Stage Zero Restoration, Design, and Implementation

37th Annual Salmonid Restoration Conference

Stage Zero Restoration, Design and Implementation

April 25, 2019

1:30pm - 5:00pm

Session Coordinator:
Brian Cluer, NOAA Fisheries

Alluvial valleys historically supported well connected stream/floodplain systems that supported salmonids and other wildlife in robust and resilient ways. Land development and drainage schemes altered nearly every one of the former Stage 0 settings in the last century, collapsing habitat to minimums and making it unreliable. Restoring floodplain stream interaction in alluvial valleys has gained favor as an ecologically superior and perhaps necessary approach to salmonid recovery. This session is an opportunity for practitioners and scientists to present their floodplain research and restoration projects.

Stage Zero Restoration, Design and Implementation

The Range and Settings of Restored Depositional Valley Types to Stage 0 in the Pacific Northwest

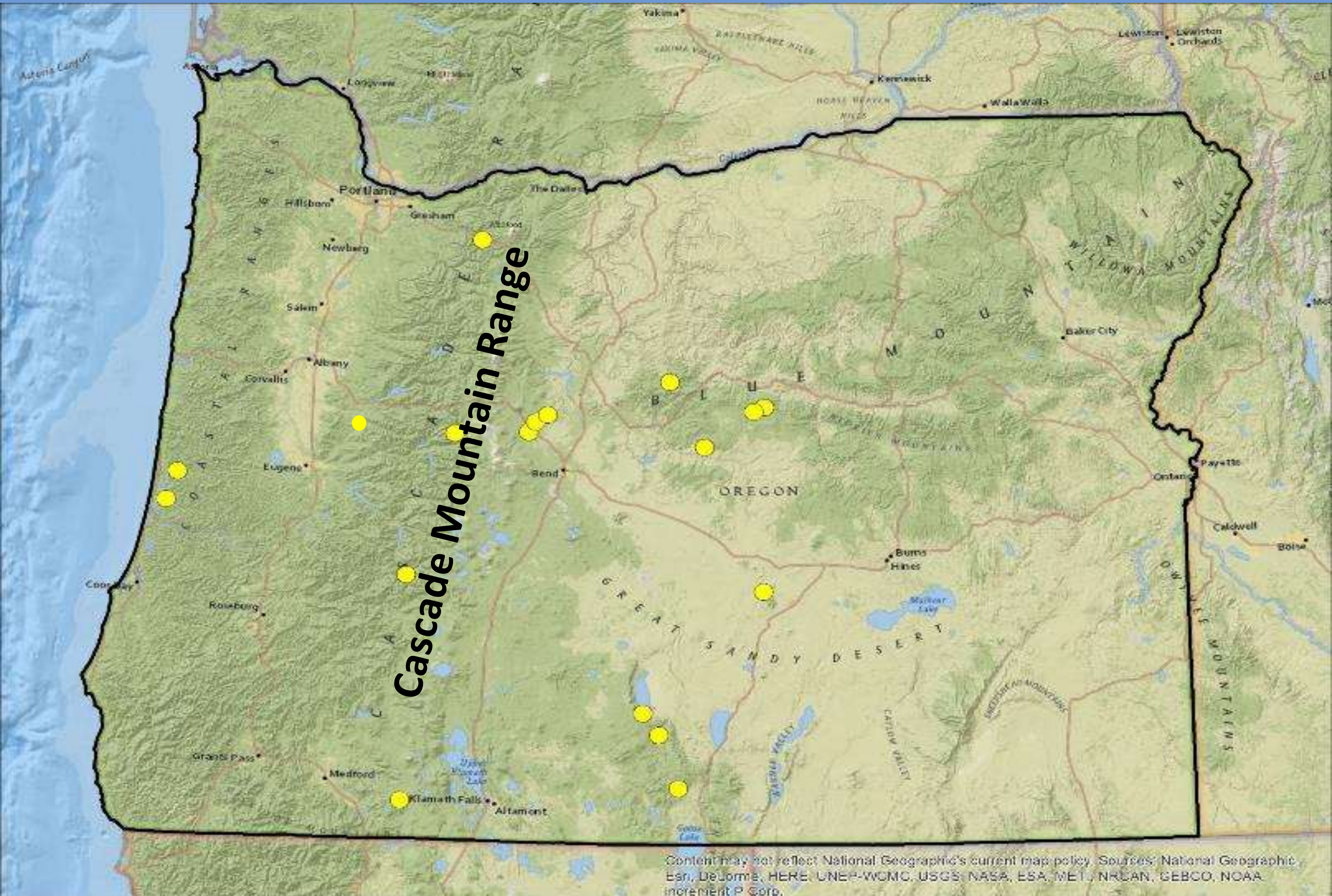
Paul Burns

Fisheries Biologist

Siuslaw National Forest

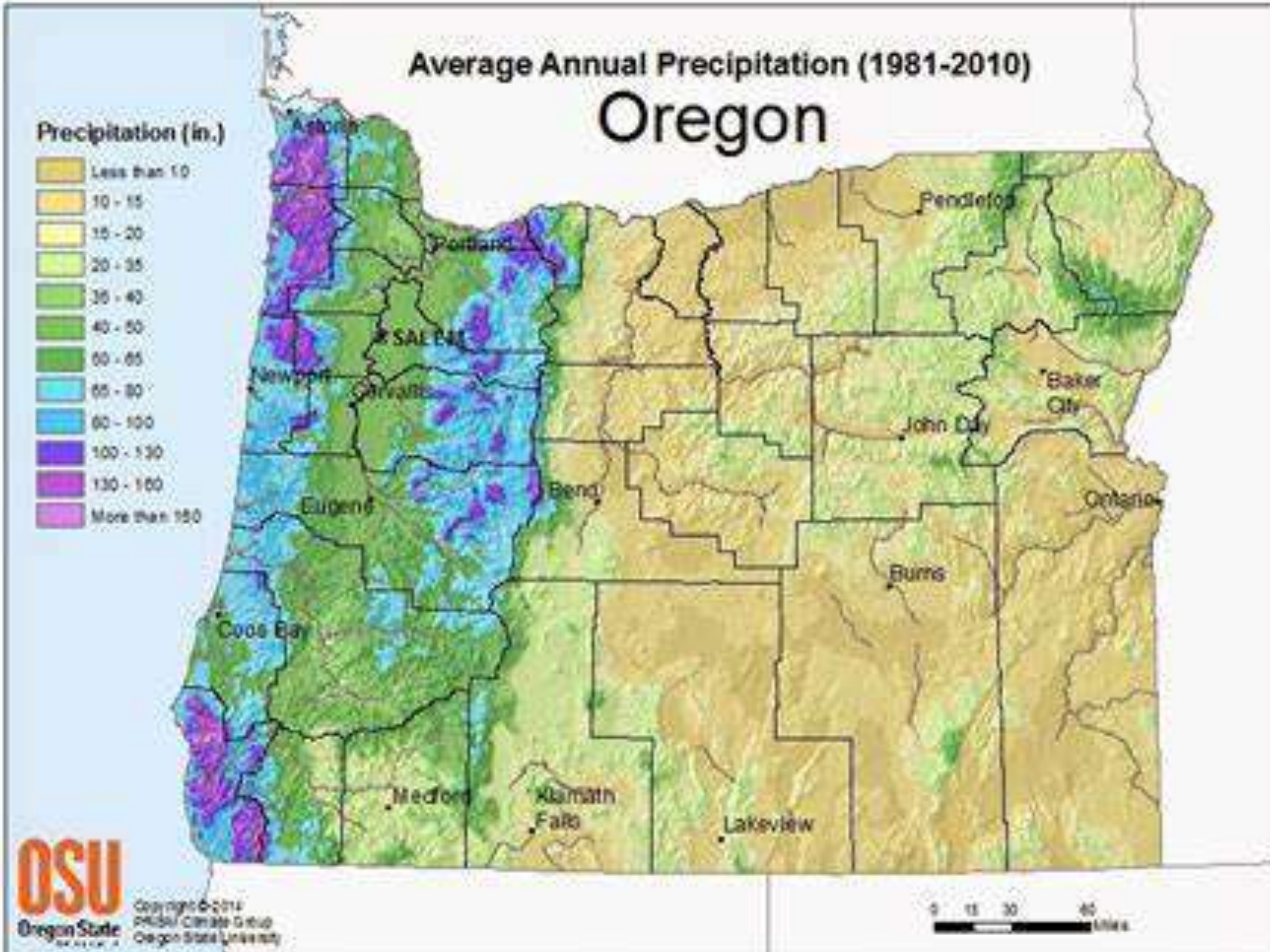
Reedsport, Oregon

Locations of Forest Service Stage 0 projects in Oregon 2012-18



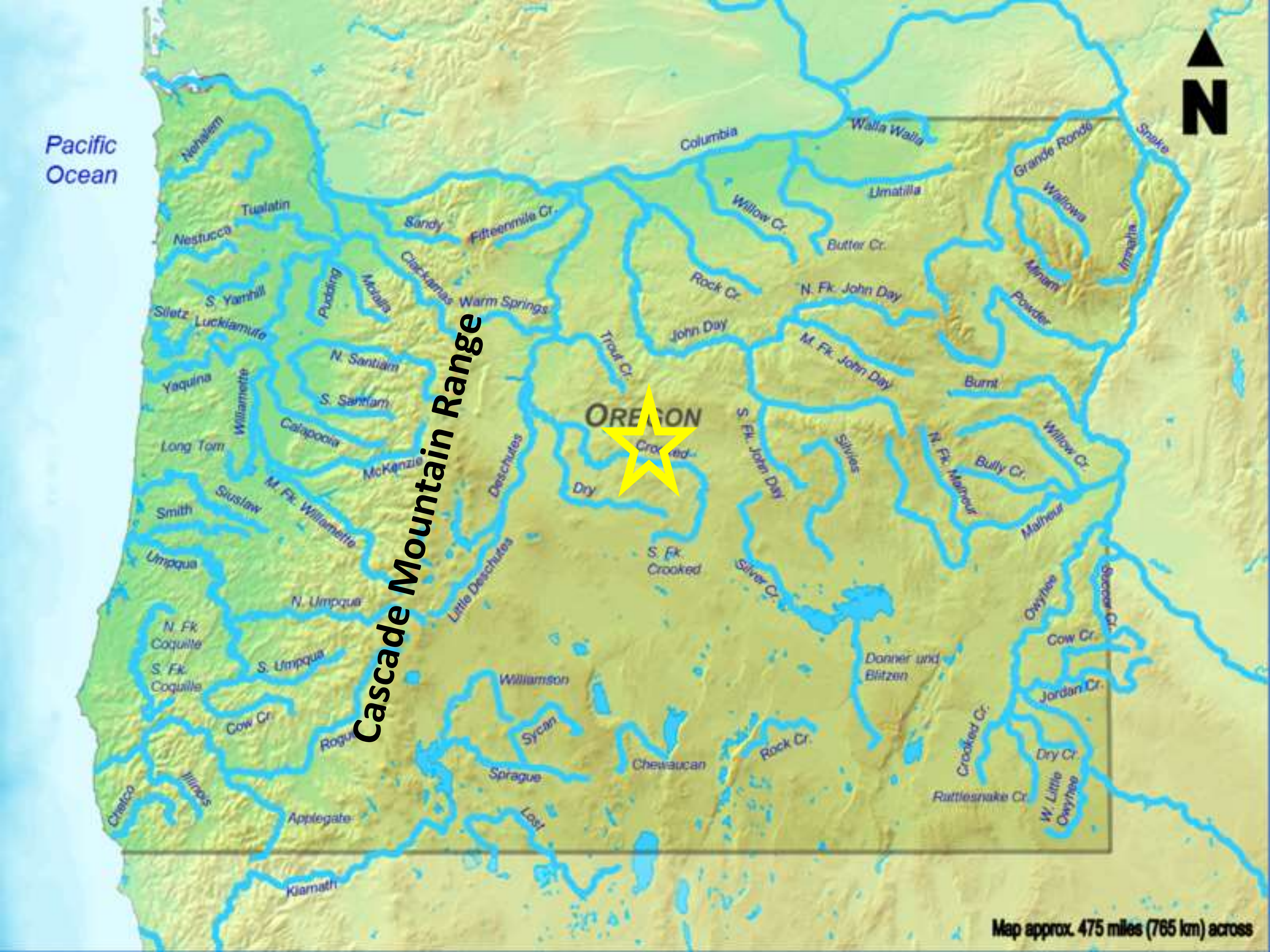
Geographic Variablility of Stage 0

- High Desert
- Montane meadows
- Cascades
- Coastal Plain


Average Annual Precipitation (1981-2010)
Oregon
Precipitation (in.)
Less than 10
10 - 15
15 - 20
40 - 50
100 - 130
130 - 160
Portland
SALEM
Newport
Eugene
Bend
Coos Bay
Medford
Klamath Falls
Lakeview
Burns
John Day
Baker City
Ontario
Pendleton
OSU
Oregon State

Oregon Stage 0 Annual Precipitation Range

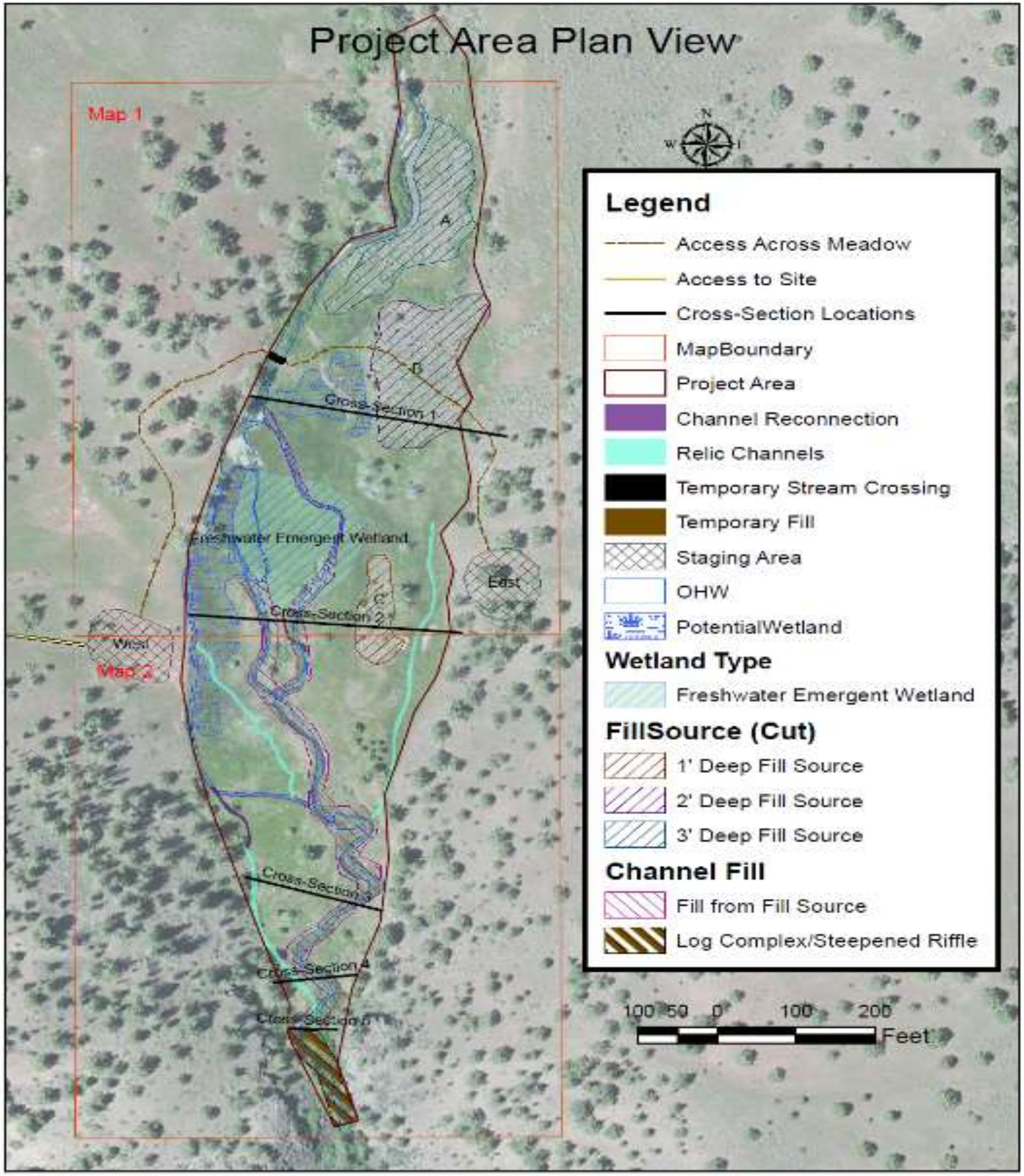
- Dry side
  - Prineville – 11 inches
  - Sisters – 14 inches
  - Klamath Falls – 28 inches
- Wet Side
  - Oakridge - 48 inches
  - McKenzie Bridge – 68 inches
  - Reedsport – Or Coast- 72 inches


