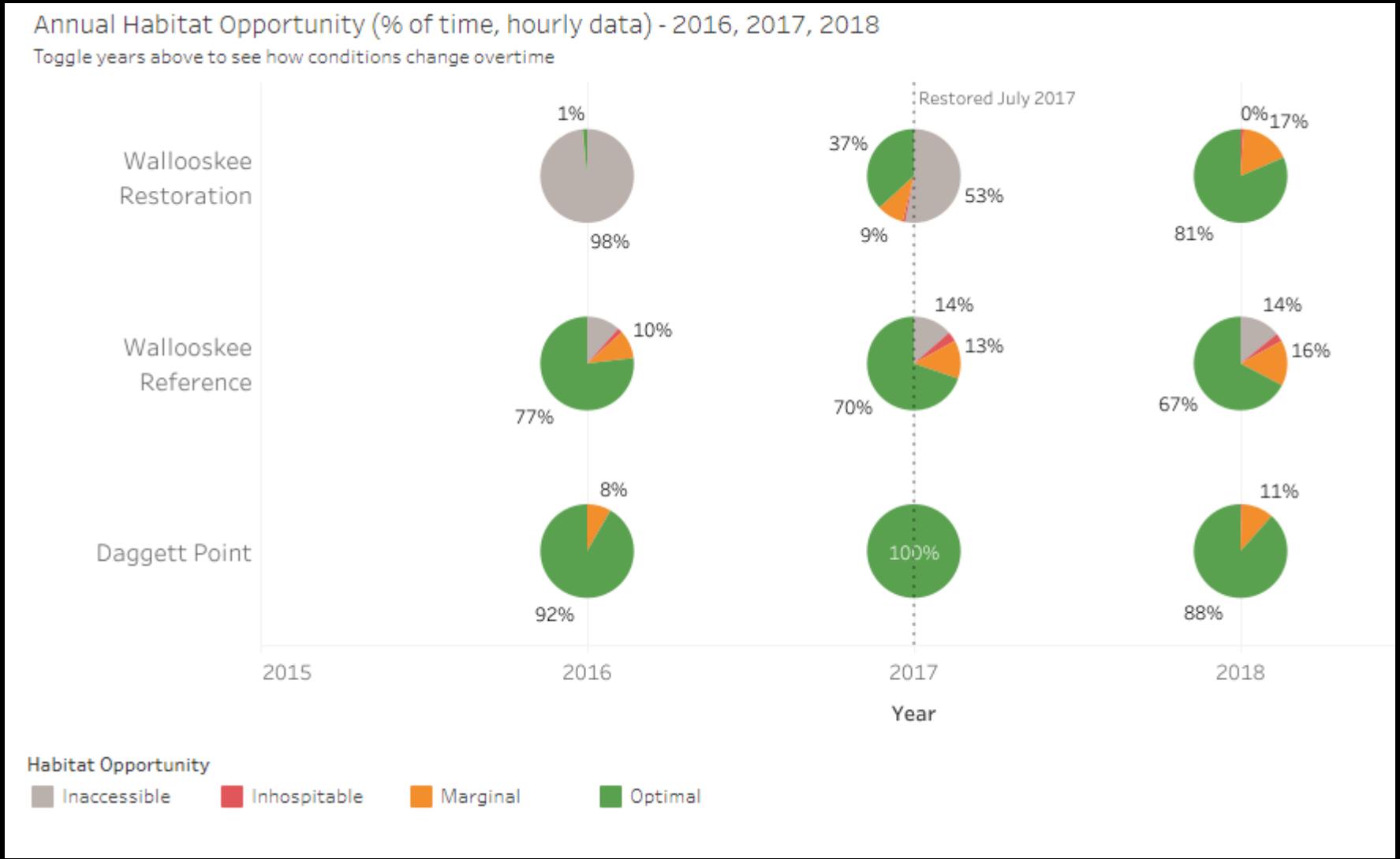
- ✓ native plant species - 69% of the site
- ✓ diversity of channel and aquatic habitats - 23%
- ✓ Non-native plant community abundance has dramatically declined, now representing a small 5% amount of the total landcover



Water Surface Elevation & Temperature



Water Surface Elevation & Temperature

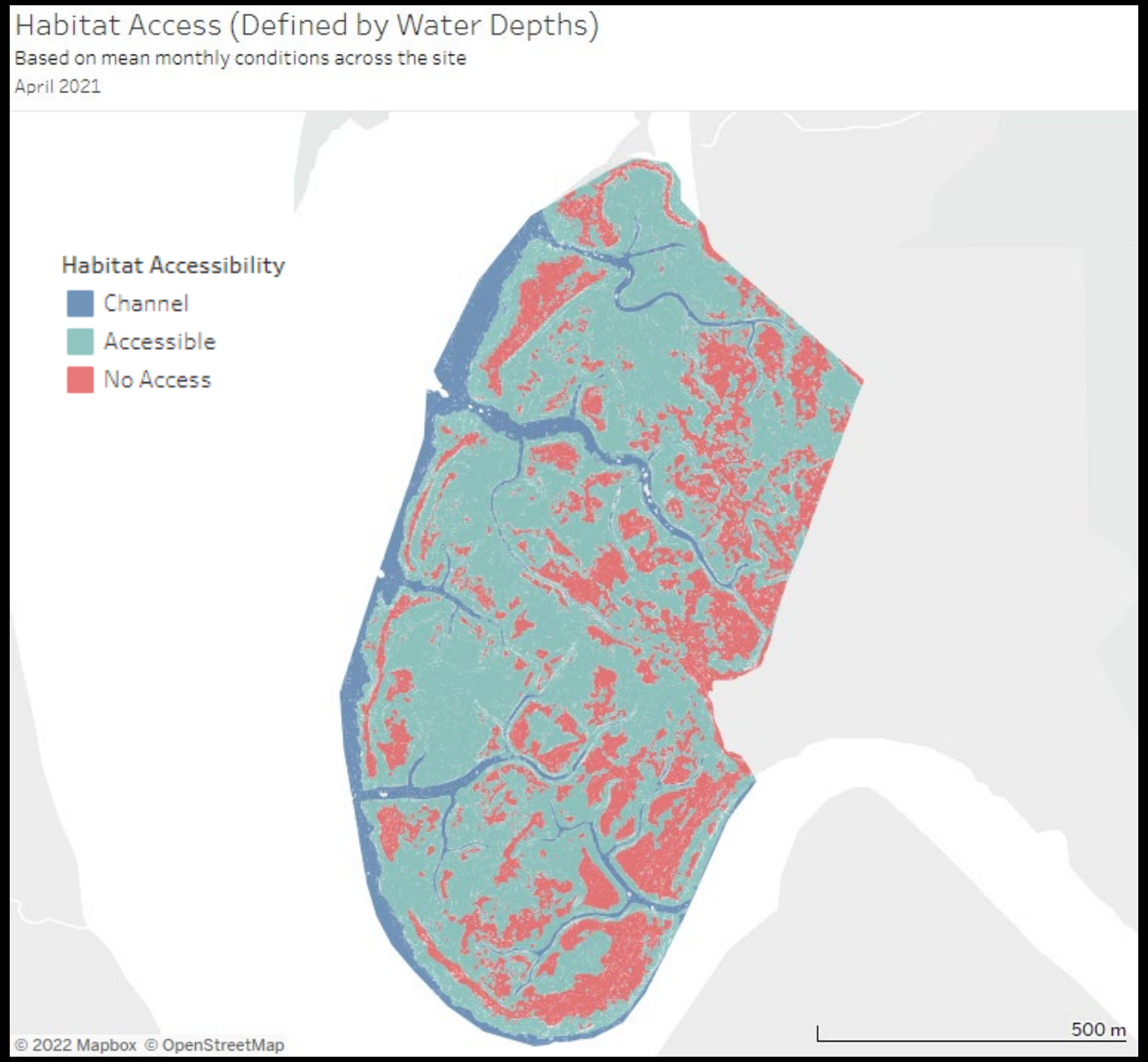


Juvenile Salmonids require

- ✓ ≥0.5 m of water depth above the channel or wetland surface for habitat access
- ✓ < 0.5 m of depth inaccessible to fish passage/use
- ✓ optimal conditions = <17.5 marginal conditions > 17.5 °C but less than 22 °C
- ✓ Inhospitable > 22 °C

Bottom et al. 2011, Schwartz and Kidd et al. 2018

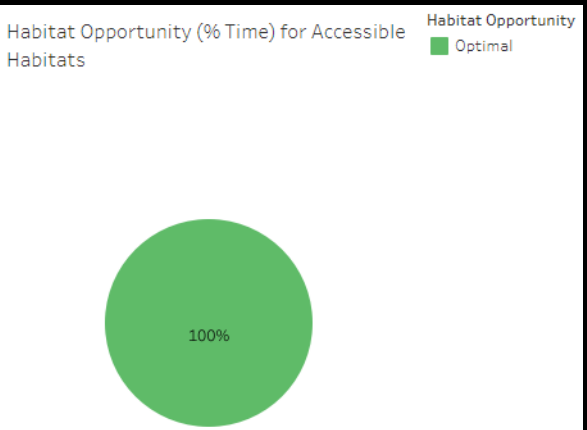
SALMONID HABITAT ACCESS AND OPPORTUNITY



- **Model Water Depths and Temperatures Across the Site**
- **Based on data collected at logger location**
- **April 2021 = 135 Acres of Optimal Habitat**

