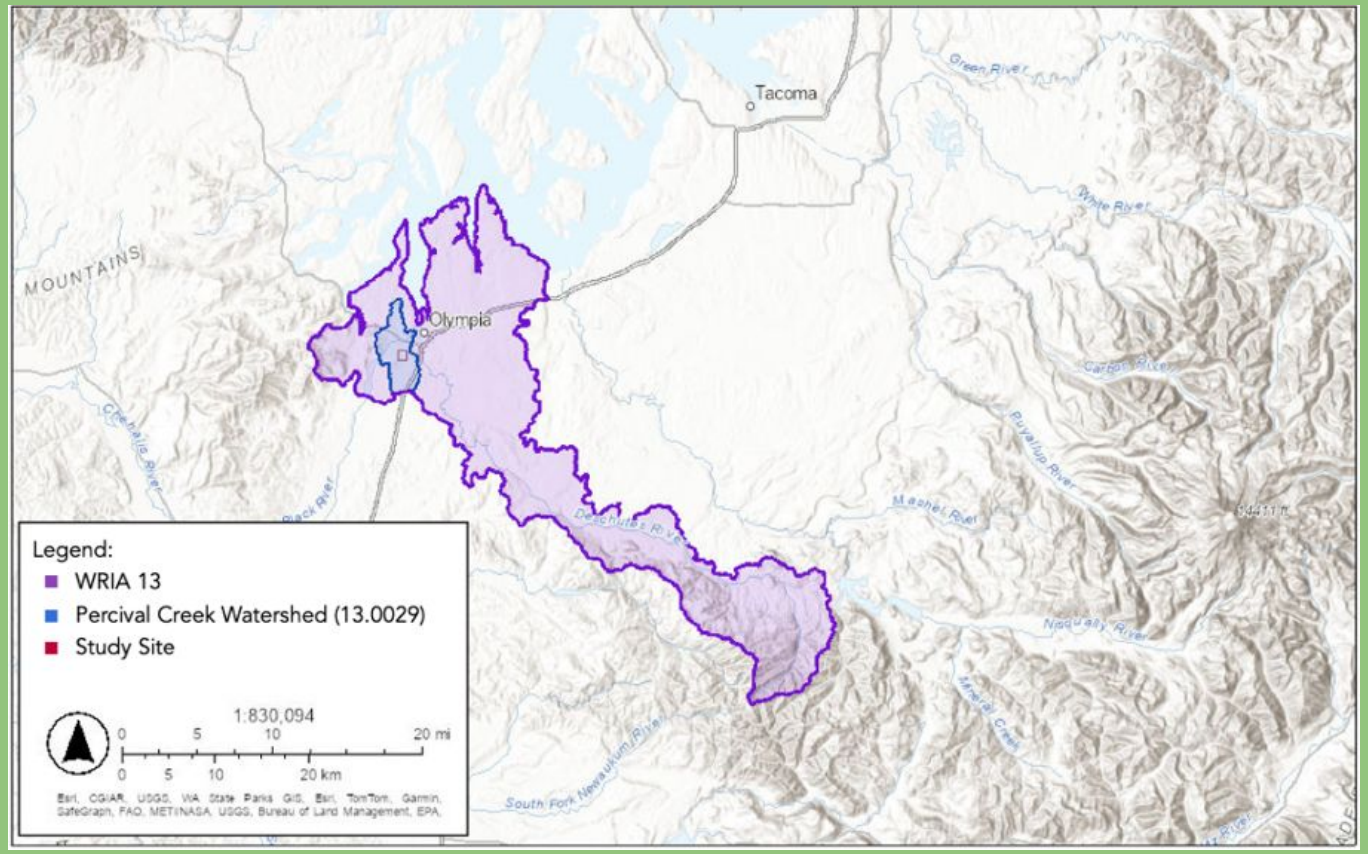
Video taken 2/19/24 of Sapp Road Park from 200 feet

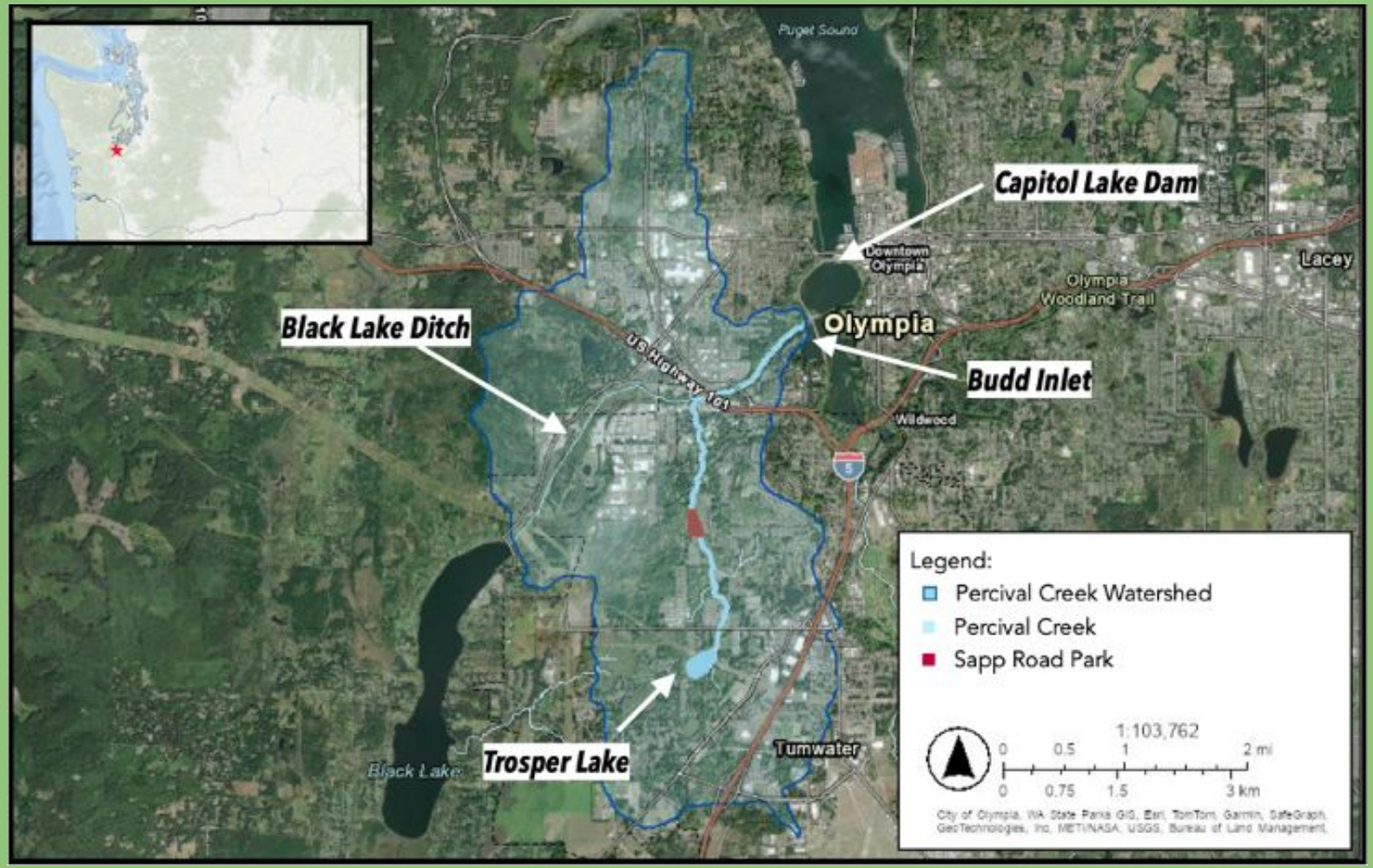
The Sapp Road Park Beaver Restoration Project

Dash Paulson, Nick Baker, Charles Hastings, Phil Harris

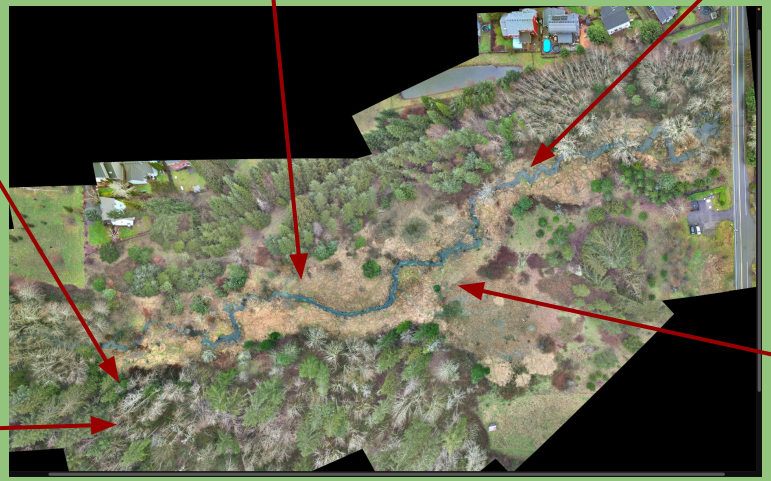
Part 1: Sapp Road Park, the Deschutes Watershed, and Salmon

Where is Sapp Road Park?