Pacific Ocean
N
Nehalem
Tualatin
Nestucca
Sandy
Fifteenmile Cr.
Columbia
Walla Walla
Umatilla
Willow Cr.
Butter Cr.
Grande Ronde
Wallowa
Snake
Imnaha
Minam
Powder
Rock Cr.
N. Fk. John Day
John Day
Trout Cr.
Clackamas
Warm Springs
Pudding
Molalla
S. Yamhill
Siletz
Luckiamute
N. Santiam
S. Santiam
Yaquina
Willamette
Calapooia
Long Tom
McKenzie
Cascade Mountain Range
Deschutes
Dry
S. Fk. John Day
M. Fk. John Day
Burnt
Silvies
N. Fk. Malheur
Bully Cr.
Willow Cr.
Malheur
Siuslaw
M. Fk. Willamette
Smith
Umpqua
Little Deschutes
S. Fk. Crooked
Silver Cr.
Owyhee
Succor Cr.
N. Umpqua
N. Fk. Coquille
S. Fk. Coquille
S. Umpqua
Cow Cr.
Rogue
Williamson
Sycan
Donner und Blitzen
Cow Cr.
Jordan Cr.
Chewaucan
Rock Cr.
Crooked Cr.
Dry Cr.
Sprague
Lost
Rattlesnake Cr.
W. Little Owyhee
Chetco
Illinois
Applegate
Klamath
Map approx. 475 miles (765 km) across

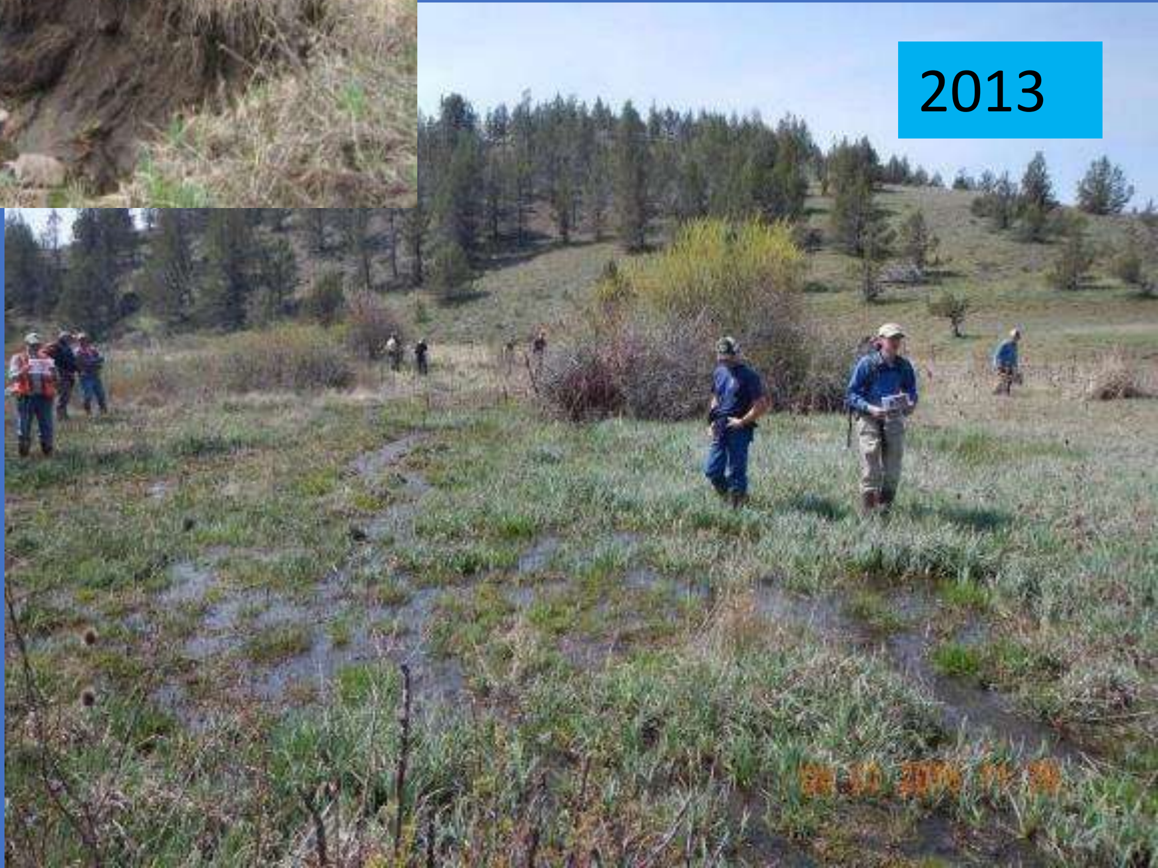
Pre-Construction Aerial View of Lost Creek Meadow Ochoco NF

Landscape

- Elevation – 4,000 ft
- Valley slope – 3 %
- Valley Width – 300 ft
- Acreage - 7
- Fill – 8,000 cyds
- Montane meadow w/ fine grain soils
- Bedrock control downstream end
- USFS ownership