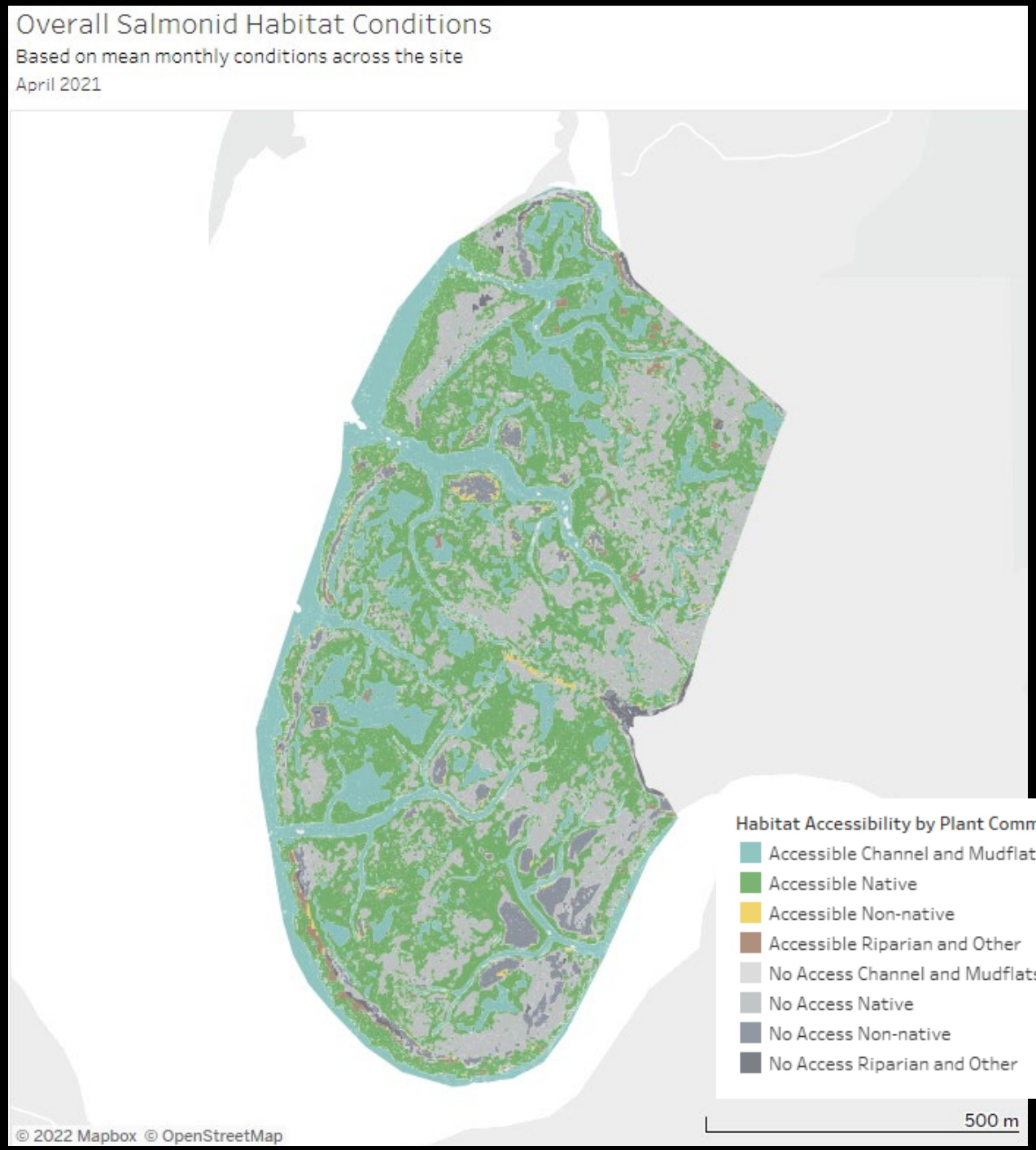
Total Average Accessible Area

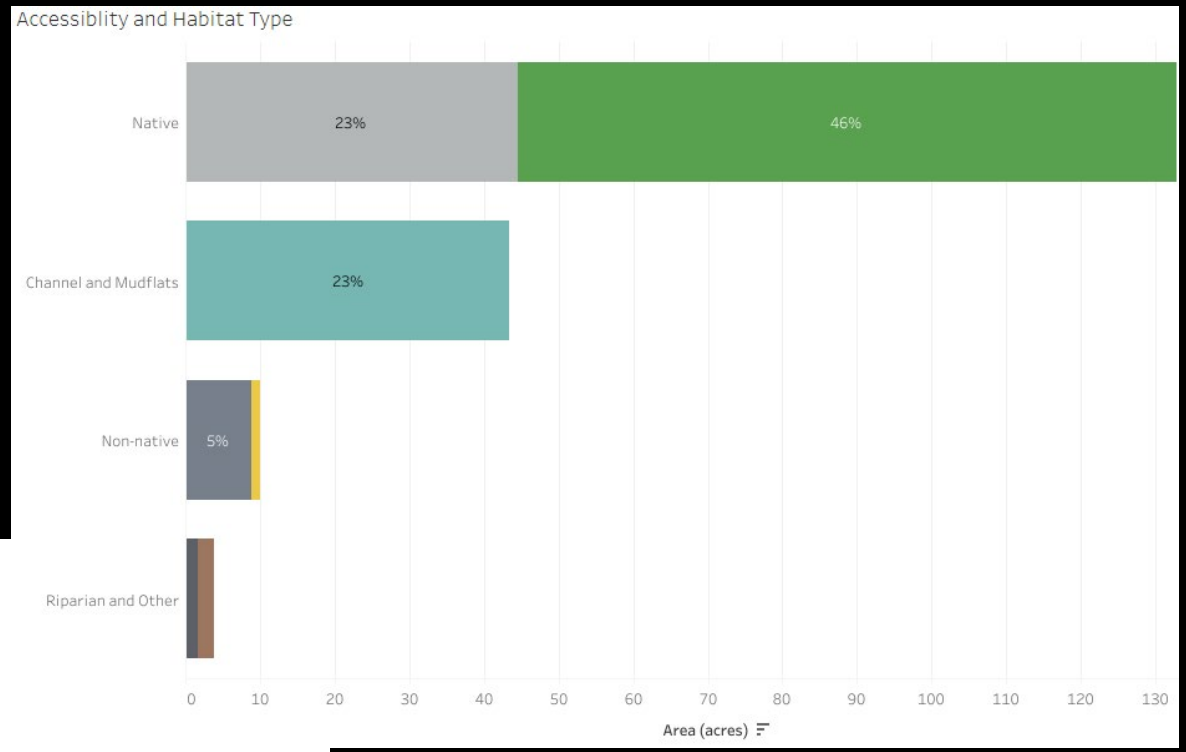
	Acres	% of Land Cover
Channel	18.6	10%
Accessible	116.3	61%
No Access	55.1	29%