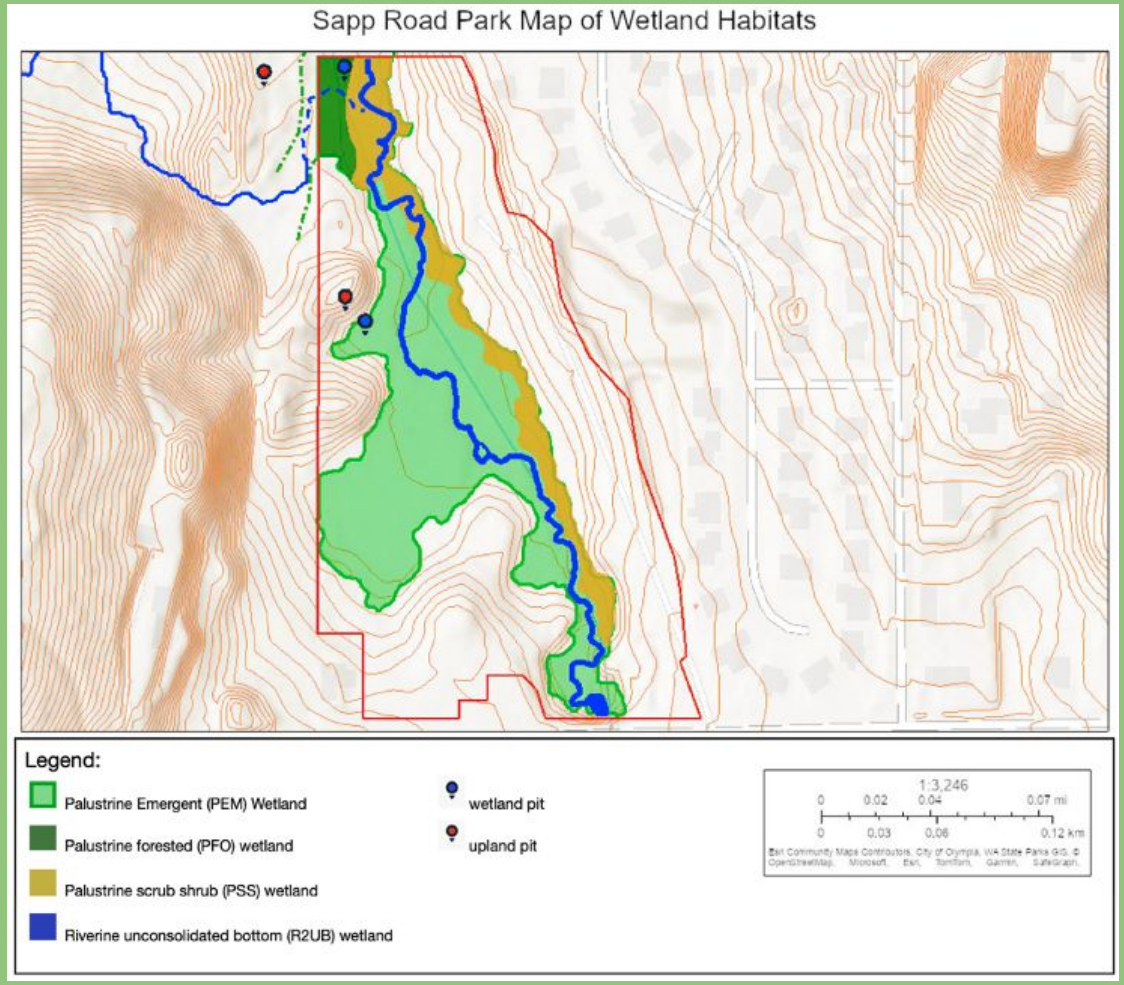

Puget Sound
Capitol Lake Dam
Downtown Olympia
Lacey
Olympia Woodland Trail
Olympia
Black Lake Ditch
US Highway 101
Budd Inlet
Wildwood
Legend:
Percival Creek Watershed
Percival Creek
Sapp Road Park
1:103,762
0 0.5 1 2 mi
0 0.75 1.5 3 km
City of Olympia, WA State Parks GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management,
Trosper Lake
Black Lake
Tumwater


1:3,878
0 0.02 0.04 0.09 mi
0 0.04 0.07 0.14 km
Bush Mountain
Tumwater Hill
Percival Creek
←Sapp Road SW→
Culvert



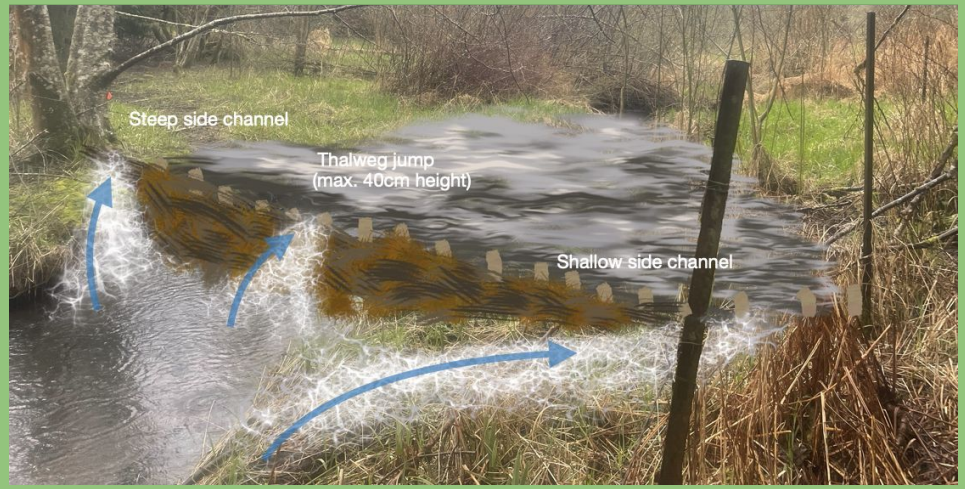
Existing Conditions

- Category II Riverine Wetland (includes riverine and slope hydrogeomorphic classes)
- 4.6 acres of wetlands
- Includes palustrine emergent, scrub-shrub, and forested habitats
- Lower perennial riverine despite location in the upper watershed



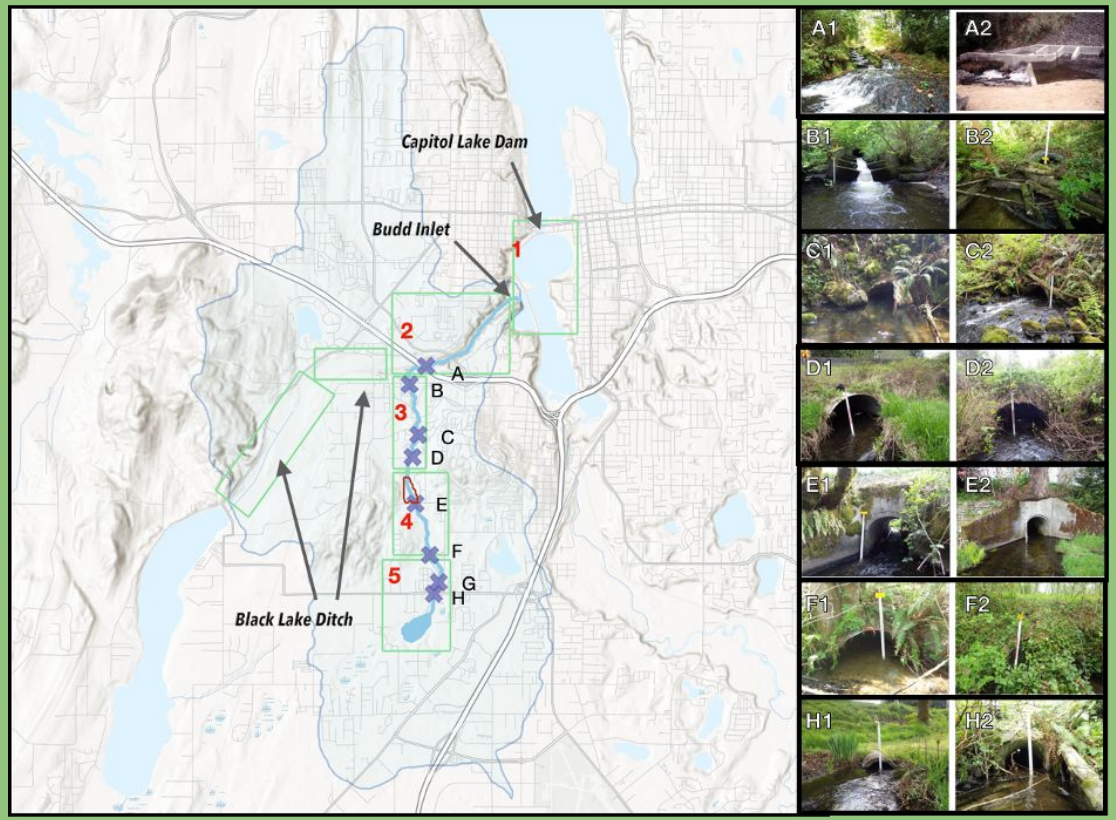
Why focus on salmon?

- Percival Creek supports coho and Puget Sound ESU Chinook salmon runs
- Salmon recovery drives a significant amount of restoration/mitigation effort and $$$ in WA via RCW §77.85 and the 2013 Federal permanent injunction.
- Following removal of the Capitol Lake Dam in Olympia, Percival Creek will play an important role in sustaining salmon populations in WRIA 13.



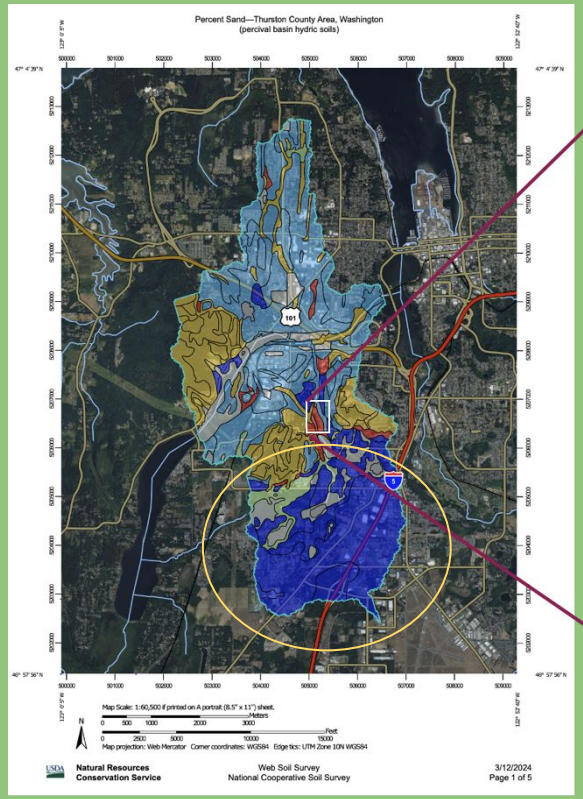
An imagined BDA at the southern extent of the Sapp Road study site with fish passage options based on Pollock et al (2022) *(not including passage directly through the structure).*

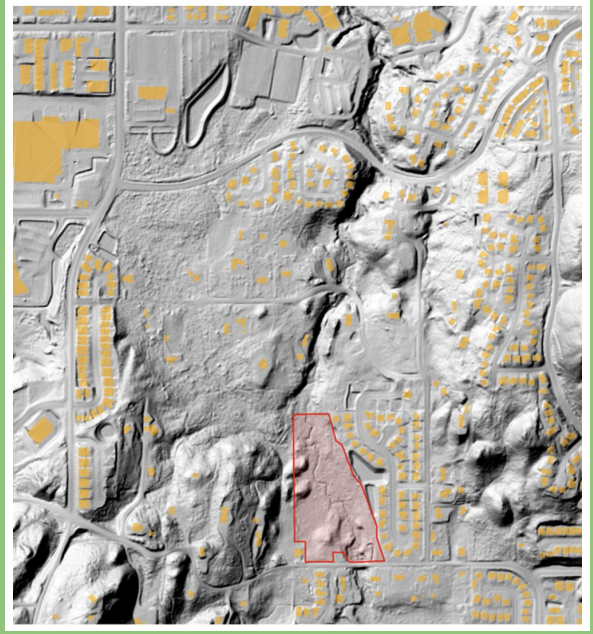
Summary of site- and mid-scale observations



1. ~2 river miles spawning habitat downstream of SRP (zones 2-3)
2. ~1 river mile rearing habitat starting from SRP, mostly degraded (zones 4-5)
3. Numerous fish passage obstacles in the system, limiting juvenile movement into zones 4-5
4. Already violating temperature, fecal coliform, and dissolved oxygen TMDLs
5. Climate predictions suggest declines in winter and summer runoff of as much as 10% with increased high pulse flooding events. (Thurston County Regional Planning Council, 2021)

- Upper watershed is very sandy with high Ksat - as high as 373 *u*m/sec - high recharge potential
- Soils at SRP have very low Ksat - between 4 and 9 *u*m/sec - high storage potential
- SRP is the last portion of open floodplain with space to store water before the canyon.