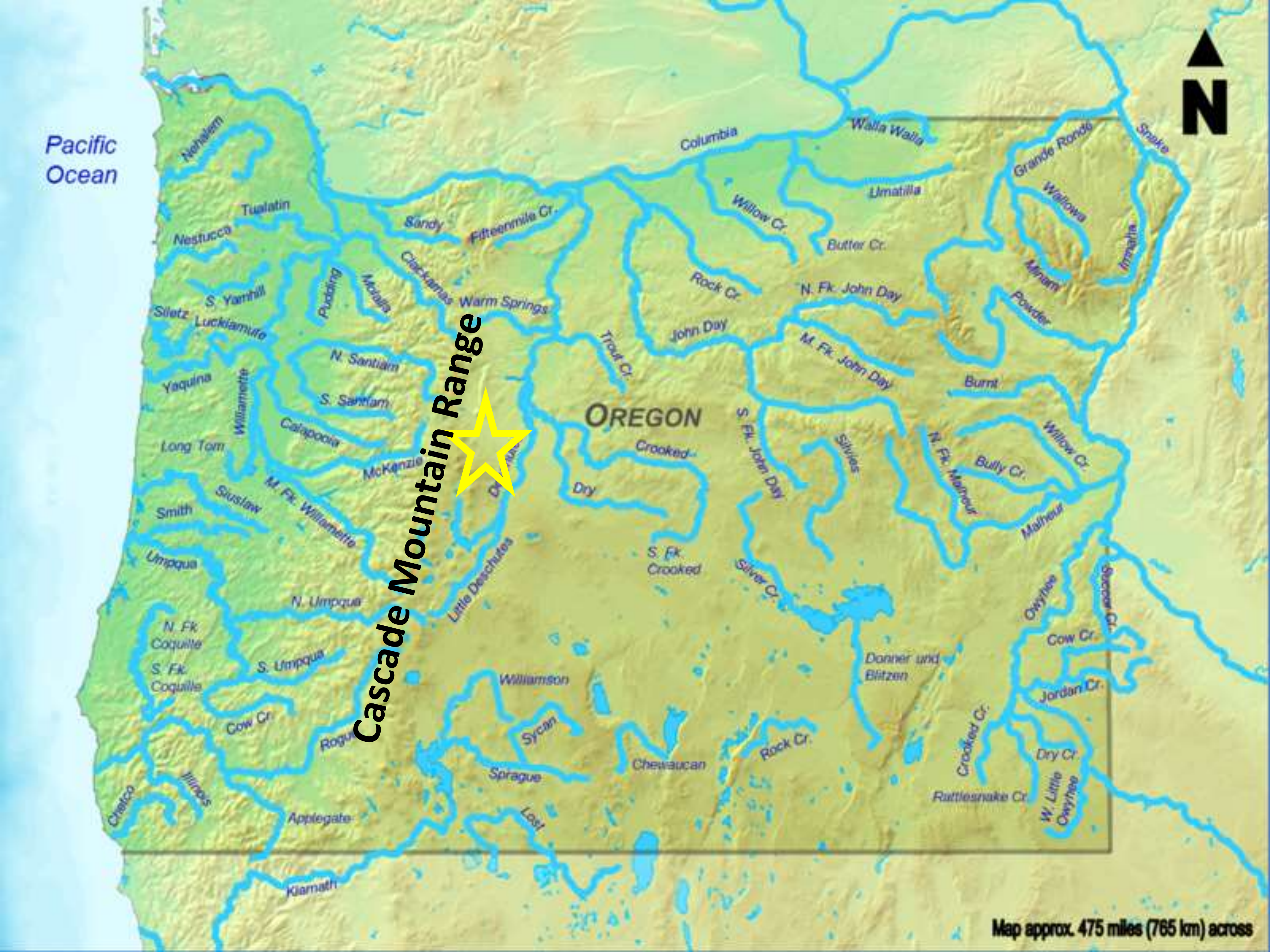



2012


2013

2014 post 2 years

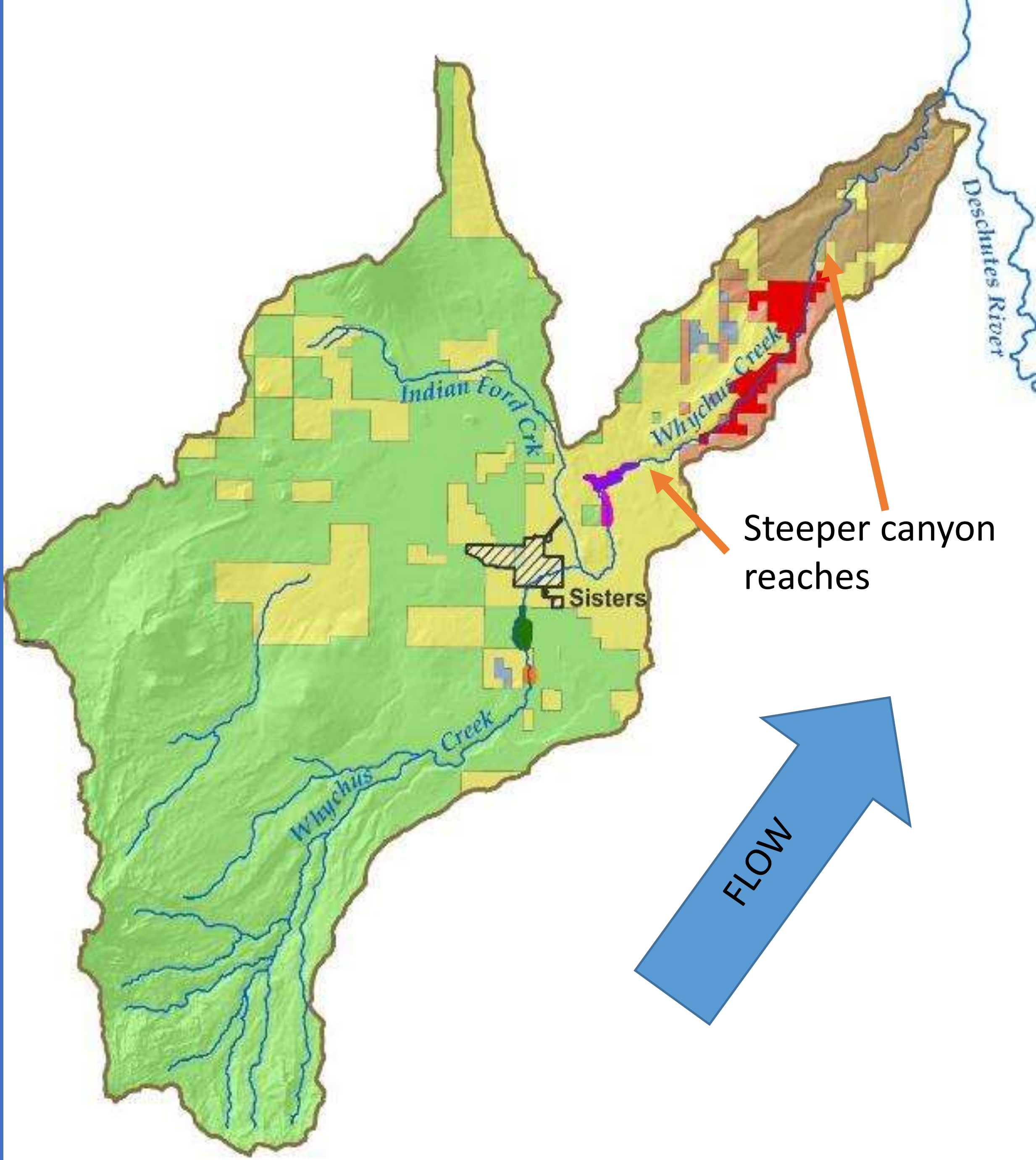

06 25 2014 10:41


Pacific
Ocean
N
Cascade Mountain Range
OREGON
Columbia
Walla Walla
Snake
Grande Ronde
Wallowa
Imnaha
Minam
Powder
Umatilla
Willow Cr.
Butter Cr.
Rock Cr.
N. Fk. John Day
John Day
M. Fk. John Day
Trout Cr.
Burnt
Willow Cr.
Bully Cr.
N. Fk. Malheur
Malheur
Silvies
S. Fk. John Day
Crooked
Dry
S. Fk. Crooked
Silver Cr.
Donner und Blitzen
Owyhee
Succor Cr.
Cow Cr.
Jordan Cr.
Crooked Cr.
Dry Cr.
Rattlesnake Cr.
W. Little Owyhee
Rock Cr.
Chewaucan
Williamson
Sycan
Sprague
Lost
Klamath
Applegate
Rogue
Illinois
Chetco
Cow Cr.
S. Umpqua
S. Fk. Coquille
N. Fk. Coquille
N. Umpqua
Umpqua
Smith
Siuslaw
M. Fk. Willamette
Little Deschutes
McKenzie
Long Tom
Calapooia
Willamette
Yaquina
S. Santiam
N. Santiam
Luckiamute
Siletz
S. Yamhill
Pudding
Molalla
Clackamas
Warm Springs
Sandy
Fifteenmile Cr.
Tualatin
Nestucca
Nehalem
Map approx. 475 miles (765 km) across