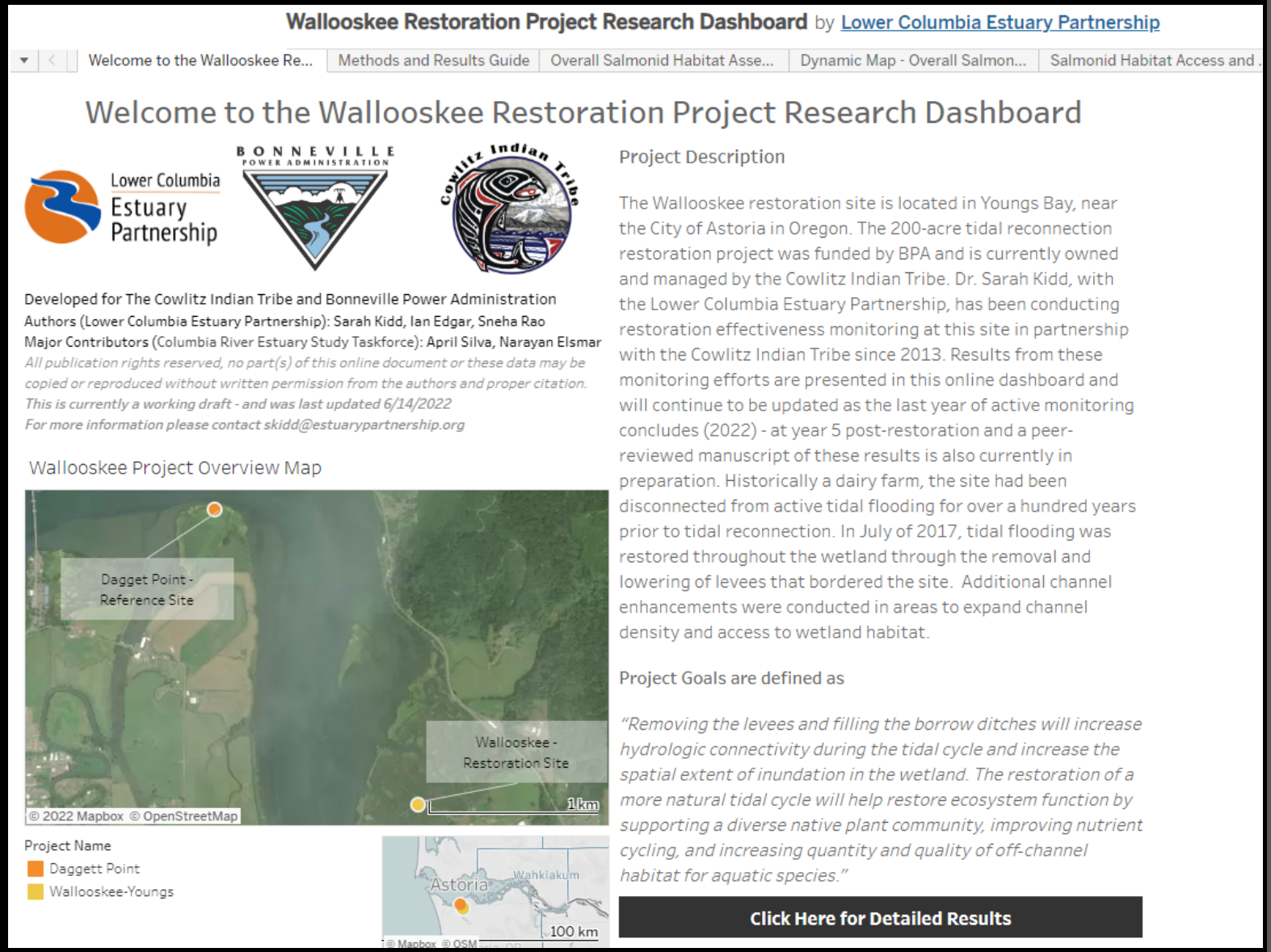


Overall Salmonid Habitat

- ✓ **Combined Modeled Habitat Access With Site-Wide Plant Community Conditions**
- ✓ **April 2021= 124 Acres of Native Habitat, Mudflats, and Channels – accessible Salmonid Habitat during High Tide**





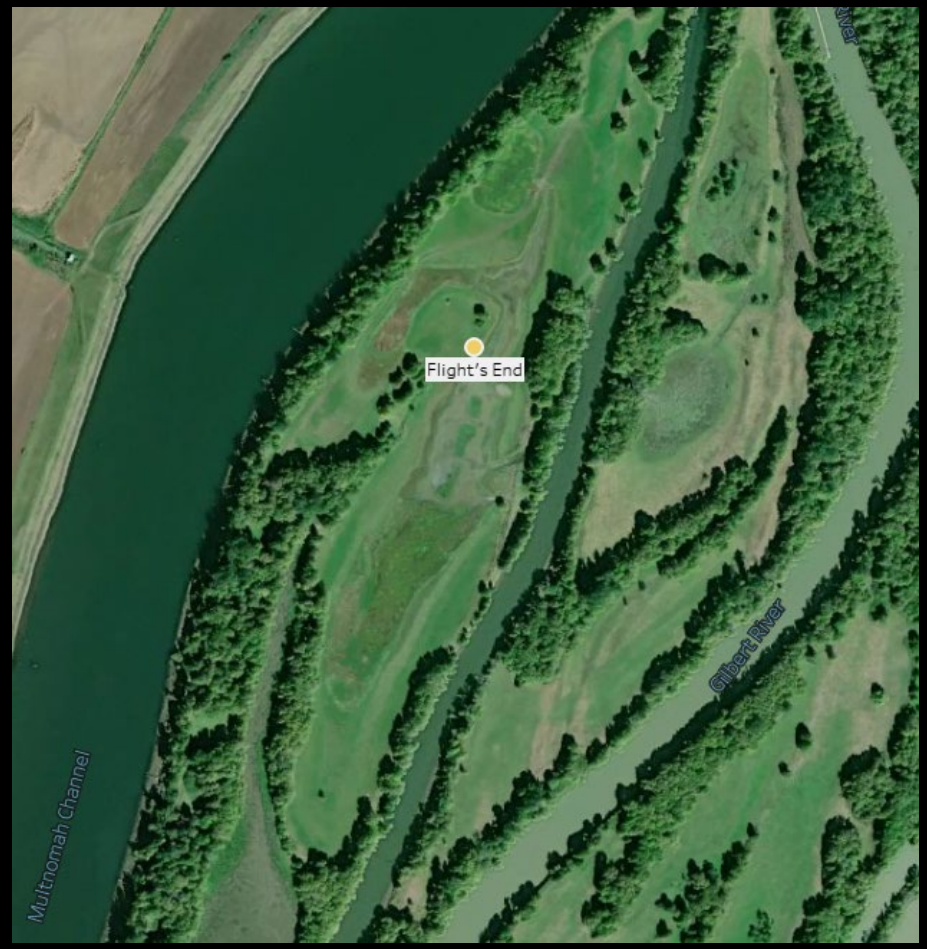


Wrap up

- Interactive Dashboard = Published
  - *Habitat Models*
  - *Mound Study – Constructed High vs. Low Marsh*
  - *Sediment Accretion and Erosion (Tracking with SLR?)*
  - *Soil Conditions*
  - *Macroinvertebrate Data*
  - *Fish Community Data – Coming Soon!*

✓ ***Year 5 (2022) Publication of Data – will occur in Spring of 2023!***

Flights End, 3 years (2020) Post-Restoration



Project Summary

Flights End wetlands are located north of Crane Lake in Sauvie Island, OR (Col RM 92, Reach F).

This restoration project was part of a landscape effort to restore connectivity of Sauvie Island Wildlife Area to Multnomah Channel. This restoration project aimed to connect 42 acres of floodplain wetlands to the Columbia River to create natural wet prairie conditions.

Cunningham Lake was chosen as reference site for monitoring efforts

Construction occurred in 2017, and construction actions included removal of two culverts, the artificial berm and marsh plain lowering.

Flights End, 1 years (2018) Post-Restoration

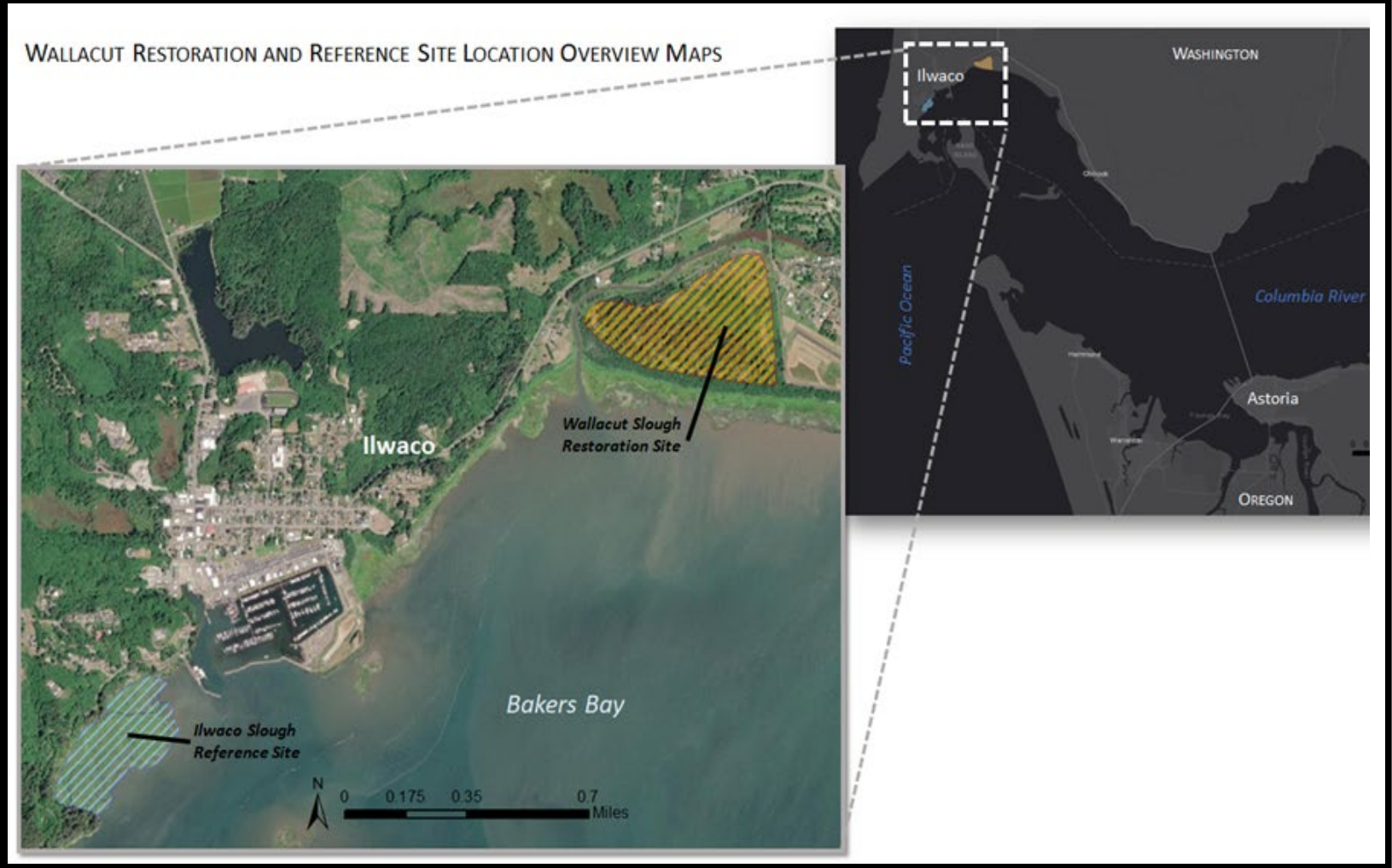
Flights End, 3 years (2020) Post-Restoration