Conclusions:

Sapp Road Park cannot be made into spawning habitat, but spawning habitat isn't the limiting factor in the system to begin with.

Increasing onsite rearing habitat is viable, however it will be underutilized until downstream culverts are restored.

Improving downstream water quality for salmon should be the highest priority, given both current and predicted future conditions in Percival Creek.

Part 2: Process Based Restoration at Sapp Road Park

Designing A Complex Of Low-Tech Structures At Sapp Road Park To Restore Floodplain Connectivity And Enhance Beaver Habitat

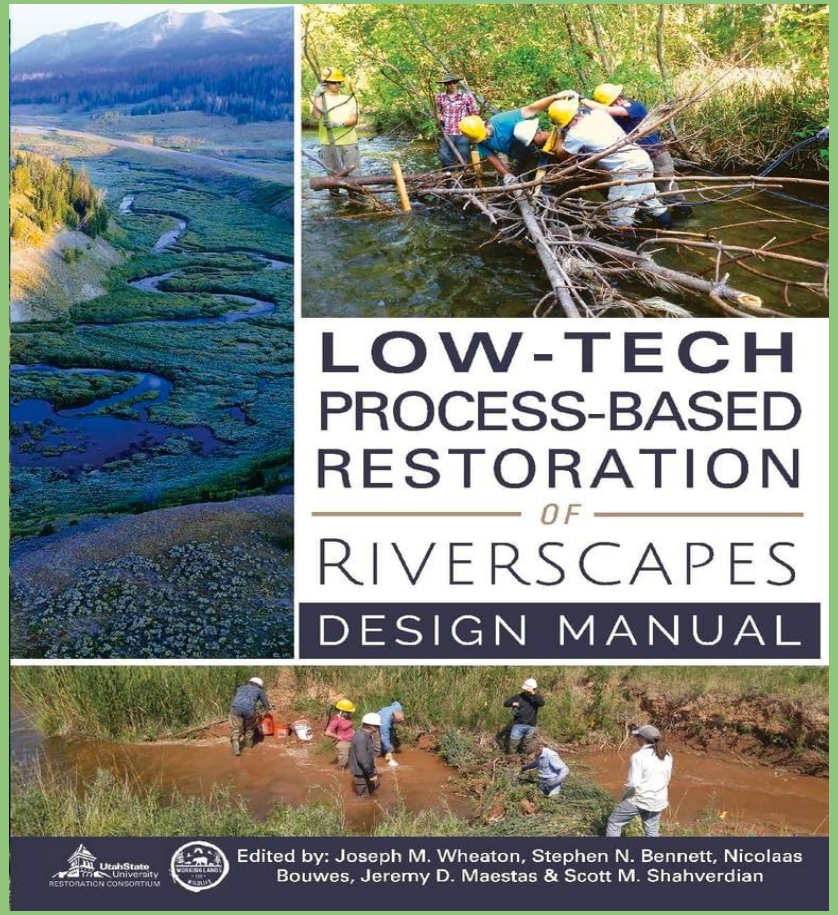
By
Dashiell Paulson
University of Washington
Certificate in Wetland Science and Management
May, 2024

What's the problem?

- Sapp Road Park is dominated by reed canary grass and yellow-flag iris
- Percival Creek is becoming incised (positive feedback loop) and disconnected from the floodplain
- Most of the floodplain habitat is degraded, but it has the potential to be good rearing habitat for salmonids, mudminnow, and Oregon Spotted Frog

What is low-tech Process Based Restoration (PBR)?

- PBR is a low-cost alternative to traditional engineering solutions for ecological restoration (Wheaton 2019).
- Beaver related restoration (BRR) is a form of PBR that aims to satisfy multiple ecological restoration objectives by encouraging beaver (Castor canadensis) activity in degraded stream systems.



LOW-TECH PROCESS-BASED RESTORATION PRINCIPLES FOR STRUCTURALLY-STARVED RIVERSCAPES

Riverscapes Principles

1. Streams need space
2. Structure forces complexity and builds resilience
3. The importance of structure varies
4. Inefficient conveyance of water is healthy

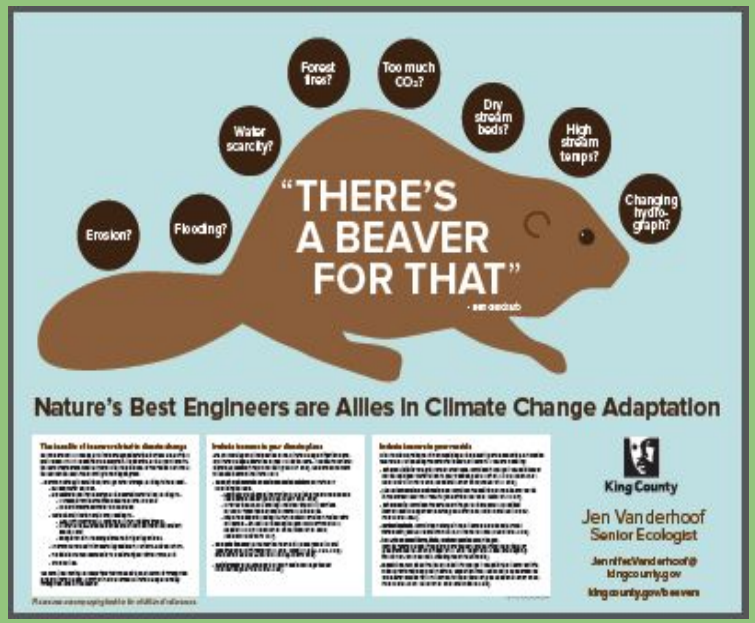
Restoration Principles

5. It's okay to be messy
6. There is strength in numbers
7. Use natural building materials
8. Let the system do the work
9. Defer decision making to the system
10. Self-sustaining systems are the solution

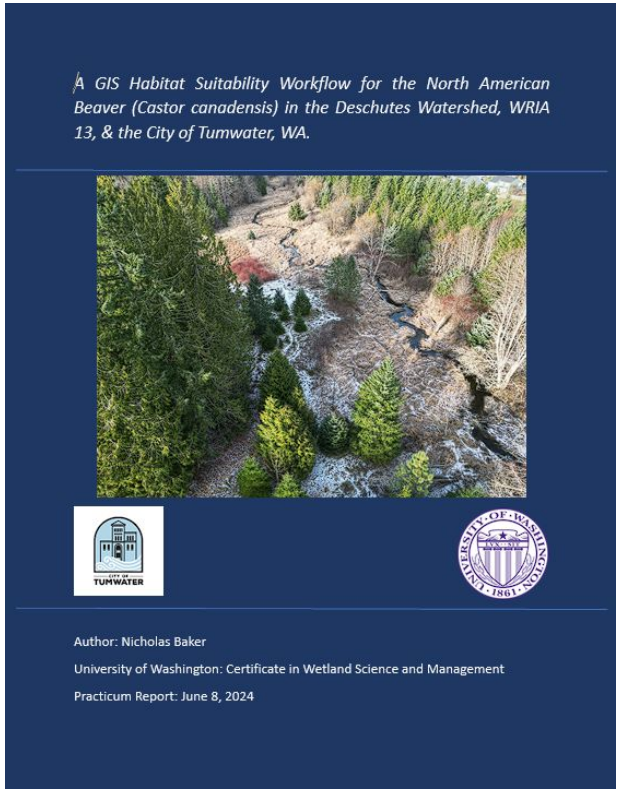
- "Let the system do the work!"
- The system being stream power, natural processes like erosion and deposition, and biogeomorphlogical agents like beavers (Butler 1991).

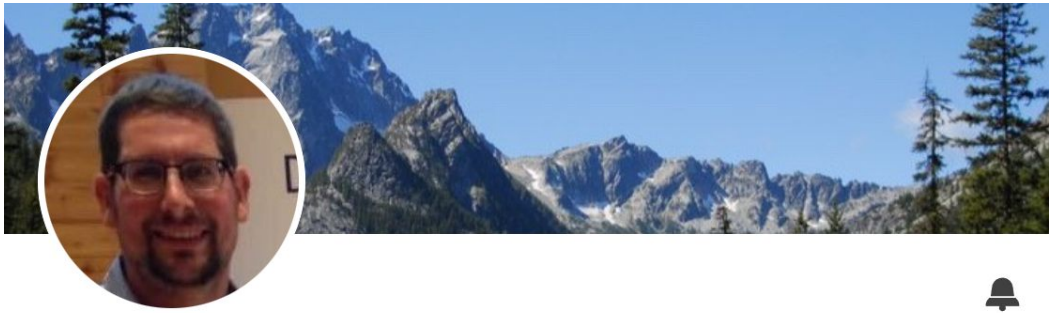
The Benefits of Beavers

- Beaver activity can improve water quality and pollution sequestration (Holzer 2019)
- Beaver dams can improve salmon habitat (Bouwes 2016)
- Beaver wetlands serve as firebreaks (Fairfax 2020)
- Beaver ponds recharge aquifers (Westbrook 2006)
- Beaver activity Increases biodiversity in the surrounding landscape (Nummi 2019)
- “Beaver dams overshadow climate extremes
- in controlling riparian hydrology and water quality” (Dewey 2022)
- And more….