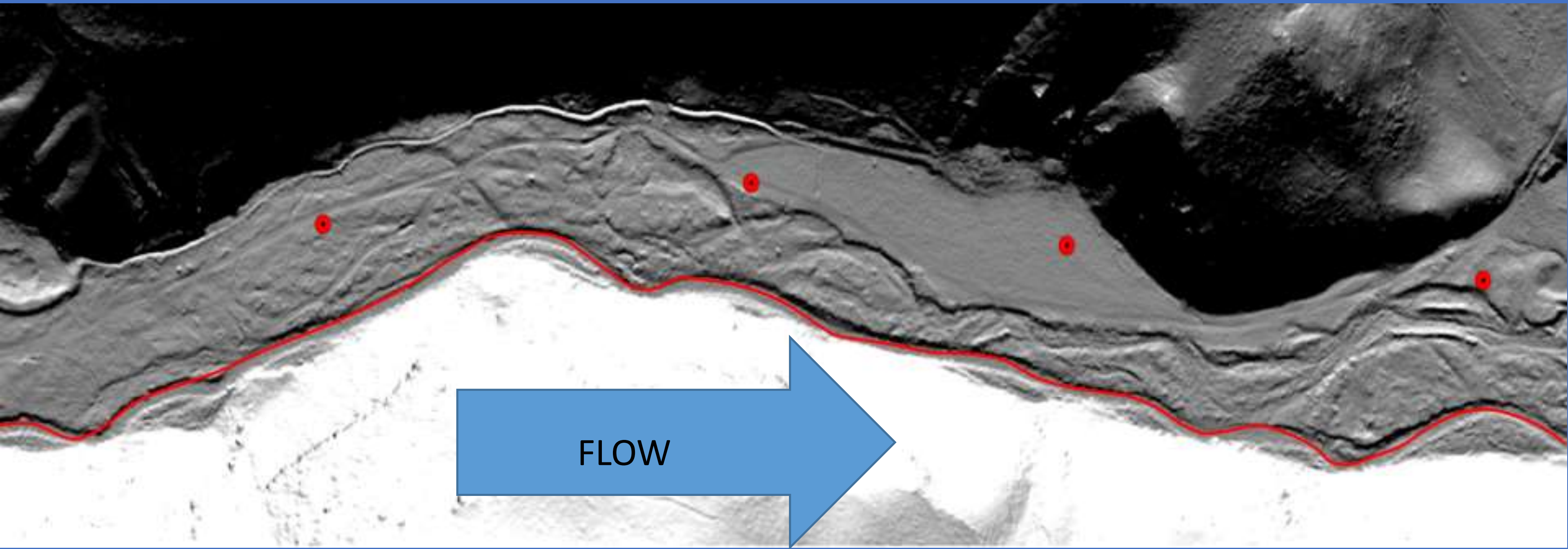
- **Camp Polk and Wychus Canyon**

Landscape

- Elevation – 2,800 ft
- Valley slope – 0.9 %
- Valley width – 800 and 350 ft
- Acreage - 200 and 125
- Fill – 45,000 cy yds each
- Mixed fines and gravelly soils
- Ponderosa Pine/Bitterbrush woodland
- Confined canyon control ds end
- Deschutes Land Trust



Whychus Canyon - 2015




FLOW


08 19 2014 12 12

Whychus Creek Oregon Pre and post

Monitoring metrics (at baseflow)

PHYSICAL

Channel morphology

- Number of channels
- Channel elevation
- Total channel length
- Ratio of primary : secondary
- Total wetted area

Groundwater

- Depth

Stream temperature

- July rate of change

Geomorphic units / habitat

- Total number of units
- Number of types of units
- Percent riffle
- Percent pool
- Pool number, types, area, dimensions
- Pieces of wood
- Substrate sizes, proportions