Flights End, 1 years (2018) Post-Restoration

Flights End, 3 years (2020) Post-Restoration

Wallacut Slough, 5 years (2021) Post-Restoration

Columbia Land Trust



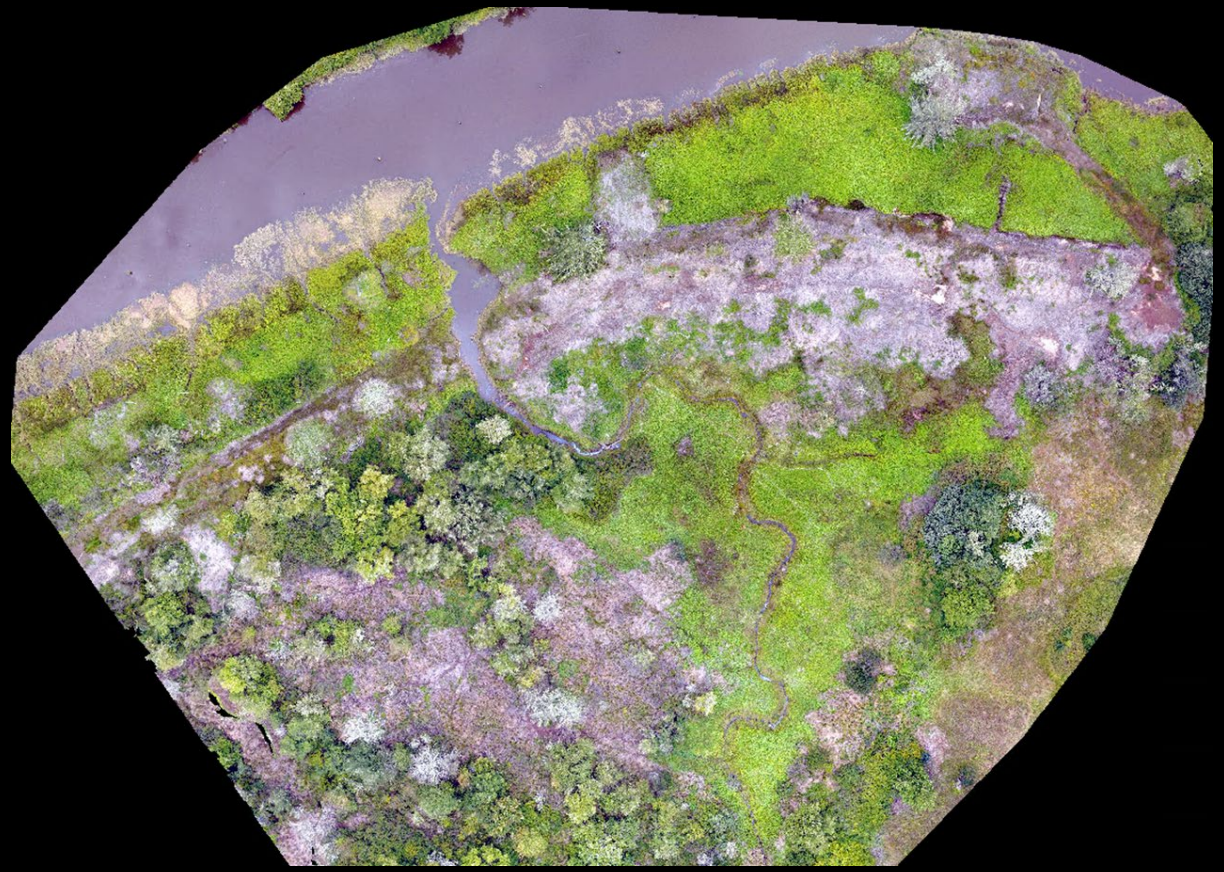
Project Summary

Wallacut Slough is in Bakers Bay. The reference Site is Ilwaco Slough, which is also an Ecosystem Monitoring Program (EMP) site.

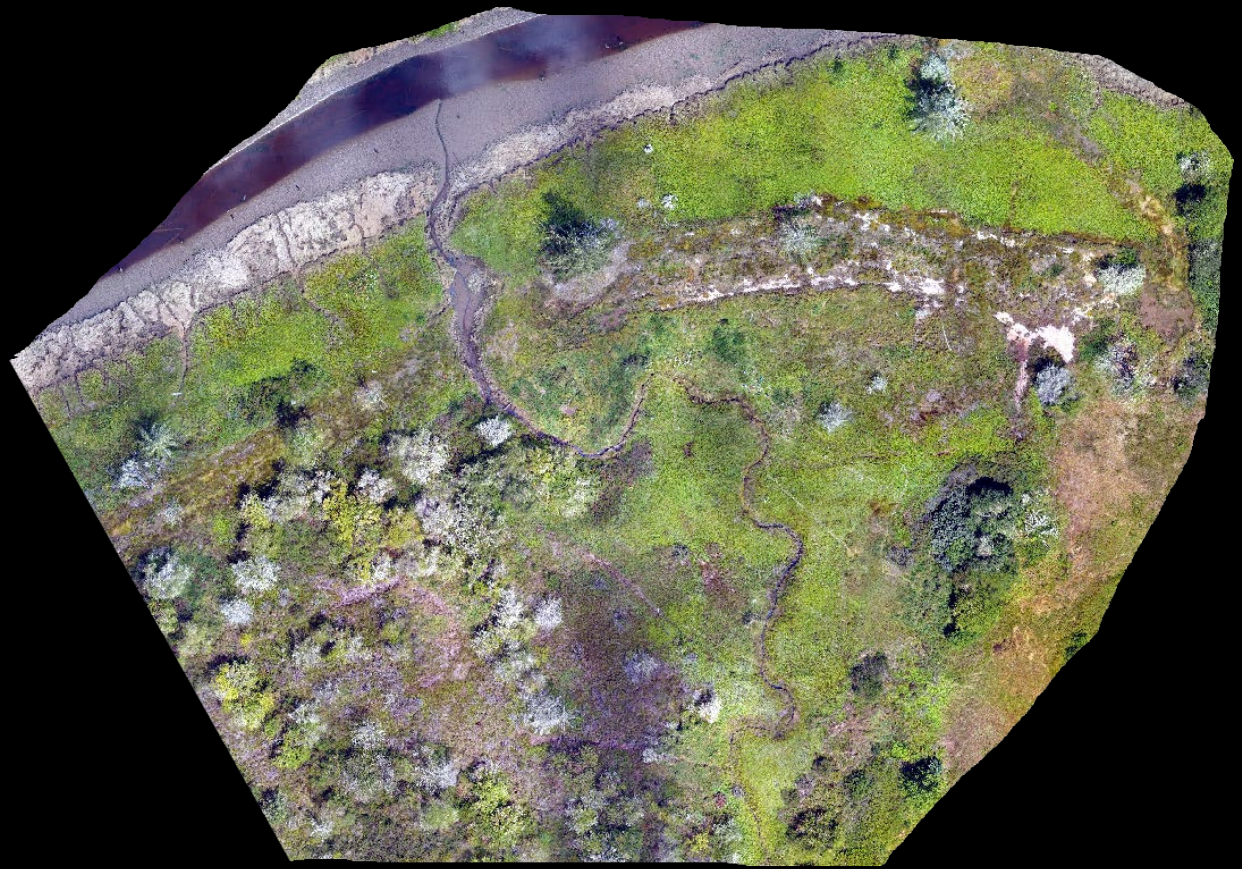
In 2016, Wallacut Slough network was restored through the removal of barriers and channel enhancements. Data collection started in 2014.

Current management includes active treatment of invasive species (gorse, thistle, and yellow flag iris)