GIS Habitat Suitability Workflow For N. American Beaver:

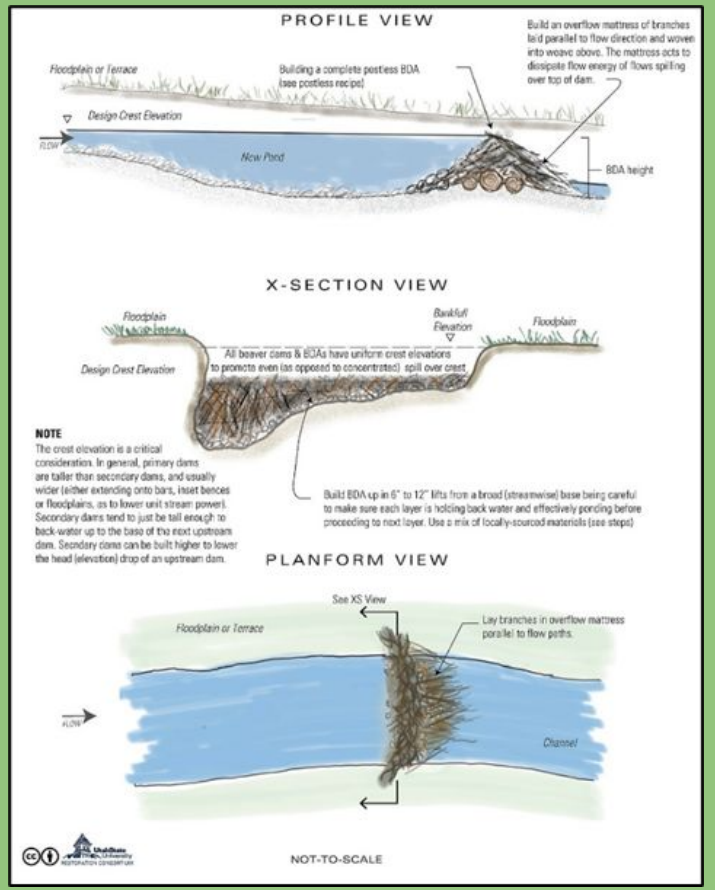




Nicholas Baker: UW Wetland Science and Management Certificate Program May 2024

GIS Habitat Suitability Workflow For N. American Beaver

- GIS workflow to find ideal Beaver Habitat in WRIA 13.
- Used to place BDAs, PALS, or for beaver reintroduction.
- Began by studying existing models, Beaver Intrinsic Model, BRAT, and multiple Beaver Habitat Suitability Indices to develop workflow and parameters.
- Can we find suitable habitat for beaver to provide ecological benefits to wetland and riparian ecosystems in an urban environment?



GIS Habitat Suitability Workflow: Parameters

- Beavers need gently sloped slow moving streams and woody deciduous vegetation to build dams and lodges.
- Model Parameters:
- Hydrogeomorphic stream features:
  - Slope
  - Bankfull Width
  - Valley Width
  - Stream Order
  - Impaired water bodies WADOE 303(d) list.
  - Vegetation: USFS Landfire dataset for the US.
  - WDFW Beaver Habitat Connectivity dataset: “Least Cost Paths”: SW Washington
  - Land Parcel Data

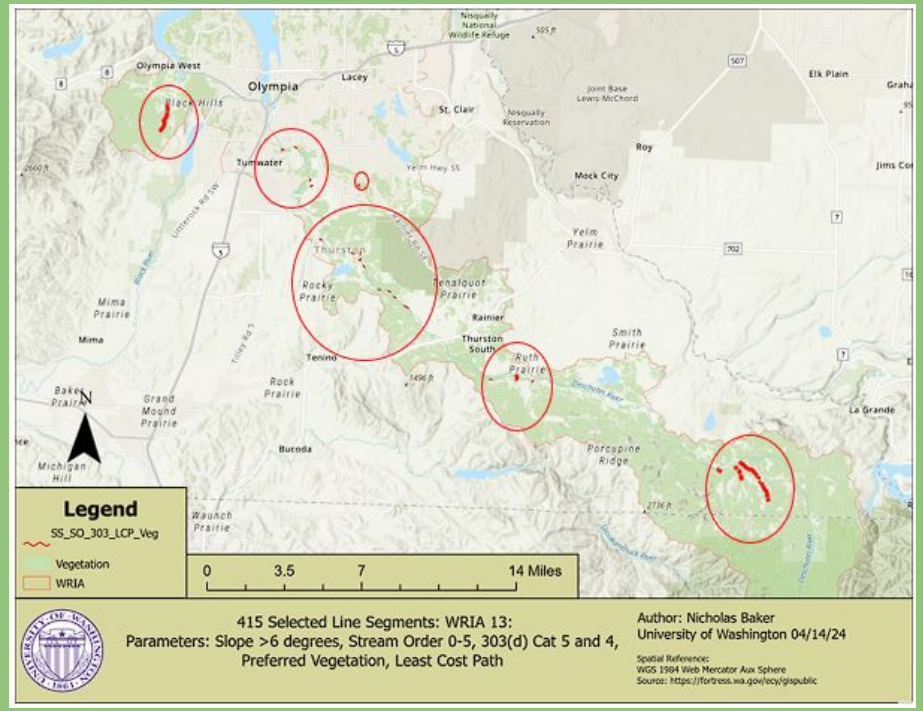
GIS Habitat Suitability Workflow: Parameters

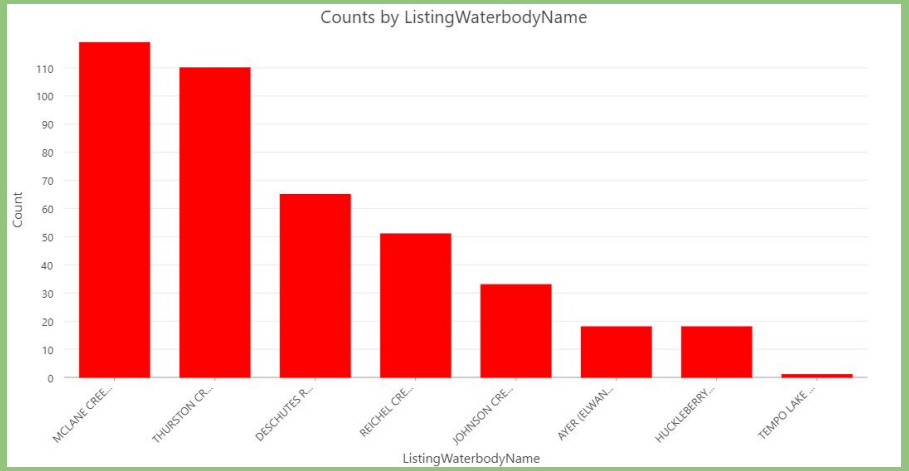
- All parameters: yielded very few results.
- Removing and varying parameters revealed more potential locations at the mid and watershed scales.
- Limiting factors at times: Beaver Habitat Suitability Model, Parcel data.

Table 2: Model Results

Sapp Road Park	Parameters:		BIP Calculations		
	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Bankfull Width	Bankfull Width	Bankfull Width
	Stream order 0-5	Stream order 0-5	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees
	303(d) list	303(d) list	Valley Width	Valley Width	Valley Width
	LCP	Preferred Vegetation	Stream order 0-5	Stream order 0-5	Stream order 0-5
	Preferred Vegetation	Parcel- Public Park	303(d) list	303(d) list	
	Parcel- Public Park		Preferred Vegetation		
Total # of Segments	***0***	***11***	***32***	***34***	***34***
City of Tumwater	Parameters:				
	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees
	Stream order 0-5	Stream order 0-5	Stream order 0-5	Stream order 0-5	Stream order 0-5
	303(d) list	303(d) list	303(d) list	303(d) list	303(d) list
	LCP		LCP		
	Preferred Vegetation	Preferred Vegetation		Preferred Vegetation	
	Tumwater Parks	Tumwater Parks			
Total # of Segments	***4***	***10***	***24***	***88***	***97***
WRIA 13	Parameters:				
	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees	Stream Slope < 6 degrees
	Stream order 0-5	Stream order 0-5	Stream order 0-5	Stream order 0-5	Stream order 0-5
	303(d) list Cat 4a, 4b, 5	303(d) list	303(d) list	303(d) list	303(d) list
	LCP		LCP	LCP	
	Preferred Vegetation	Preferred Vegetation		Preferred Vegetation	Preferred Vegetation
	Parcel- Public Park	WA State- Parcels / DNR Parcel	WA State- Parcels / DNR Parcel		
Total # of Segments	***0***	***27 / 170***	***0 / 0***	***0 /415***	***4079***

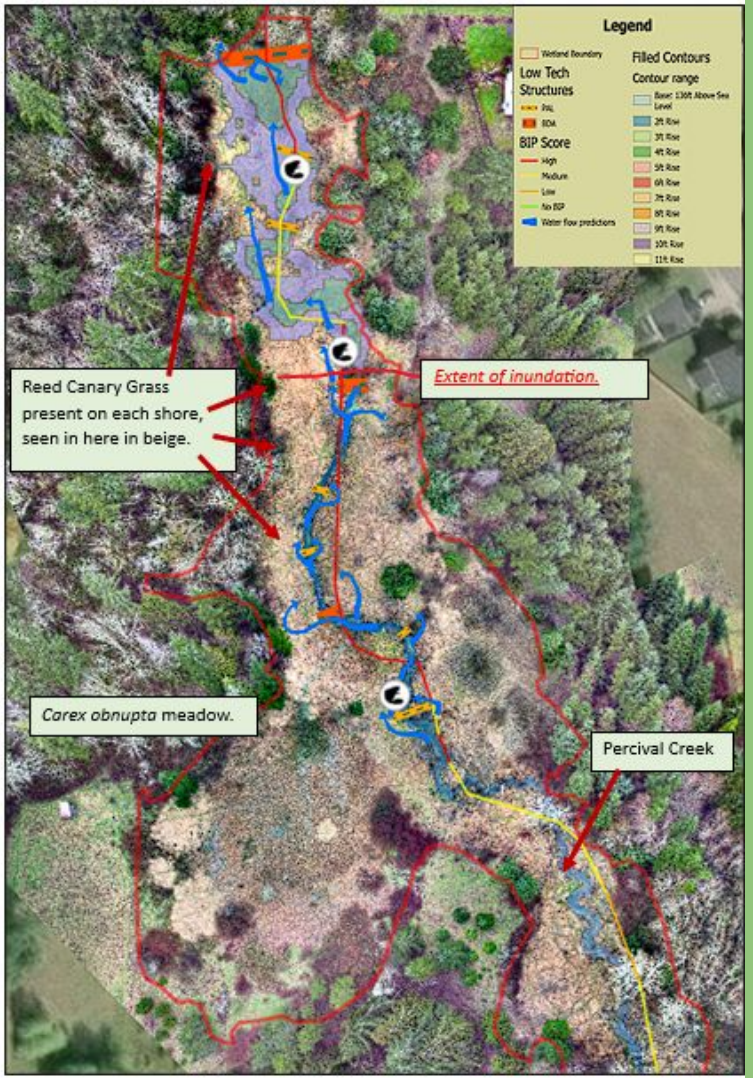
One Set of Results: WRIA 13 & City of Tumwater