BIOLOGICAL

Riparian and wetland vegetation

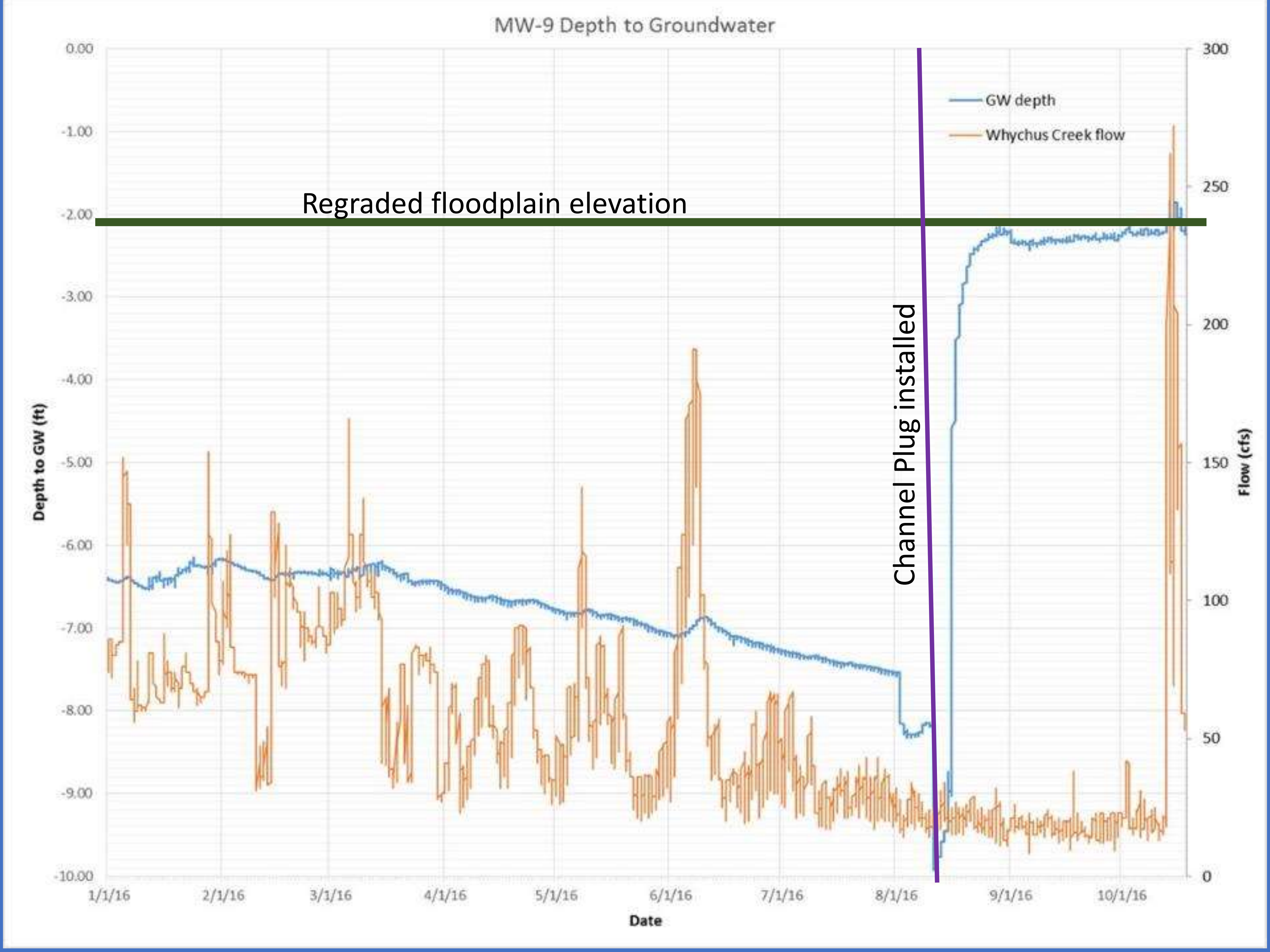
- Area
- Species richness and type

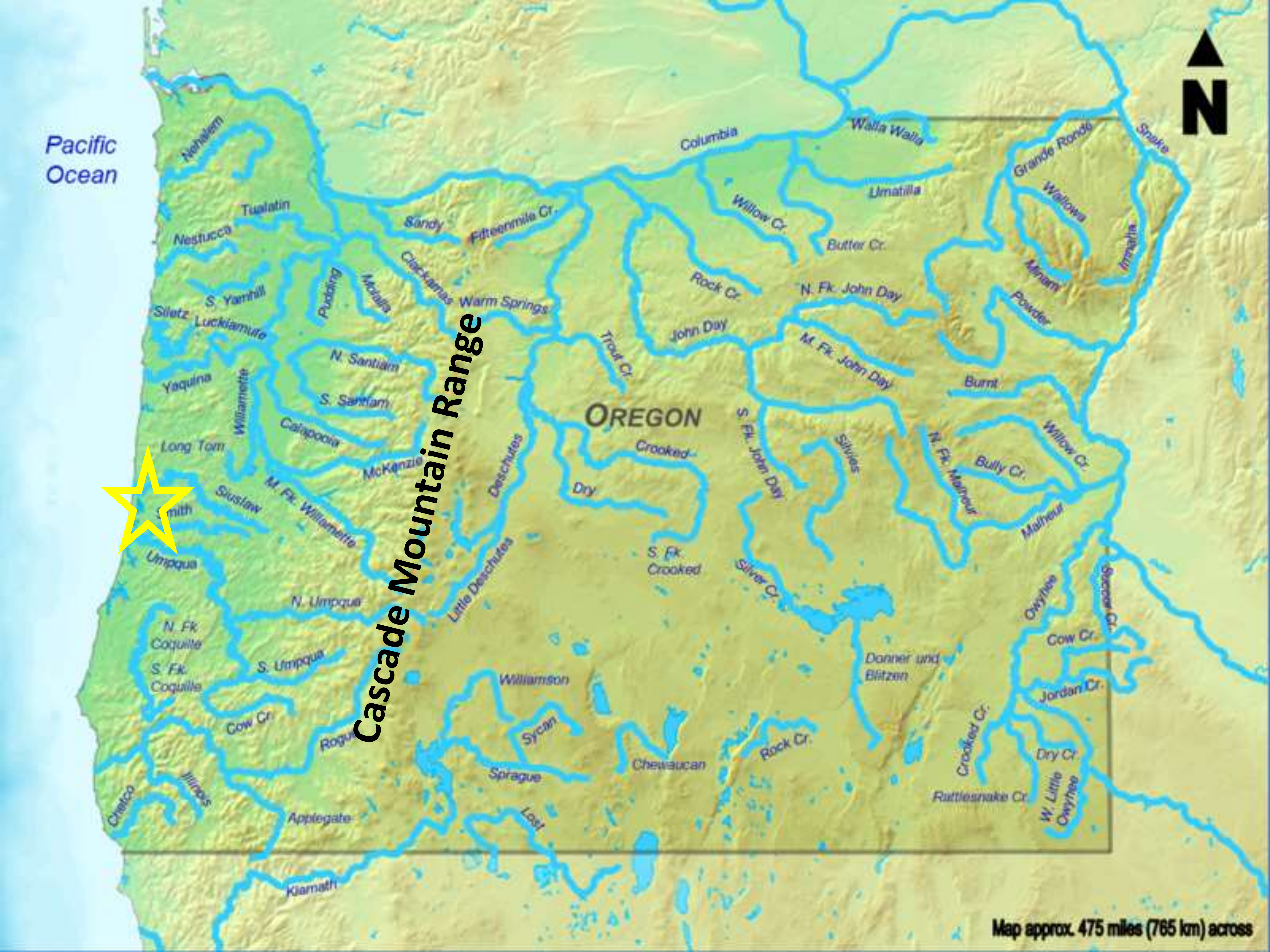
Primary production

- Algae and diatom species richness and abundance

Secondary production

- Macroinvertebrate taxa richness and abundance
- Fish density
- Fish growth rate and condition

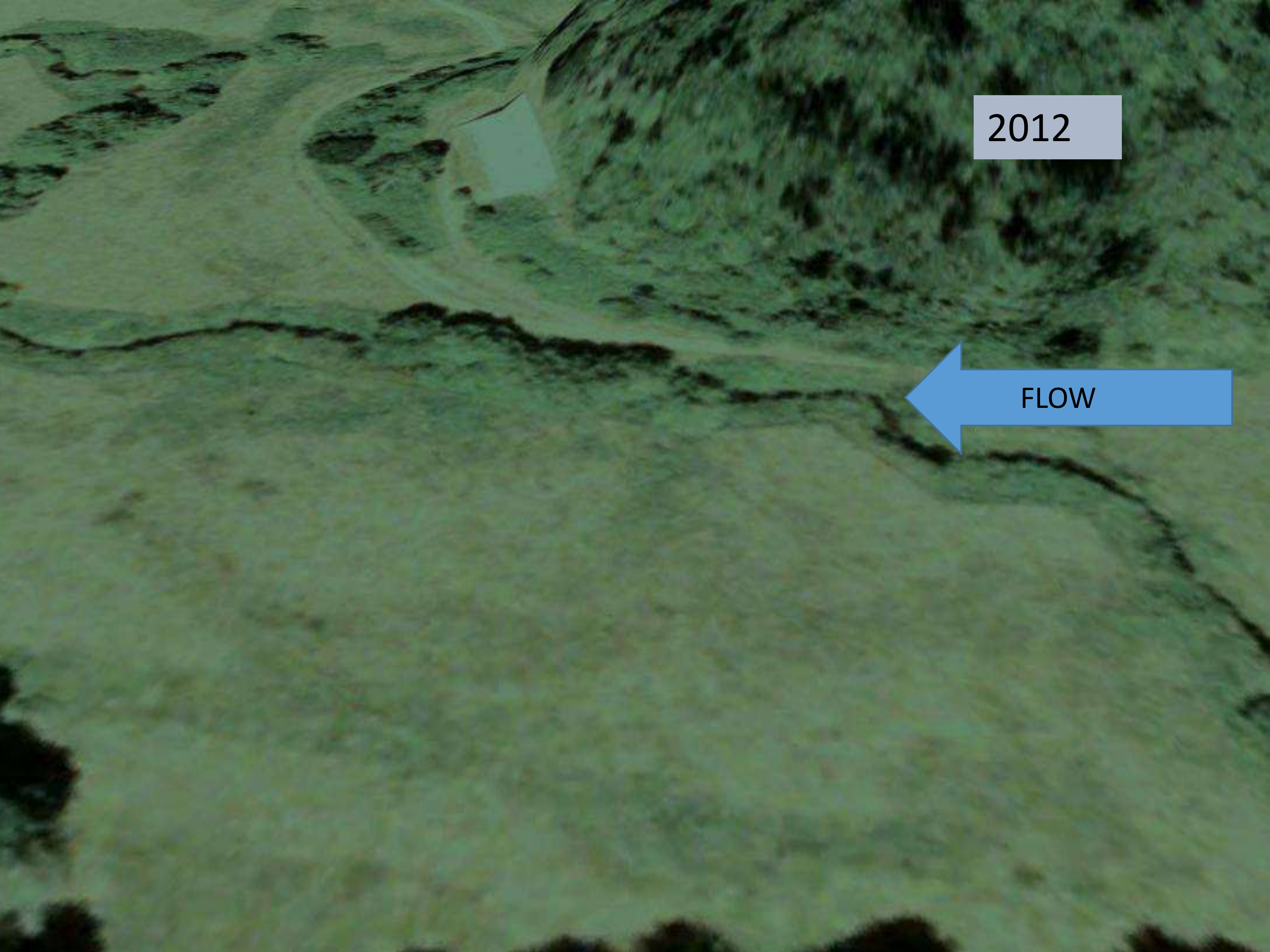

MW-9 Depth to Groundwater
GW depth
Whychus Creek flow
Regraded floodplain elevation
Channel Plug installed
Depth to GW (ft)
Flow (cfs)
Date
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00
-9.00
-10.00
300
250
200
150
100
50
0
1/1/16
2/1/16
3/1/16
4/1/16
5/1/16
6/1/16
7/1/16
8/1/16
9/1/16
10/1/16