Wallacut, 3 years (2019) Post-Restoration



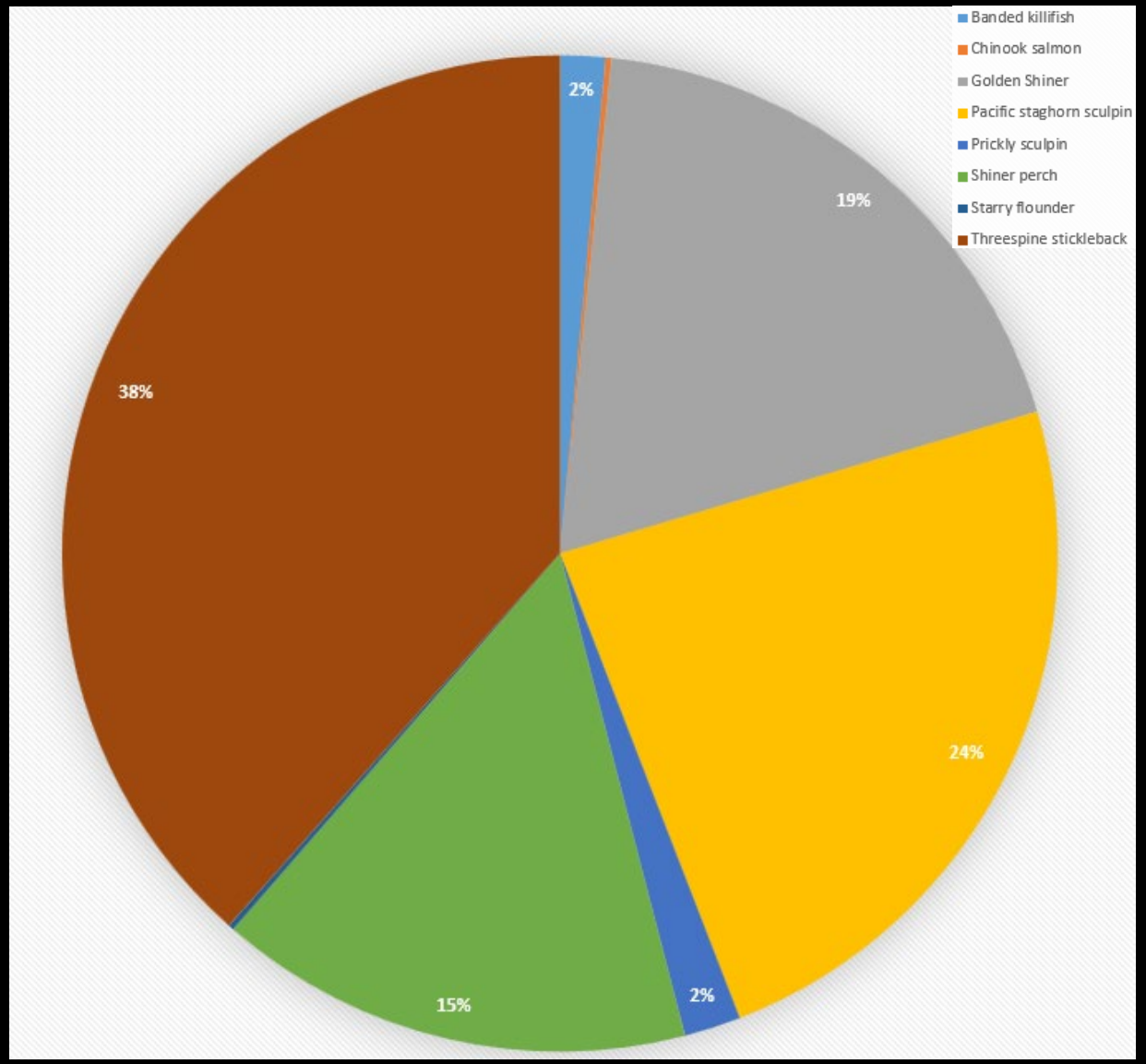
Wallacut, 5 years (2021) Post-Restoration



2021 – Year 5 Wallacut Images

2021 – Year 5 Wallacut Images

Wallacut, 5 years (2021) Post-Restoration Fish Check-in



Wallacut fish data was collected at year 5 post-restoration, over two days in April 2021.

Fish sampling occurred at three areas at each site – Wallacut Slough was fished in different channels.

Majority of the community sampled in 2021 consisted of Non-salmonids. 38% of the community at the site was comprised of
Threespine stickleback and 24% Pacific Staghorn Sculpin.

Only one Chinook Salmon was found during sampling, indicating that other salmonids use the site.

La Center, 5 years (2020) Post-Restoration

Project Summary

La Center Wetlands is a restoration site located in La center, Washington along the East Fork Lewis River (EFLR) (Columbia RM 88, Reach F).

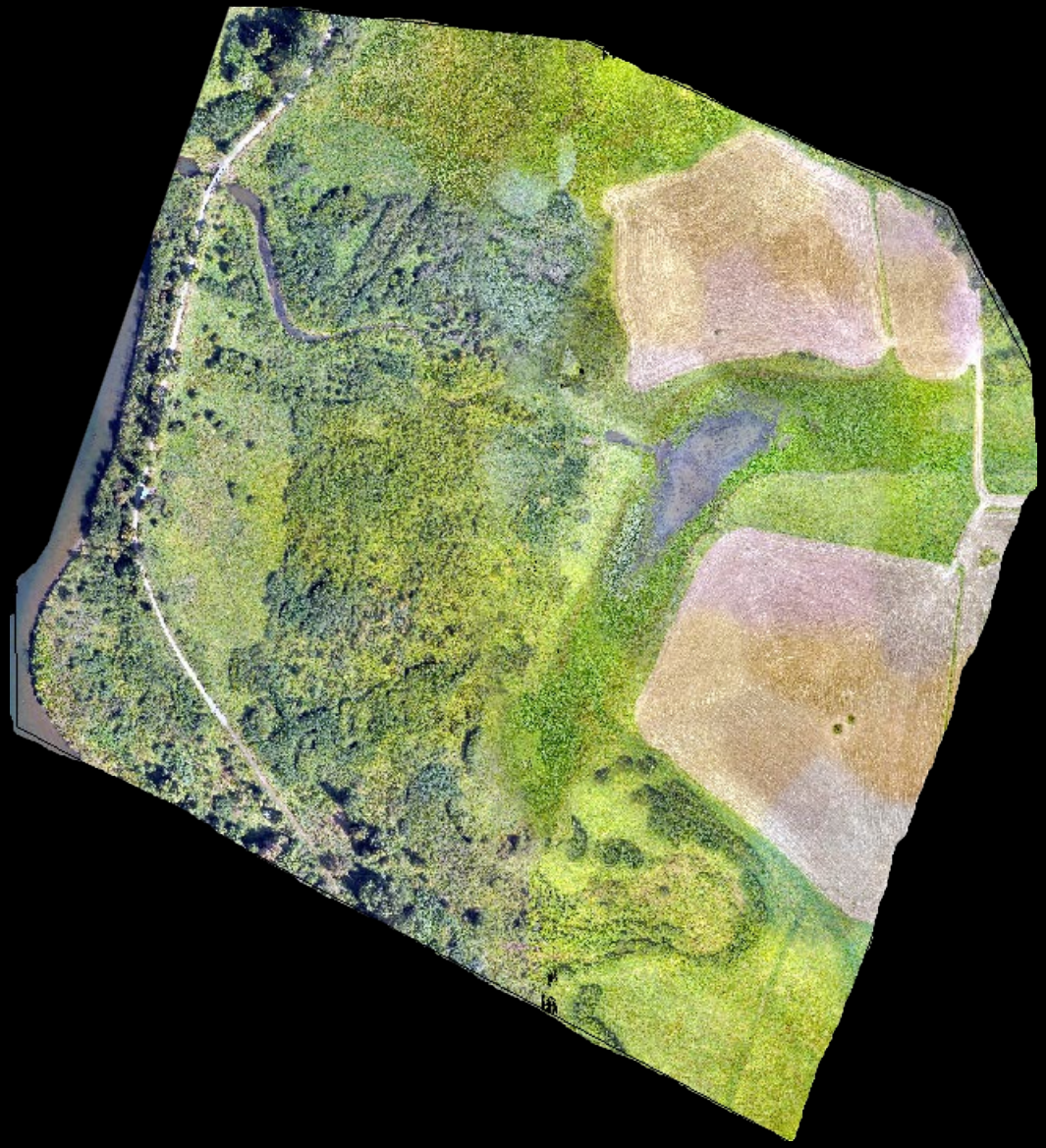
The wetlands are a collection of two sites – La center West and La center East. La center Control was selected as the reference for monitoring.

The overall project goal was to restore hydrologic and geomorphic processes at the two sites.

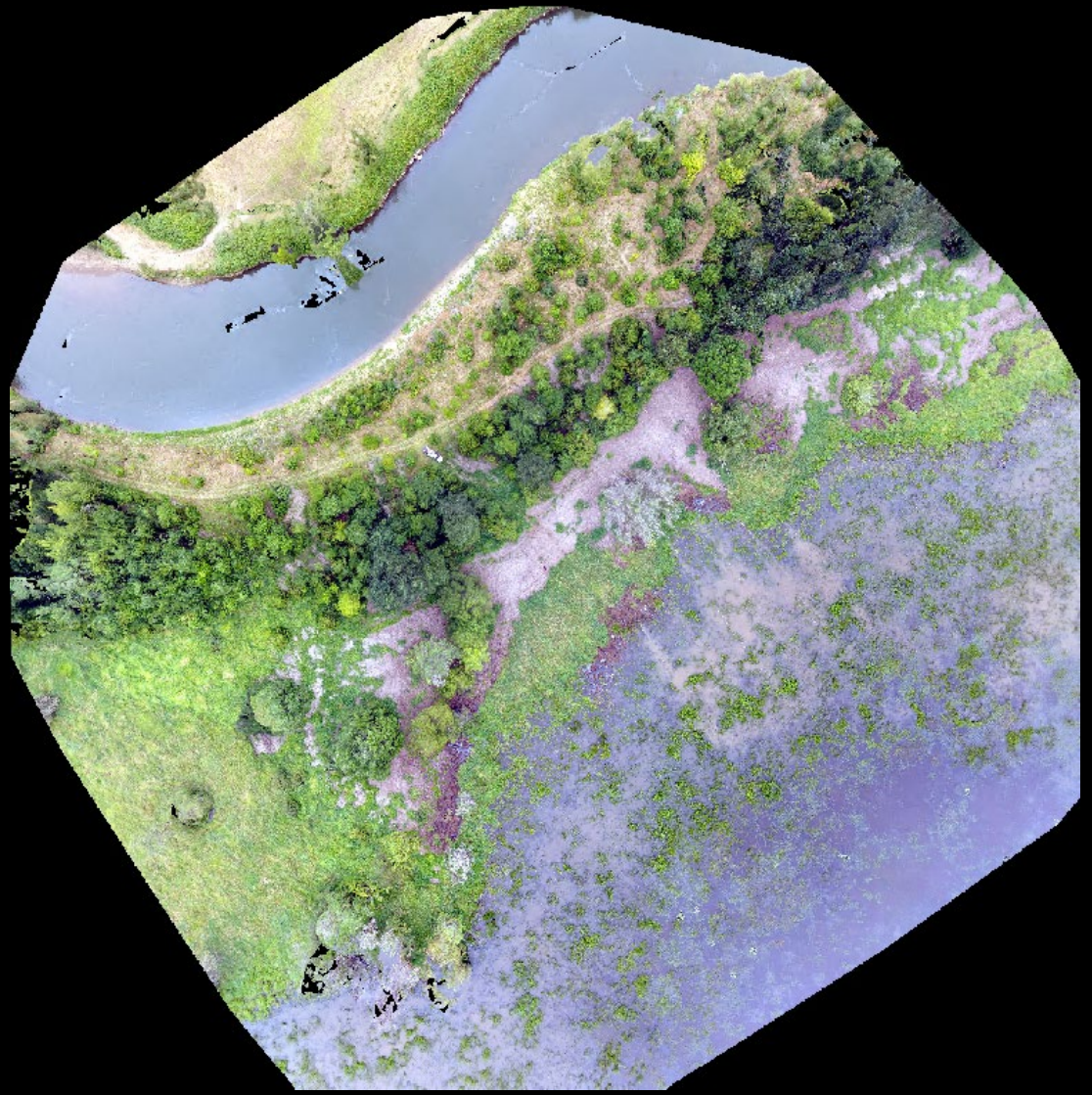
Construction at these sites occurred in 2015, and actions included levee breeches, weir and culvert removals and riparian revegetation.