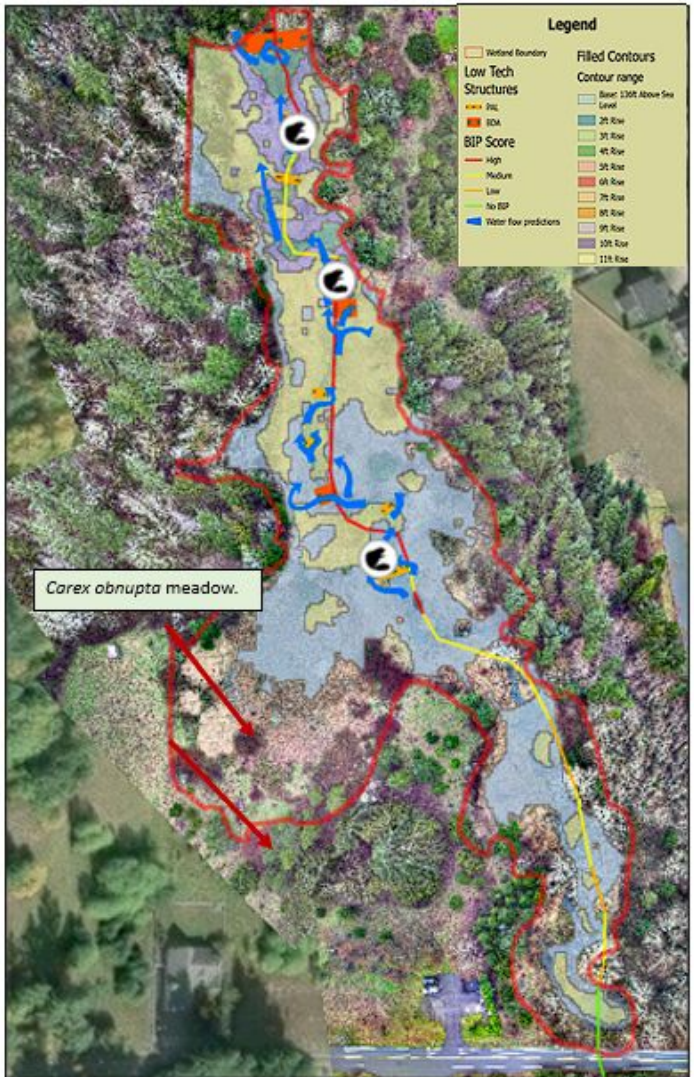




Sapp Road Park BIP Analysis

- Beaver Intrinsic Potential Model (BIP)
- Stream specific placement of BDAs or PALS
- Scoring Based off of 3 Hydrogeomorphic Parameters: slope, valley width, bankfull width. Scored, normalized, ranked.
- Best score: 4 / High BIP:
  - Slope of 2% or less
  - Valley Width greater than 30 meters
  - Bankfull width of 7 meters or less
- Additionally: Flood analysis derived from LIDAR -> Filled contours -> Height of Inundation potential upstream.


Legend
Wetland Boundary
Low Tech Structures
PBL
BDA
BIP Score
High
Medium
Low
No BIP
Water flow predictions
Filled Contours
Contour range
Base: 136ft Above Sea Level
2ft Rise
3ft Rise
4ft Rise
5ft Rise
6ft Rise
7ft Rise
8ft Rise
9ft Rise
10ft Rise
11ft Rise
Reed Canary Grass present on each shore, seen in here in beige.
Extent of inundation.
Carex obnupta meadow.
Percival Creek


Legend
Wetland Boundary
Low Tech Structures
PBL
BDA
BIP Score
High
Medium
Low
No BIP
Water flow predictions
Filled Contours
Contour range
Base: 136ft Above Sea Level
2ft Rise
3ft Rise
4ft Rise
5ft Rise
6ft Rise
7ft Rise
8ft Rise
9ft Rise
10ft Rise
11ft Rise
Carex obnupta meadow.

GIS Habitat Suitability Workflow Thoughts

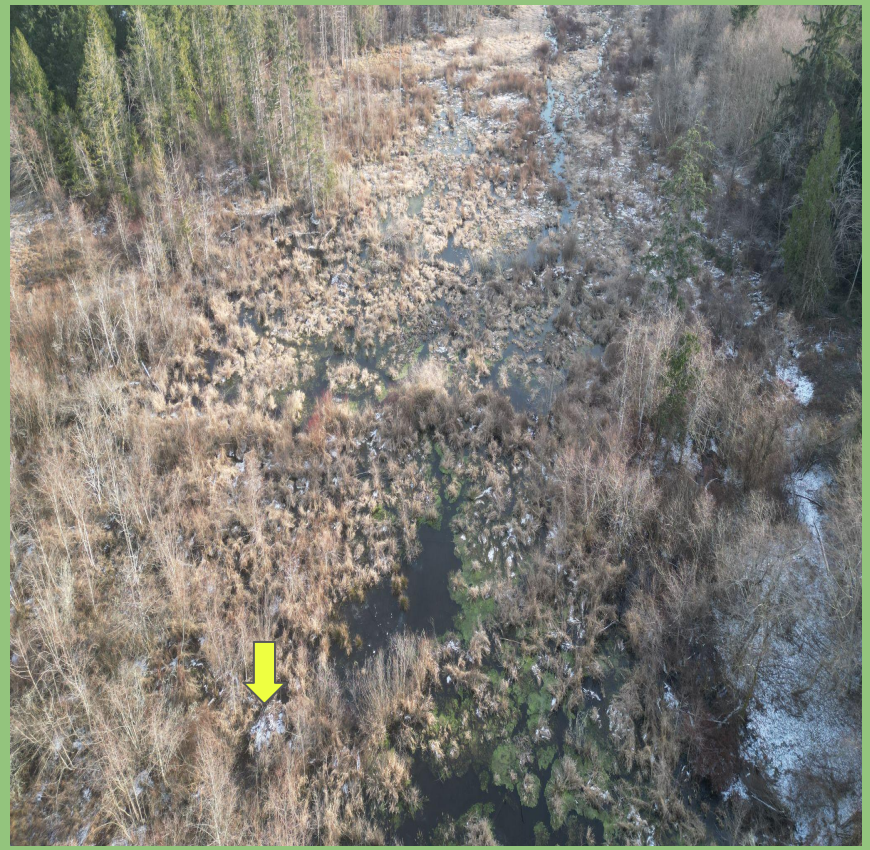
- Further study:
  - Find more detailed vegetation data.
  - Statistical analysis and ground truthing
  - Evaluate old scripting tools, and update for newer software
  - Study beaver migration patterns in urban streams.
  - Incorporate critical infrastructure used for proximity analysis.
  - Multi-Criteria Evaluation: Ecological Function monetary value, costs of construction and maintenance, BDAs, Parcel Ranking, vegetation inventory.

But where will the beavers come from?

- Relocation of beavers can be hazardous for the beavers
- According to Petro (2015), the Kaplan–Meier survival rate for relocated beavers was 0.47 ± 0.12 % for 16 weeks post-release.
- Causes of death? Predation disease or illness, and human-related mortalities

Beavers already at Sapp Road Park!

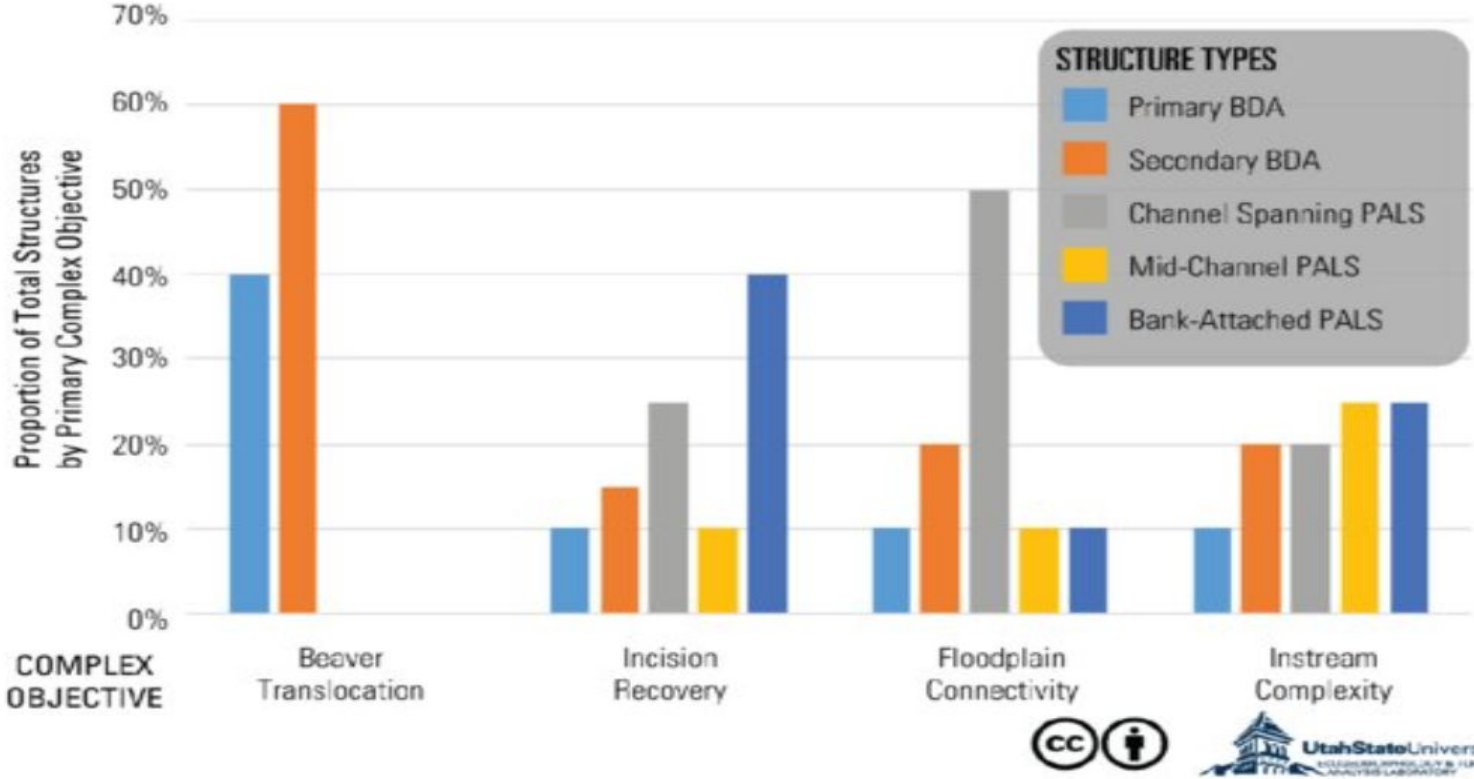
- Lots of relict beaver chew and stick piles at Sapp Road Park
- Beavers still present near site and actively foraging at Sapp Road Park



Suitability of low tech PBR for Sapp Road Park

- Is Percival Creek structurally starved?
  - **Yes, the stream lacks meanders, wood, and is incised**
- Is Percival Creek starved of beavers and beaver dams?
  - **No, there is a beaver family immediately upstream**
- What is the stage of the riverscape at Sapp Road Park?
  - **Probably in stage 1-3 (incision)**
- Are stakeholders willing to allow dynamic processes to occur on site (channel change, erosion, deposition, inundation?
  - **Yes, the City of Tumwater is interested**