Pacific Ocean
OREGON
Cascade Mountain Range
N
Columbia
Walla Walla
Snake
Grande Ronde
Wallowa
Umatilla
Willow Cr.
Butter Cr.
Imnaha
Minam
Powder
Nehalem
Tualatin
Nestucca
Sandy
Fifteenmile Cr.
Clackamas
Warm Springs
Rock Cr.
N. Fk. John Day
John Day
M. Fk. John Day
S. Yamhill
Siletz
Luckiamute
Pudding
Molalla
N. Santiam
S. Santiam
Yaquina
Willamette
Calapooia
Trout Cr.
Burnt
Long Tom
McKenzie
Deschutes
Crooked
S. Fk. John Day
Silvies
N. Fk. Malheur
Willow Cr.
Bully Cr.
Siuslaw
M. Fk. Willamette
Dry
Malheur
Umpqua
S. Fk. Crooked
Silver Cr.
Little Deschutes
Owyhee
Succor Cr.
N. Umpqua
N. Fk. Coquille
S. Fk. Coquille
S. Umpqua
Cow Cr.
Donner und Blitzen
Williamson
Jordan Cr.
Rogue
Sycan
Rock Cr.
Chewaucan
Crooked Cr.
Dry Cr.
Sprague
Illinois
Chetco
Applegate
Lost
Rattlesnake Cr.
W. Little Owyhee
Klamath
Map approx. 475 miles (765 km) across

Fivemile Bell Floodplain Restoration Project, 2012-Present

Landscape

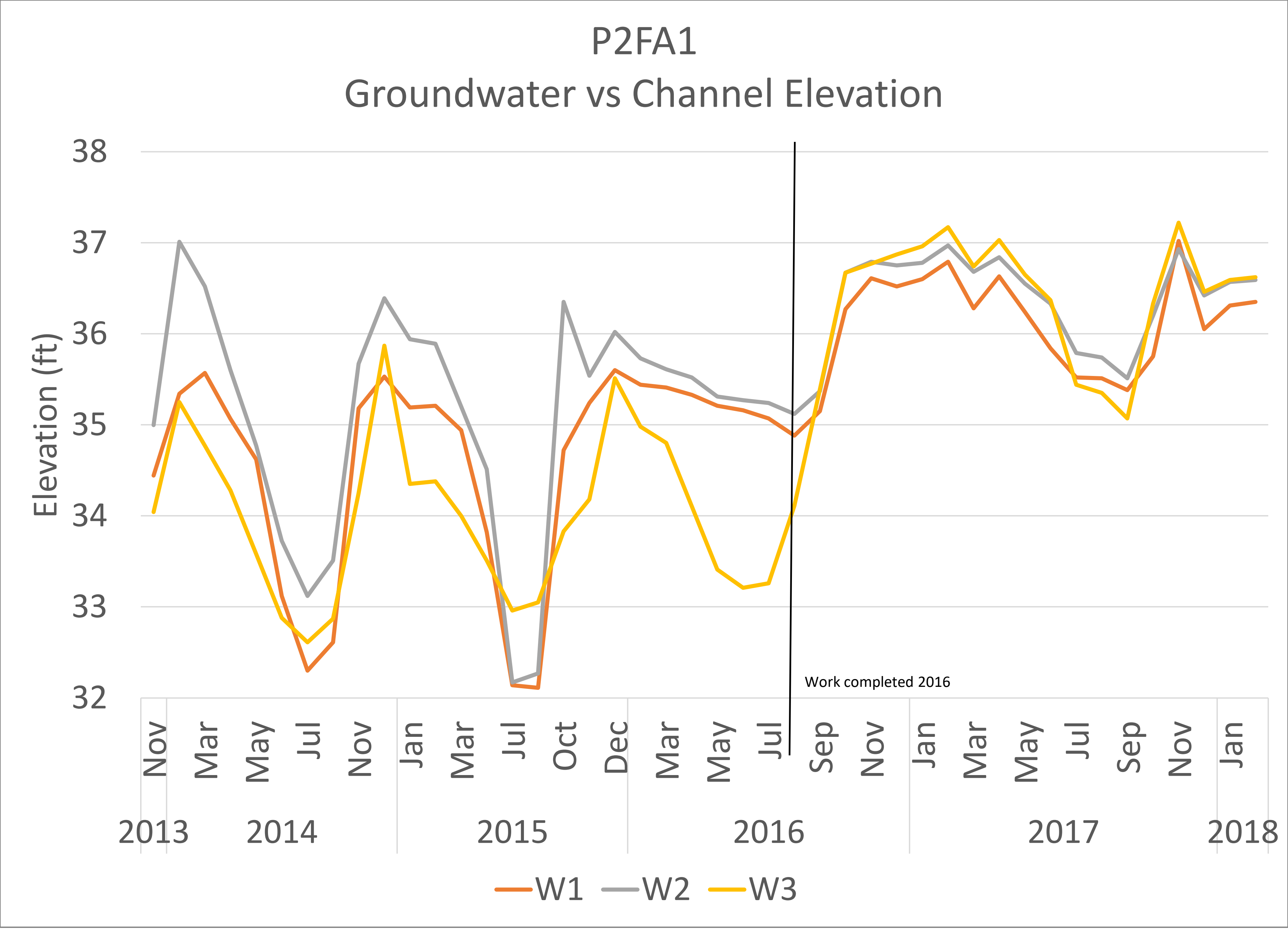
- Elevation – 32 ft
- Valley slope – 0.1 %
- Valley Width - 300 ft
- Acreage - 115
- Fill – 135,000 cy yds
- 98% non-native vegetation pre-project
- Native Plant community restoration
- Sandy Soils
- Coastal Wetland, Unconfined valley
- Lake provides gradient control
- USFS Ownership