La Center West, 3 years (2018) Post-Restoration

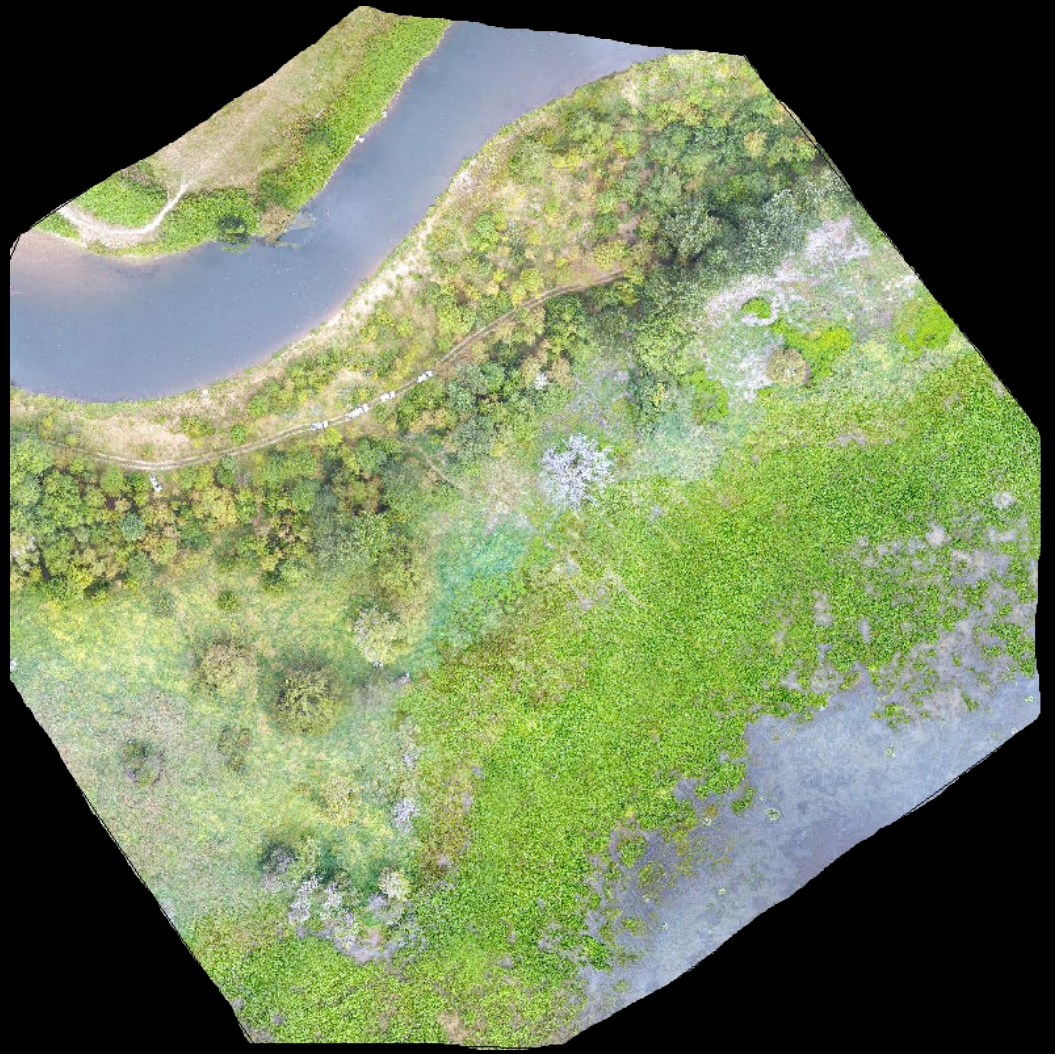
La Center West, 5 years (2020) Post-Restoration



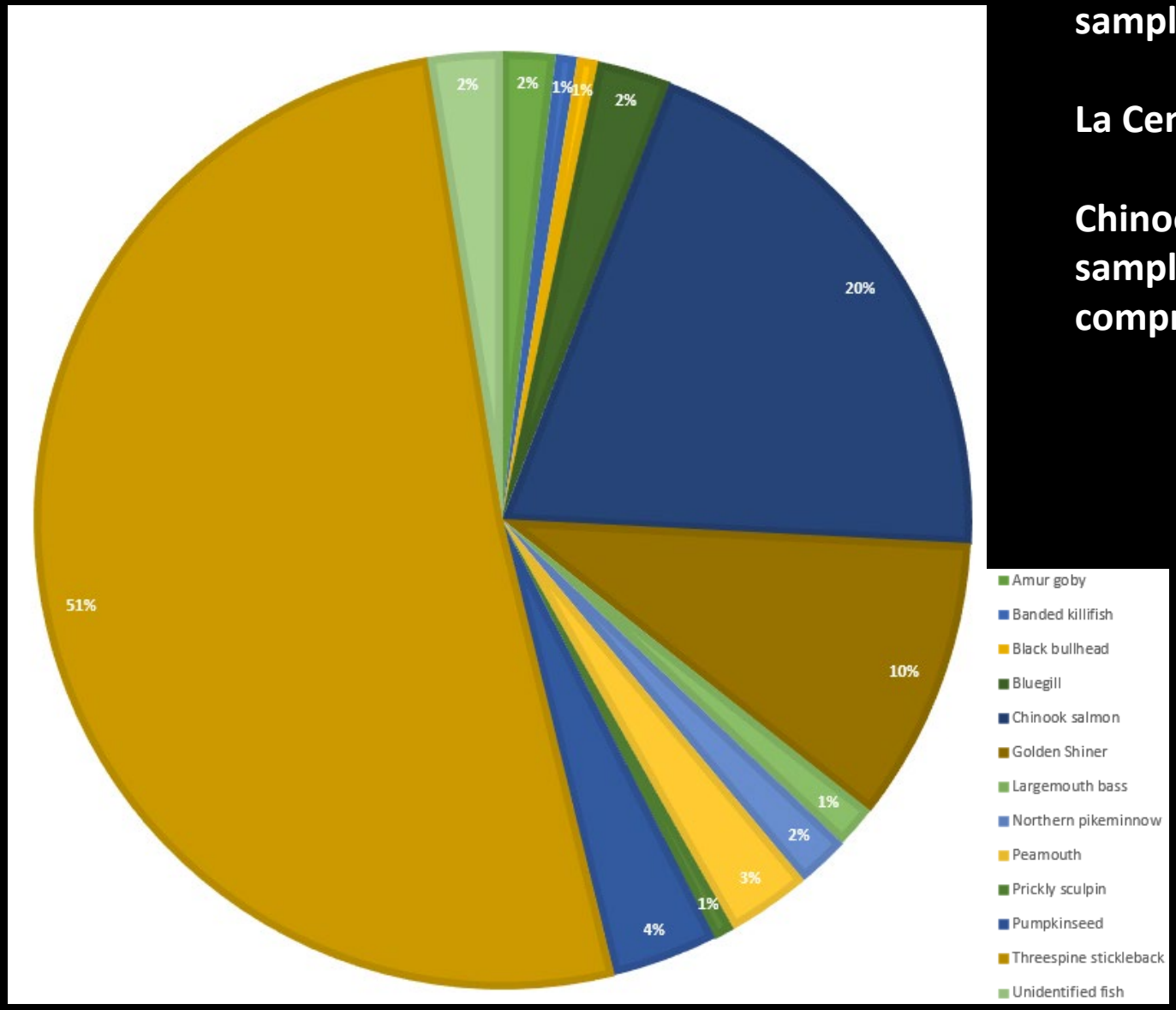
La Center East, 3 years (2018) Post-Restoration



La Center East, 5 years (2020) Post-Restoration



La Center, 6 years (2021) Post-Restoration Fish Check-in



La center fish data was collected at year 6 post-restoration – this delay was caused due to COVID-19 lockdowns which prohibited the researchers to travel to the site. The site was sampled over two days in May 2021.