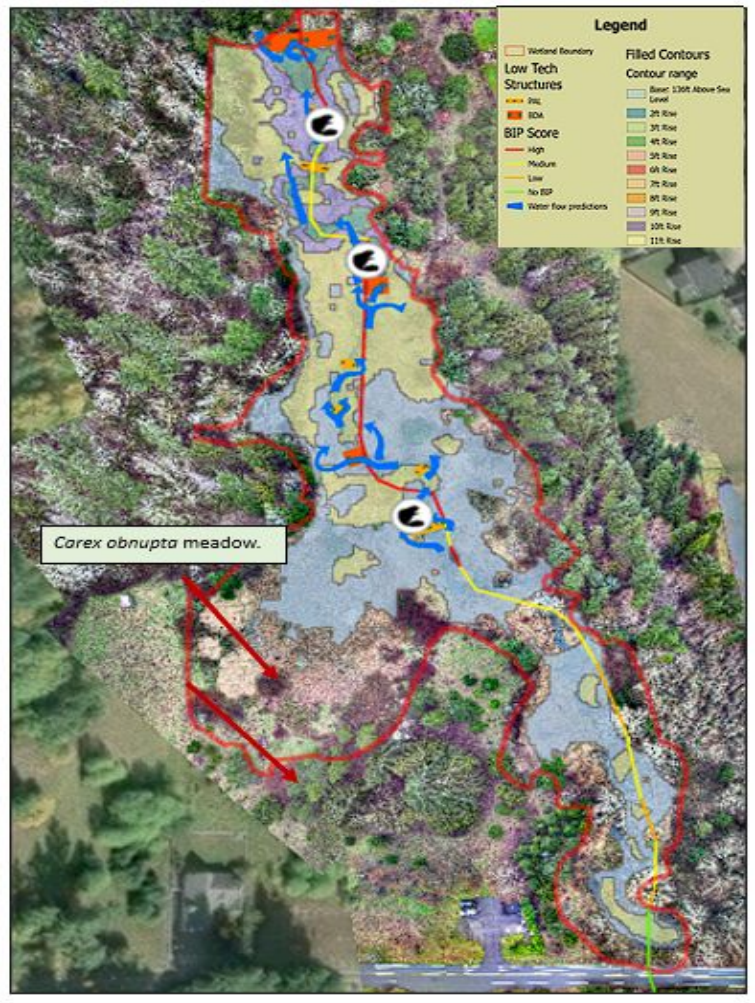
What's the design goal?



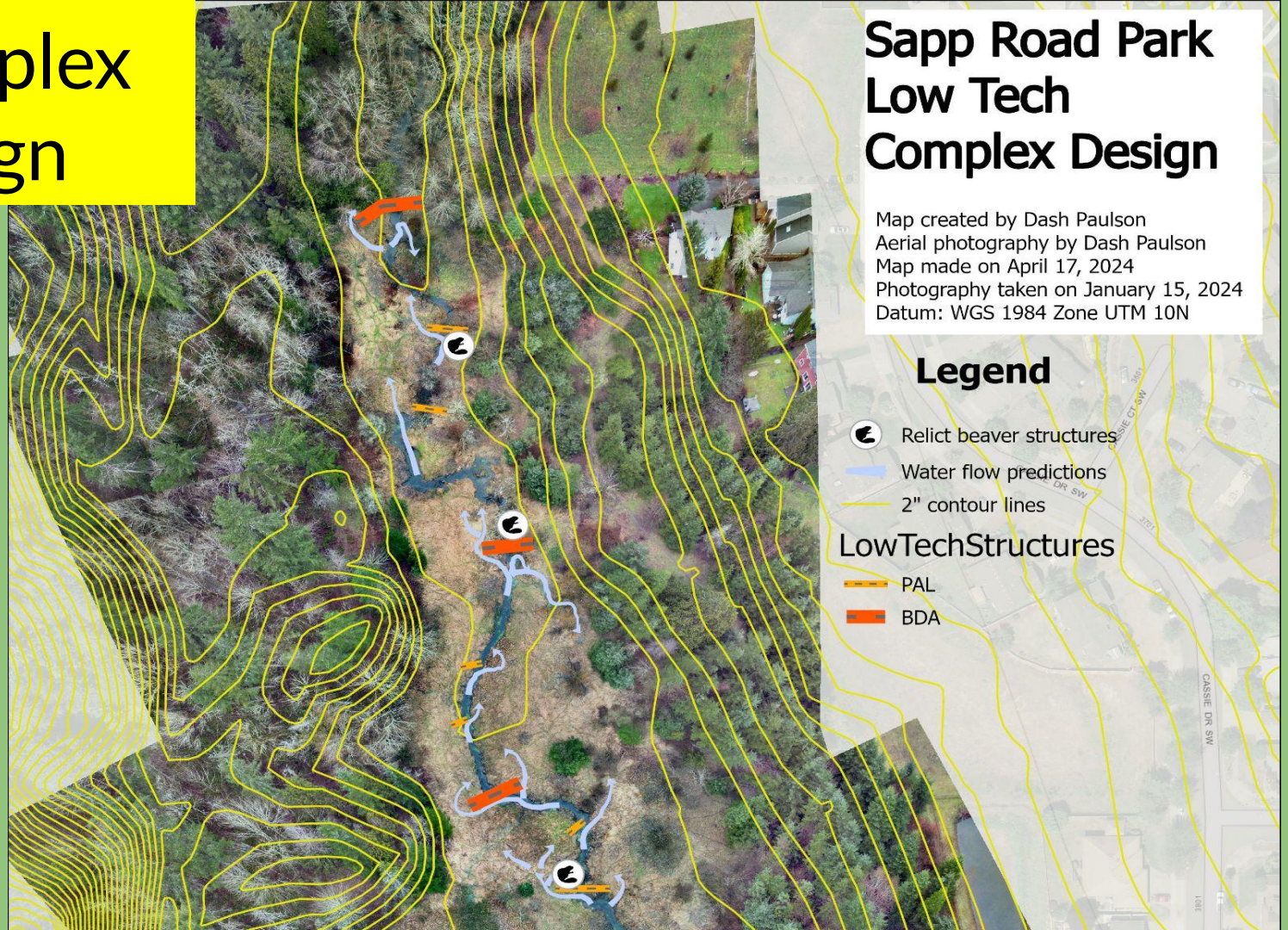
Designing Around Predicted Inundation

Where would beavers build a dam?

- Narrow points in the stream (Hartman 2006)
- At topological breaks and drips
- Areas with in-stream woody material / tree roots, or other material to anchor
- Relict dam sites
- Near a food / building material source



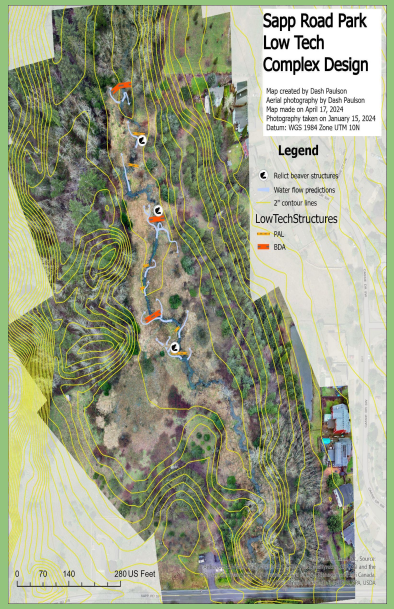
Complex Design



Potential challenges

- Percival Creek has low stream power (less than 20 cubic feet/second), which could limit channel bank erosion.
- Observed channel incision may actually be floodplain aggradation (Chris Jordan, NOAA, personal communication) and requires further study.
- Local buy in: residents may oppose BRR because they're worried about the water table, tree felling, etc.

Ultimate goal: beaver adoption!



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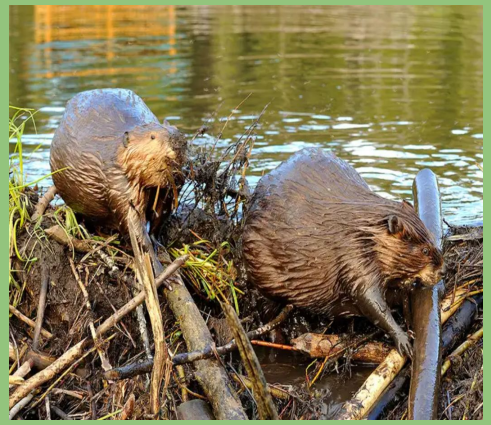

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?

No single “one-and-done” solution; design and management must be adaptable

Beaver management & conflict resolution

- Public outreach and education are essential
- Hold public comment hearings to hear the concerns of the community
- Education on long term benefits
- Strategic fencing of ornamentals and trees of value
- Signage explaining BRR and providing contact information
- Routine site monitoring

Planting for Beaver Habitat Enhancement

Beaver Habitat Suitability

Geomorphic Suitability

If site is along a stream it is most conducive to beaver dam-building if:	Percival Creek in this section:
Stream gradient is 4% or less (*gentler slope, slower water*)	✅
Stream width is less than 10 meters (*stream is not too wide to build across*)	✅
Valley width is greater than 30 meters (*stream & its floodplain are not too confined*)	✅

Beaver Habitat Suitability

Vegetation Suitability

Most favored woody species*:

Salicaceae (Willow family):

- **Aspen (***Populus* spp. - ex:*Populus tremuloides*)
- **Cottonwood (***Populus* spp. - ex: *Populus balsamifera* subsp. *trichocarpa*)
- **Willows (***Salix* spp. - ex: *Salix lasiandra*, *Salix sitchensis*)

Herbaceous plants eaten ex: sedge rhizomes; yellow pond lily - leaves, tubers (*Nuphar polysepala*)

***Many other woody and herbaceous species are eaten, and this varies a lot by region, situation, perhaps even by beaver colony- beavers seem to be highly adaptable.**


Cassie Dr SW
Percival Creek
Percival Creek
Sapp Rd SW


Pacific willow
“sedge meadow”
black cottonwood
red alder stand
recent beaver chew
“coppiced grove”
culvert


Sitka willow “groves”
old beaver structure
Pacific willow
“little sedge meadow”

Principles of Planting Design: Plant Selection

1. **Beaver-favored plant species** - provides a food supply for a beaver colony
2. **Ecologically appropriate** - “listen to the land”, native to this bioregion, fits this ecosystem, appropriate moisture/light/soil (good indicator of appropriateness - already grows there or nearby in a similar ecosystem)
3. **Renewable / sustainable** - possesses the ability to regenerate / resprout after being cut by beavers
4. **Practicable** - ease of propagation, on-site sources of propagules, can be planted as live stakes - can serve a dual purpose of suppressing reed canary grass

Plant Selection

Sitka willow
Salix sitchensis

Pacific willow
Salix lasiandra

Black cottonwood
Populus balsamifera subsp. trichocarpa

Designing Around Predicted Inundation - Pinch Points

Where might beavers build a dam?