La Center West was sampled in the main channel and pond.

Chinook Salmon contributed to 20% of the community sampled at the site. 51% of the community at the site was comprised of Threespine stickleback and 10% Golden Shiner

Ruby Lake, 8 years (2021) Post-Restoration

Project Summary

North Unit Phase 1 – Ruby Lake is a restoration site located in the northern portion of Sauvie Island, Oregon (Columbia RM 89, Reach F).

This restoration project was the first of three planned phases in the Sauvie Island Wildlife Refuge area.

The goal of reestablishing juvenile salmonid access to 292 acres of historical wetland habitat (all 3 phases combined). Cunningham Lake was chosen as reference for monitoring.

Ruby Lake restoration occurred in 2013, and construction actions included removing water control structure, channel enhancements, strategic marsh plain lowering and implementation of a vegetation enhancement plan. These techniques were aimed at increasing habitat opportunity at the site.

Ruby Lake, 8 years (2021) Post-Restoration

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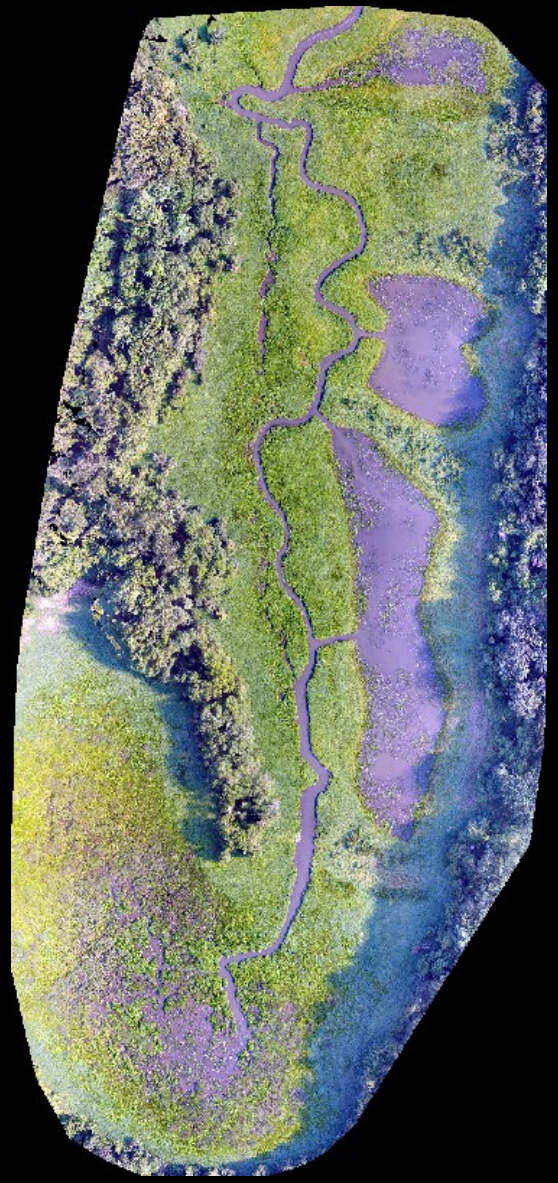
Ruby Lake, 5 years (2018) Post-Restoration



Ruby Lake, 8 years (2021) Post-Restoration

Scappoose Bay, 2019

Next steps

Monitoring/Research

- Finalize and Publish Level 2 Tableau Dashboards Discussed today
- Work with Project Sponsors on Report outs for Level 3 sites (Re-visits)
- Consistently incorporate UAV veg and soil conditions monitoring into all Level 2 data collection
- UAV general photo monitoring recommended for all sites (Level 1-3)
- Increase number and distribution of sed benches/pins across sites
- Monitoring Protocols Update (Fall 2022, for reals!)

Restoration trajectories - adaptive management suggestions

- Recommend not mowing Flights End
- Recommend limiting Grazing at all Sites

Wallacut (2021)








Thank You!
Questions?

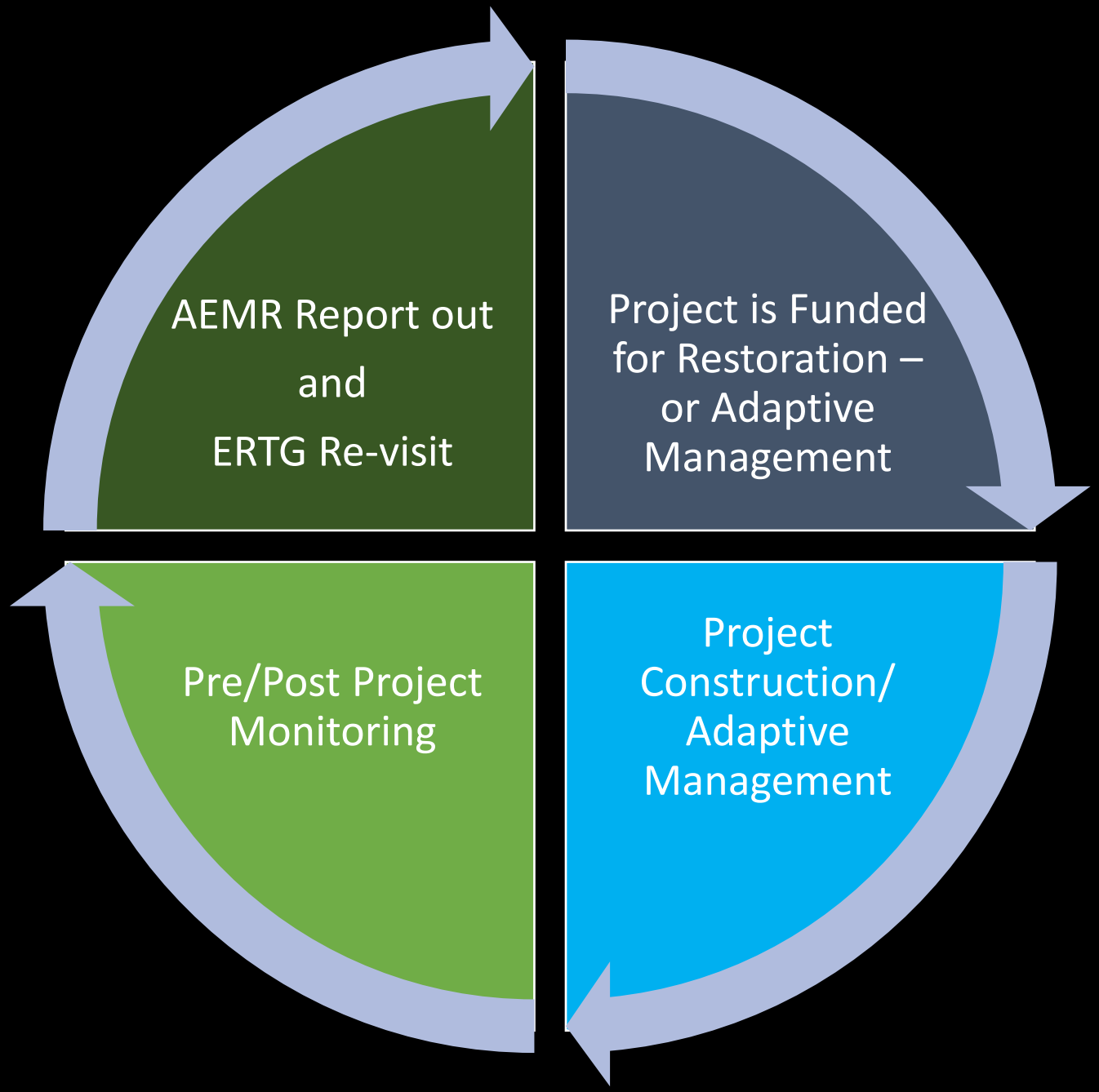
SWG Group Discussion

- What thresholds and endpoints are we looking for to determine if more restoration or monitoring is needed?
  - Project Design
  - Frequency of Monitoring

- How should we better incorporate monitoring data into an adaptive management framework?
  - Site topography and hydrology
  - Wetland plant community
  - UAV Technology
  - Fish and Macroinvertebrate Sampling

Expert Regional Technical Group (ERTG) Re-Visits

- **Recommendations**
  - Phase re-visits to coincide with AEMR report outs and data collection
    - Provides adequate time for data gathering and reporting
  - Adaptively update monitoring based on project uncertainties
    - as defined by ERTG and Project Sponsors
  - What are the various uncertainties going into each project and where is that project data found?
    - Can we connect the dots – with data collected vs. questions?