- Narrow points in the stream
- Areas with in-stream woody material / tree roots, other objects to anchor to
- Sites of former dams
- Where, topographically, deep ponding can occur with dam construction
- Near a food / building material source

Cassie Dr SW
Percival Creek
Klahowya Ln SW
Percival Creek

Cassie Dr SW
Percival Creek
Percival Creek
Sapp Rd SW

Cassie Dr SW
Percival Creek
Percival Creek
Sapp Rd SW

Planting to Compete With and Decrease Reed Canary Grass

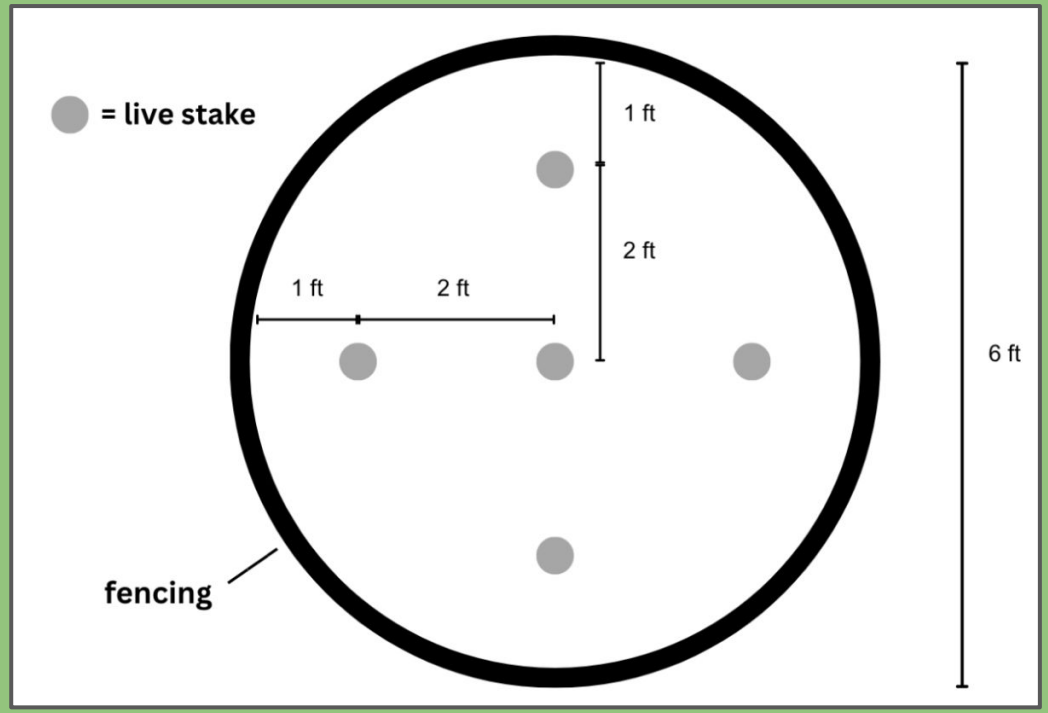
Kim et al. at the University of Washington found that **willow live stakes planted 2ft apart** from one another in the midst of reed canary grass "**reduced total biomass of reed canarygrass by 44.9%**... in the first year and by **68.0%**...in the second year."

Sound Native Plants crew installing live stakes.

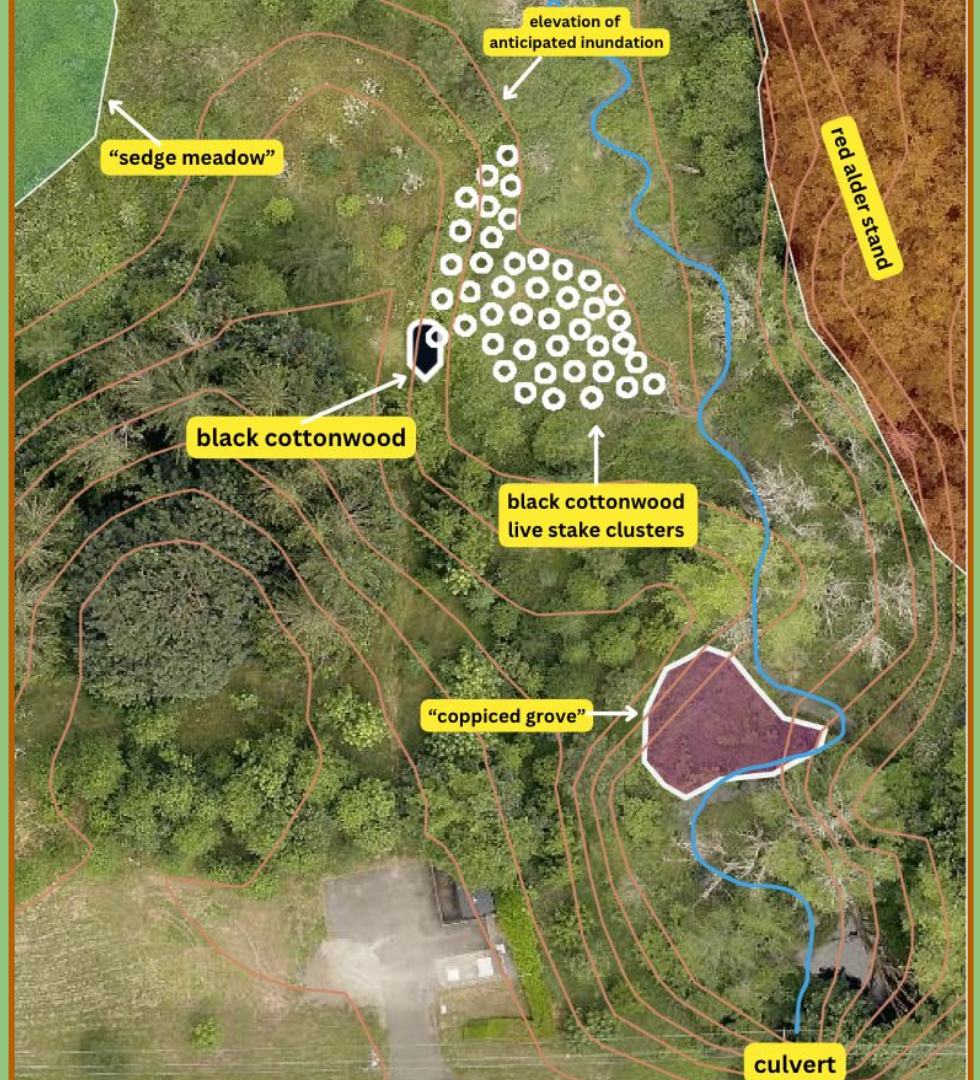
from capitolandtrust.org

Managing Herbivory

Live stakes can be protected with fencing or other barriers to allow them root and establish before beavers or other wildlife eat them. After establishment, these species will be able to resprout.



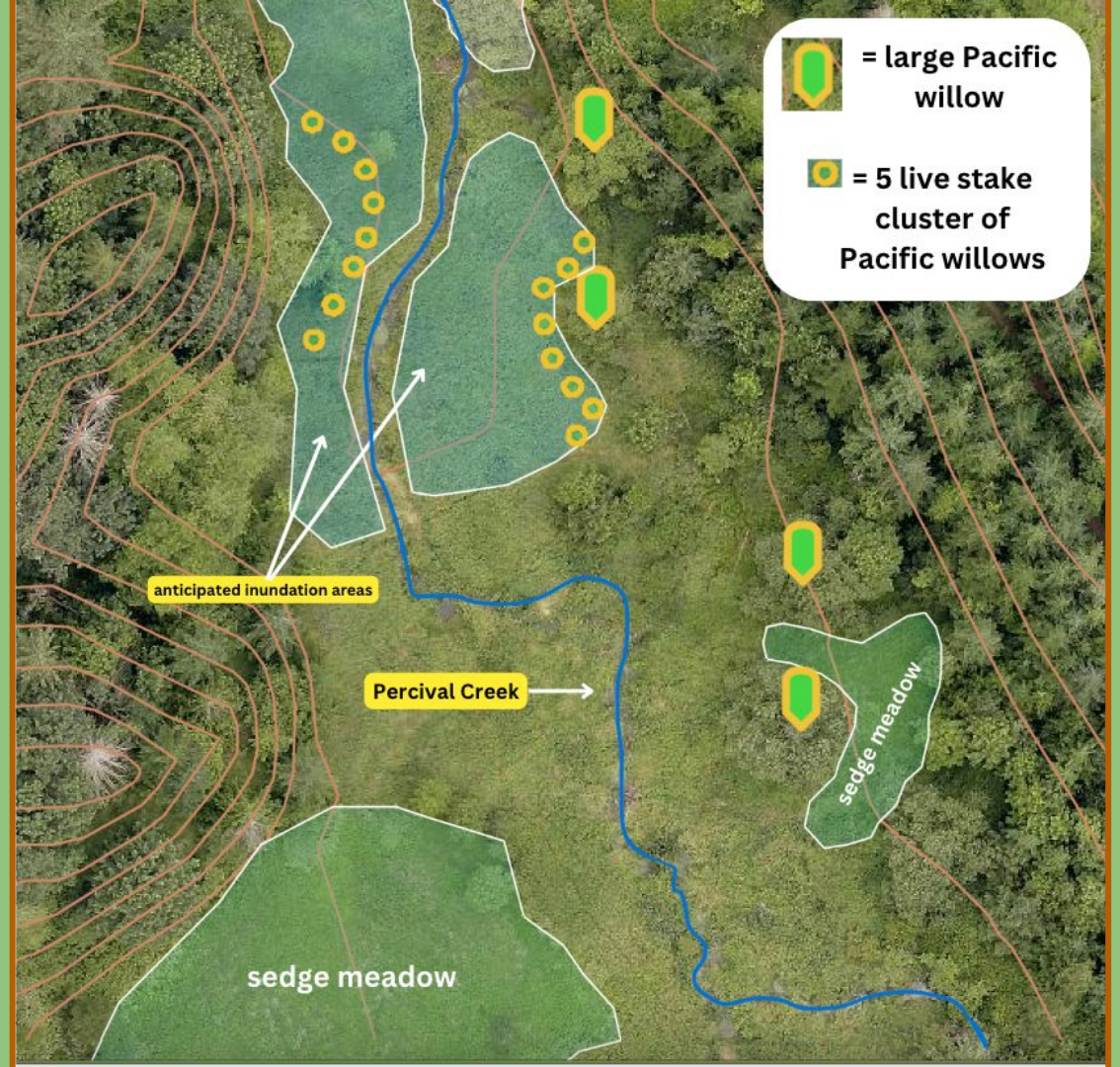
Planting Plan: “South Section”