BPA Restoration Project Re-visit Schedule Suggestions

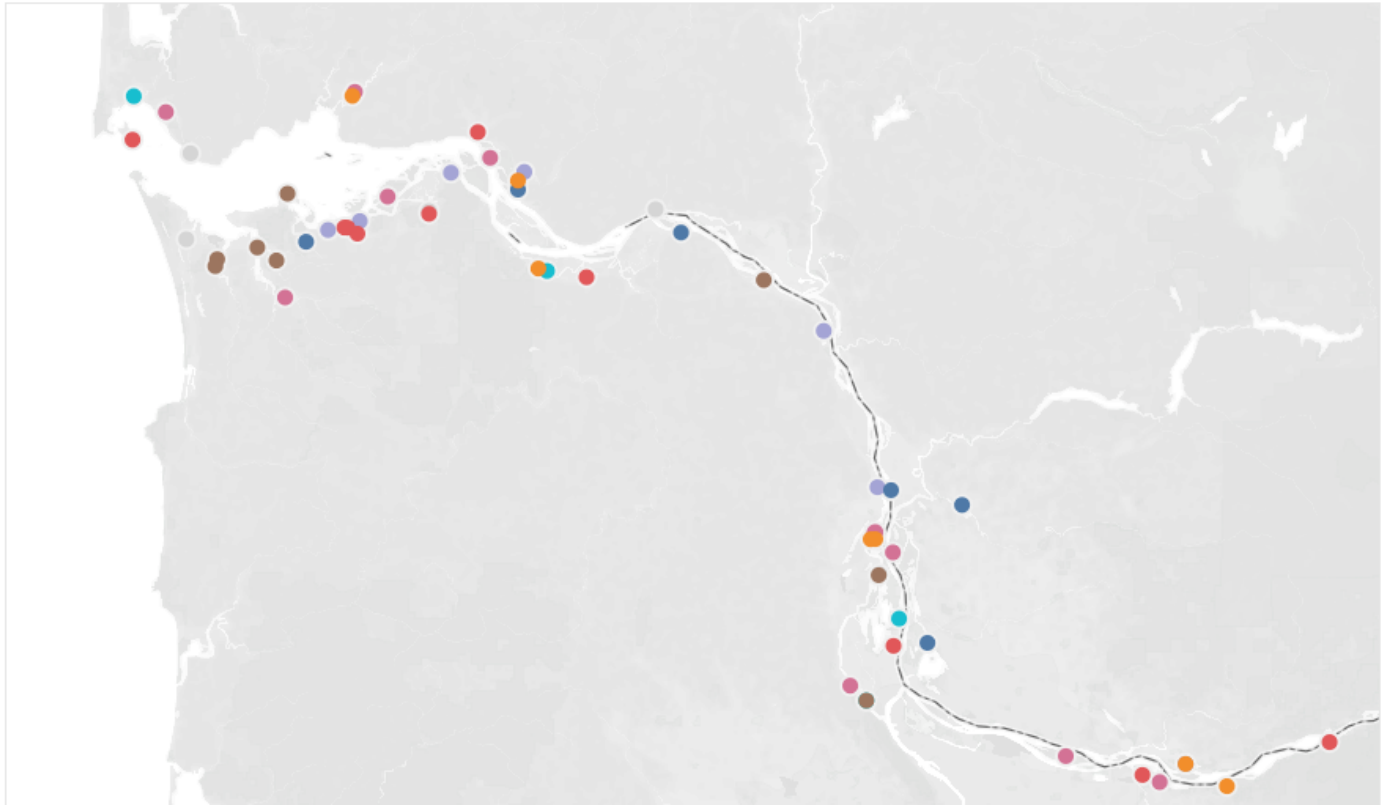
DRAFT 6/21/2022 - Please take a look and we can update this with everyone's feedback. Also if you see typos and mistakes in these data please let me know. Many thanks! Sarah Kidd - LCEP

Welcome to the AEMR re-visit suggestion map for 2022 and into the future. Mouse over each site to see details and monitoring data - planned and existing. We have based the re-visit schedule suggestions on when sites have report-outs on monitoring either through Level 2 reporting or Year 5 /Year 10 post-restoration milestones (in addition to the notes included in the recent ERTG re-visit memo). Report outs typically occur in the spring following the year of monitoring, and these data would be available for the ERTG re-visit template at that time - Including UAV videos/images and regular photo-points - which is perfect for a summer or fall (or remote) site visit schedule.

Based on the CEERP, all sites should receive Level 3 monitoring: sediment accretion/erosion, water temperature, and depth, and photo-points 0-5 years post-restoration, as well as year 10 post-restoration. Level 2 sites additional plant community, macroinvertebrate, channel cross-sections, and UAV imagery data are collected on Years 0, 1, 3, 5, and 10 post-restoration. Fish monitoring is also included in years 5 and 10 when the budget allows. UAV data collection was added to the Level 2 monitoring in 2019, however, most projects have UAV photo points collected by the project sponsor (also starting in earnest around 2019 - at the sponsor's discretion). The current data inventory does not include UAV and photo-point data, or channel cross-section data, but these will be included in the future.

Recommend Re-visit
- Null
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028
- NA

AEMR Site Re-visit Suggestions Map



Recommend Re-visit
- [x] (All)
- [x] Null
- [x] 2022
- [x] 2023
- [x] 2024
- [x] 2025
- [x] 2026
- [x] 2027
- [x] 2028
- [x] NA

Primary Sponsor
- [x] (All)
- [x] Null
- [x] CLT
- [x] COE
- [x] Cowlitz Tribe
- [x] CREST
- [x] FS
- [x] LCEP
- [x] WDFW

Reach
- [x] (All)
- [x] Null
- [x] A
- [x] B
- [x] C
- [x] D
- [x] E
- [x] F
- [x] G
- [x] H

- https://public.tableau.com/app/profile/sarah.ann.kidd/viz/BPARestorationProjectRe-vistScheduleSuggestions/BPARestorationProjectRe-visitScheduleSuggestions#1

Adaptive Management Trigger Table

- What metrics can we monitor?
- What data do we already have?

✓Recommend providing more quantitative guidelines on all metrics being evaluated

Attachment 3: Post-Construction Assessment Grading Criteria

ERTG SEC Post-Construction Assessment Criteria (DRAFT)

DRAFT 11/11/21, 'Based on ERTG Scoring Criteria (matrices from file "ERTG Scoring Criteria Matrix 051420.xlsx"
Matrices below based on ERTG Doc #2020-02, Feb 2020. The original scoring criteria were ERTG Doc #2010-02.
The Assessment Criteria cover the same five factors as the Scoring Criteria:
Certainty of Success, Habitat Access, Habitat Capacity-site scale, Landscape-scale elements, and Habitat Capacity-matrix
EDITED for post-construction assessment
Bolded blue font implies potential for the ERTG to set quantitative levels

Certainty of Success (site-scale)	A	B	C	D	F
Restoring natural process or landform	Fully	Largely	Partially	Partially	Not evident
Self-maintaining	Obviously well self-maintaining	A fair amount of self-maintenance evident	Some self-maintenance evident	Self-maintenance not apparent and not likely	Intervention required
Risk of detrimental effects	None evident and no potential	None evident but potential exists	Very small amount evident	Small amount evident	Definitely evident

Habitat Access (site-scale)	A	B	C	D	F
Hydrologic site-scale connectivity	Full	High	Moderate	Low	Minimal to none
Site access for juvenile salmonids	Fully restored	Significantly increased	Modestly increased	Barely increased	Clearly no increase

Habitat Capacity (site-scale)	A	B	C	D	F
Habitat complexity and diversity	Excellent	Very good	Moderate	Moderate to low	Little
Natural disturbance regime and ecosystem functions	Well-developed	Very good	Not ideal	Moderately developed	Poorly developed
Channel and edge network	**Extensive**	**Very good**	**Some**	**Little**	**None**
Prey resource production and export	Excellent	Very good	Moderate	Moderate to low	Little
Invasive species or nuisance predators	None present	Minimal amount present	Some present	Moderate amount present	Large amount present
Water quality/ temperature	**Excellent**	**Very good**	**Moderate**	**Moderate to low**	**Poor**
Site size	Large (> 100 ac)	Relatively large (30-100 ac)	Relatively large (30-100 ac)	Small (< 30 ac)	Small (< 30 ac)

Adaptive Management Trigger Table

- Level 3
  - WSE/Temperature data can be used to evaluate **Habitat Opportunity and Access for Salmonids**
    - Especially useful when coupled with site digital terrain data – such as the Wallooskee Model

    ✓For how much time (% of the year?) and how many acres should a site provide optimal conditions for salmonids post-restoration?
  - Sediment Accretion/Erosion data can be used to evaluate if the site is **Keeping Pace with Sea Level Rise**
    - Especially useful when collected at multiple elevations – at different distances from the main channels

    ✓Is the site keeping pace with sea level rise projections? Is the site keeping pace with reference site conditions?

Steamboat East (2019)

Adaptive Management Trigger Table

- Level 2
  - Plant Community Analysis
    - Especially useful when used to model vegetation across the site coupled with UAV data– such as the Wallooskee Model
    - ✓**How much of the site is expected to be restored to native dominant vegetation? What threshold of natives is ideal for this reach of the river?**
  - Macroinvertebrate Data
    - Only collected during April or May – would be useful to collect more data for a longer period of time
    - ✓**Are macroinvertebrate communities representing reference level abundance and diversity – to support juvenile salmonids?**
  - Fish Data
    - Typically, only collected during April or May (Year 5)– would be useful to collect more data for a longer period of time
    - ✓**Are salmonids utilizing the restoration project?**
    - ✓**Are they occurring at similar abundances to what we see at reference sites? (This would require more data)**

Contact us if you have questions:
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