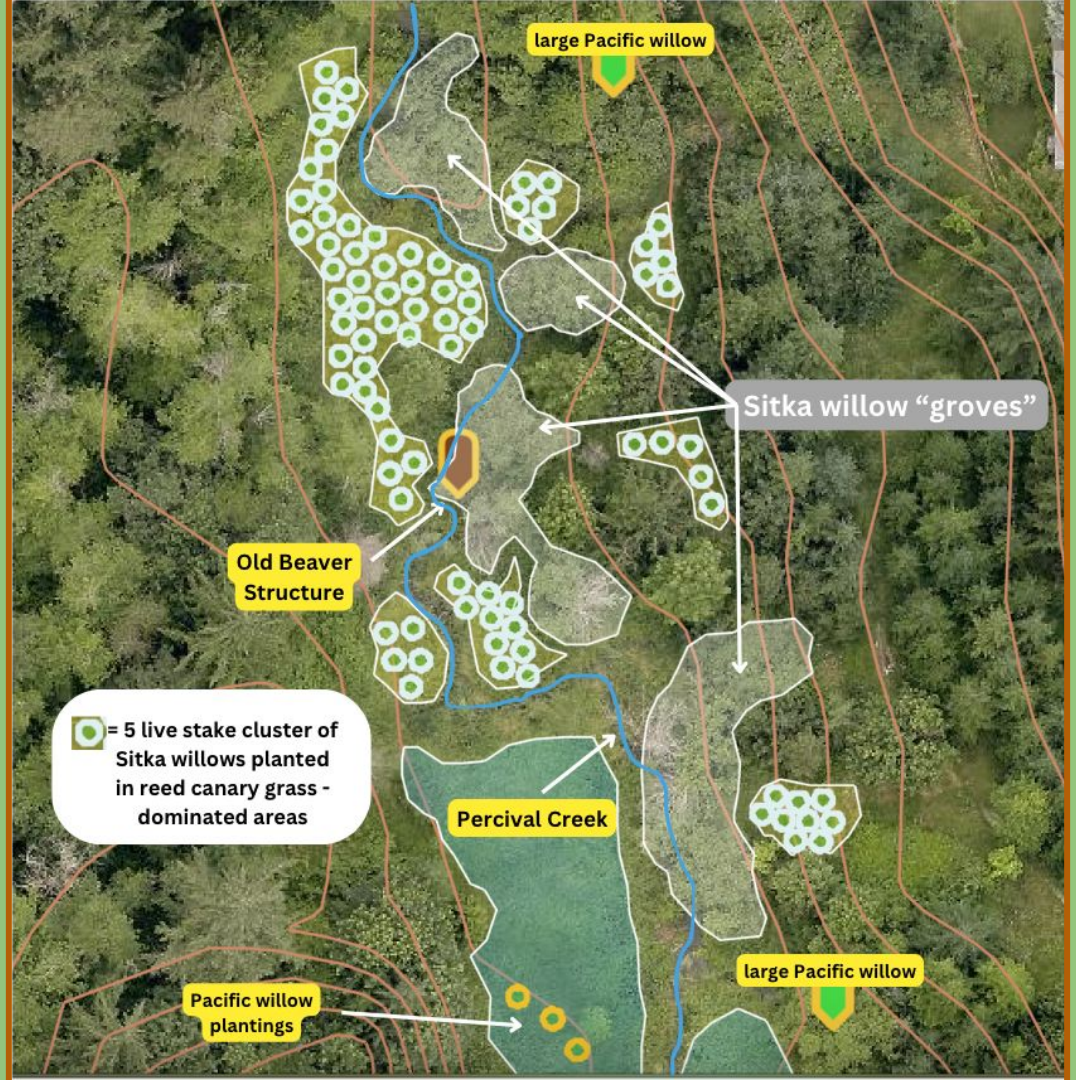
N

Percival Creek flow direction

Planting Plan: “Middle Section”



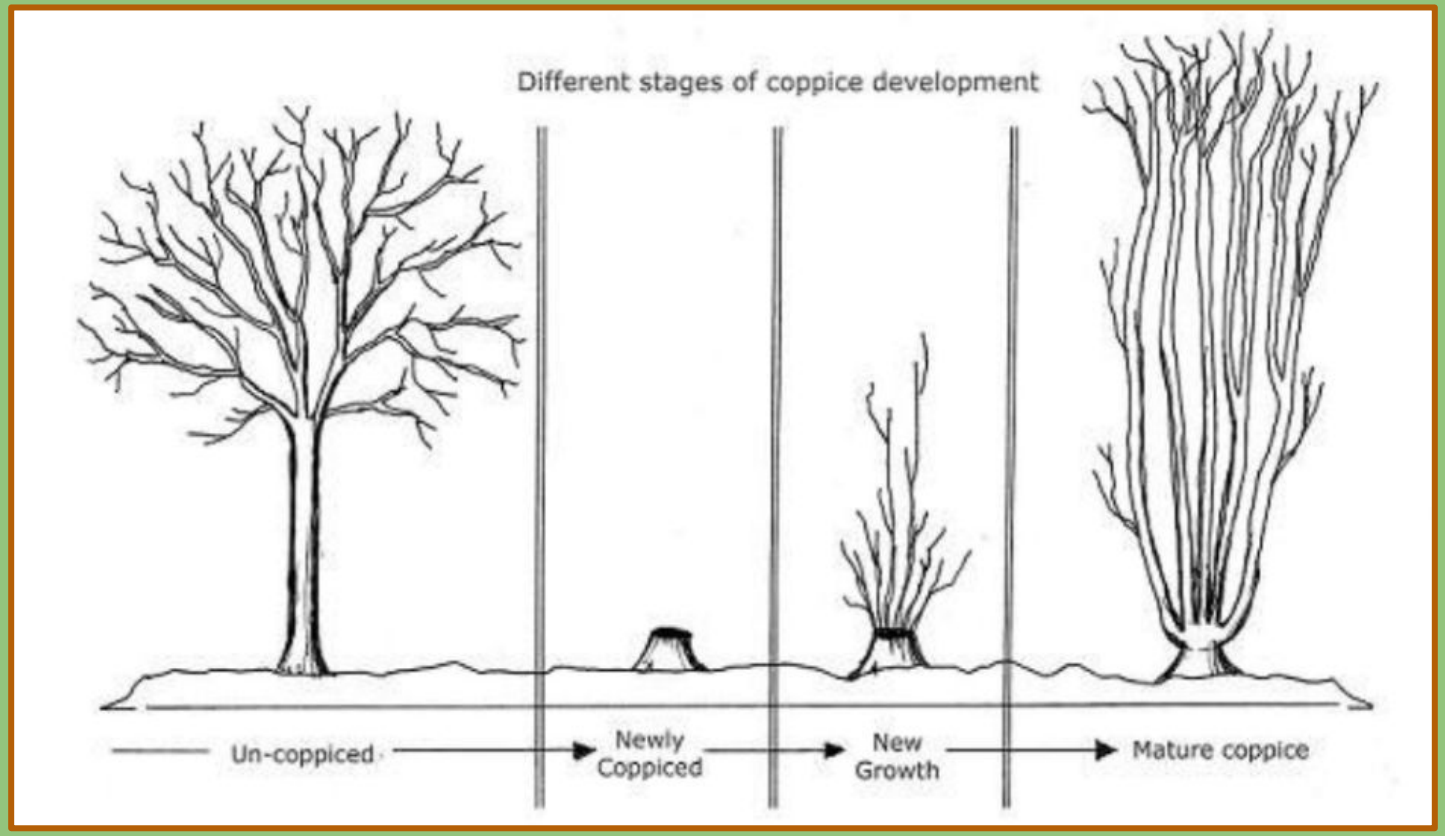
Planting Plan: "North Section"



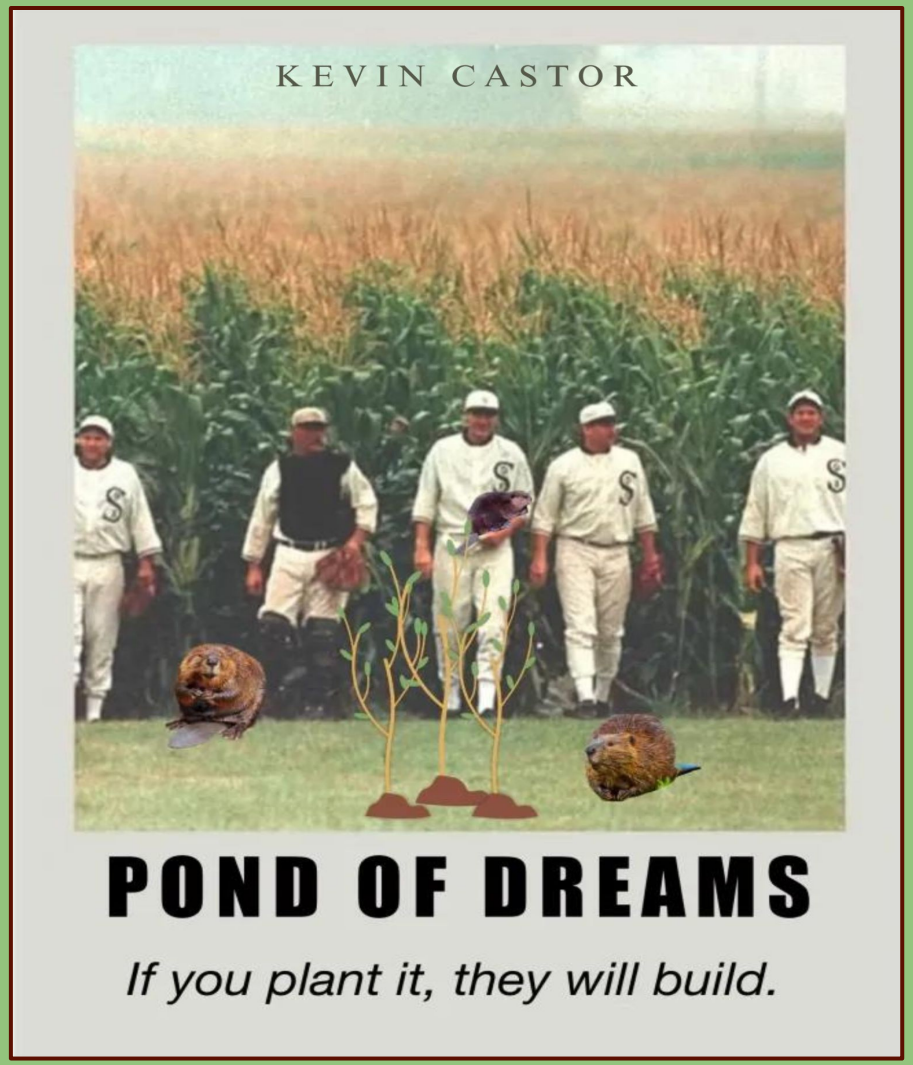
N

Percival Creek flow direction

Experimental Method: Beaver Mimicry in Plant Management - Coppicing Before Planting



Questions?



Feedback?