2012
FLOW

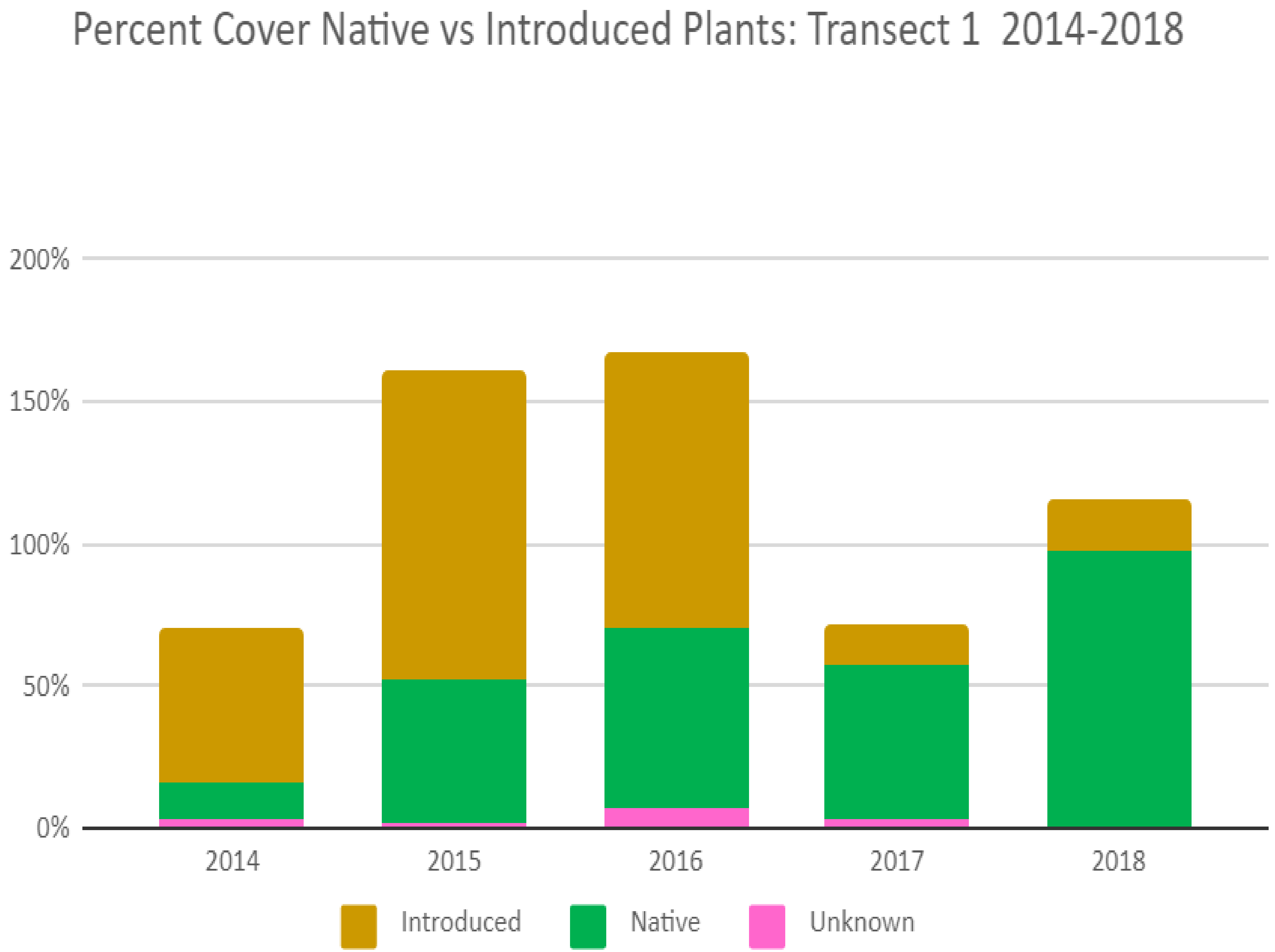

© 2016 Google

2017 1 year post regrade

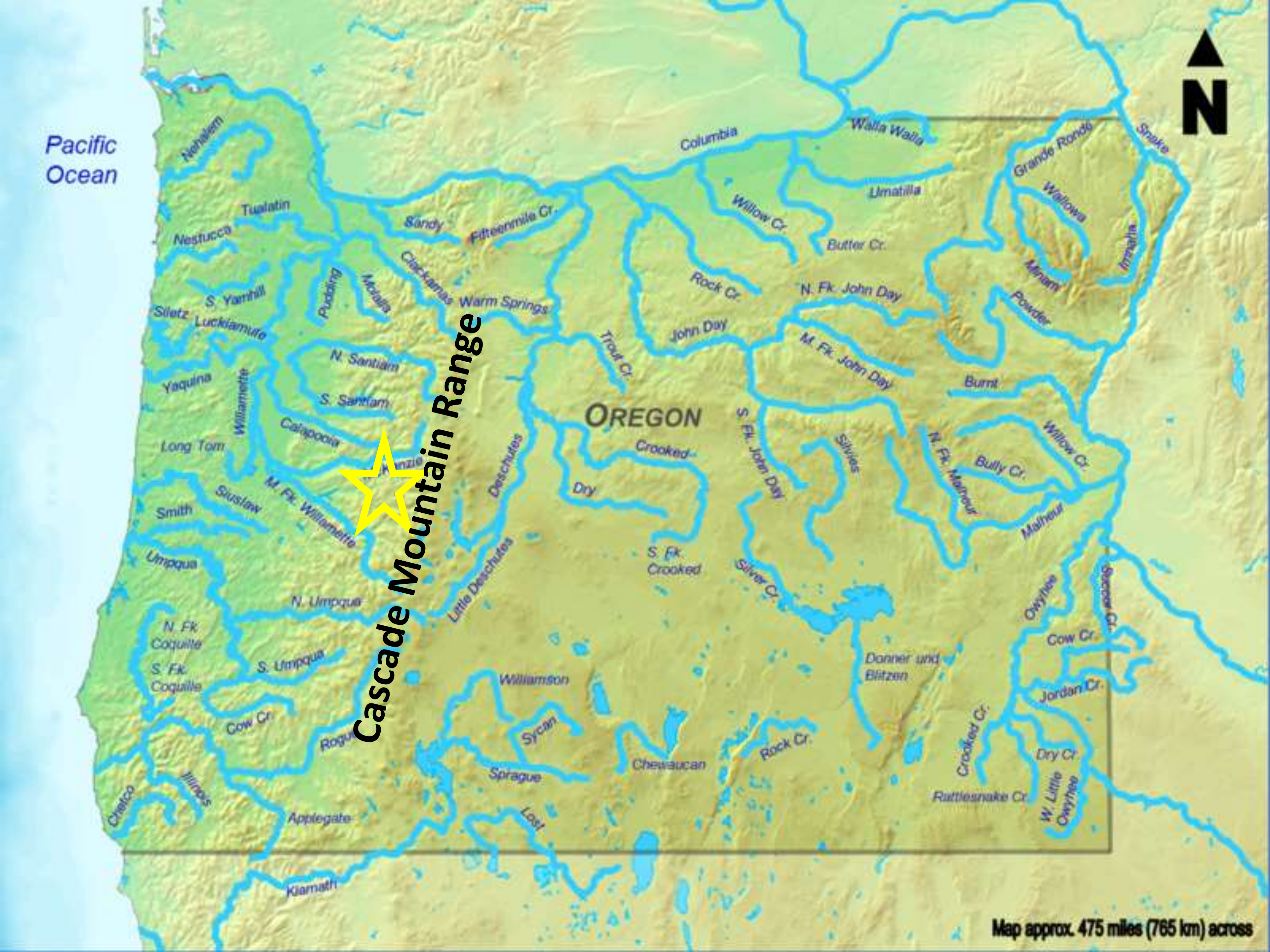

July 2013



P2FA1
Groundwater vs Channel Elevation
Elevation (ft)
38
37
36
35
34
33
32
Work completed 2016
Nov
Mar
May
Jul
Nov
Jan
Mar
Jul
Oct
Dec
Mar
May
Jul
Sep
Nov
Jan
Mar
May
Jul
Sep
Nov
Jan
2013
2014
2015
2016
2017
2018
W1
W2
W3


Percent Cover Native vs Introduced Plants: Transect 1 2014-2018
200%
150%
100%
50%
0%
2014
2015
2016
2017
2018
Introduced
Native
Unknown


Transect 1 Quad 3 2015
2018
Transect 1 Quad 1B 2015
2018


N
Pacific Ocean
Nehalem
Tualatin
Nestucca
S. Yamhill
Siletz
Luckiamute
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Bully Cr.
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Malheur
Owyhee
Succor Cr.
Cow Cr.
Jordan Cr.
Crooked Cr.
Dry Cr.
Rattlesnake Cr.
W. Little Owyhee
Map approx. 475 miles (765 km) across

Willamette NF Stage 0’s

- Deer Creek
- Staley Creek
- South Fork McKenzie River

- **Deer cr**

Landscape

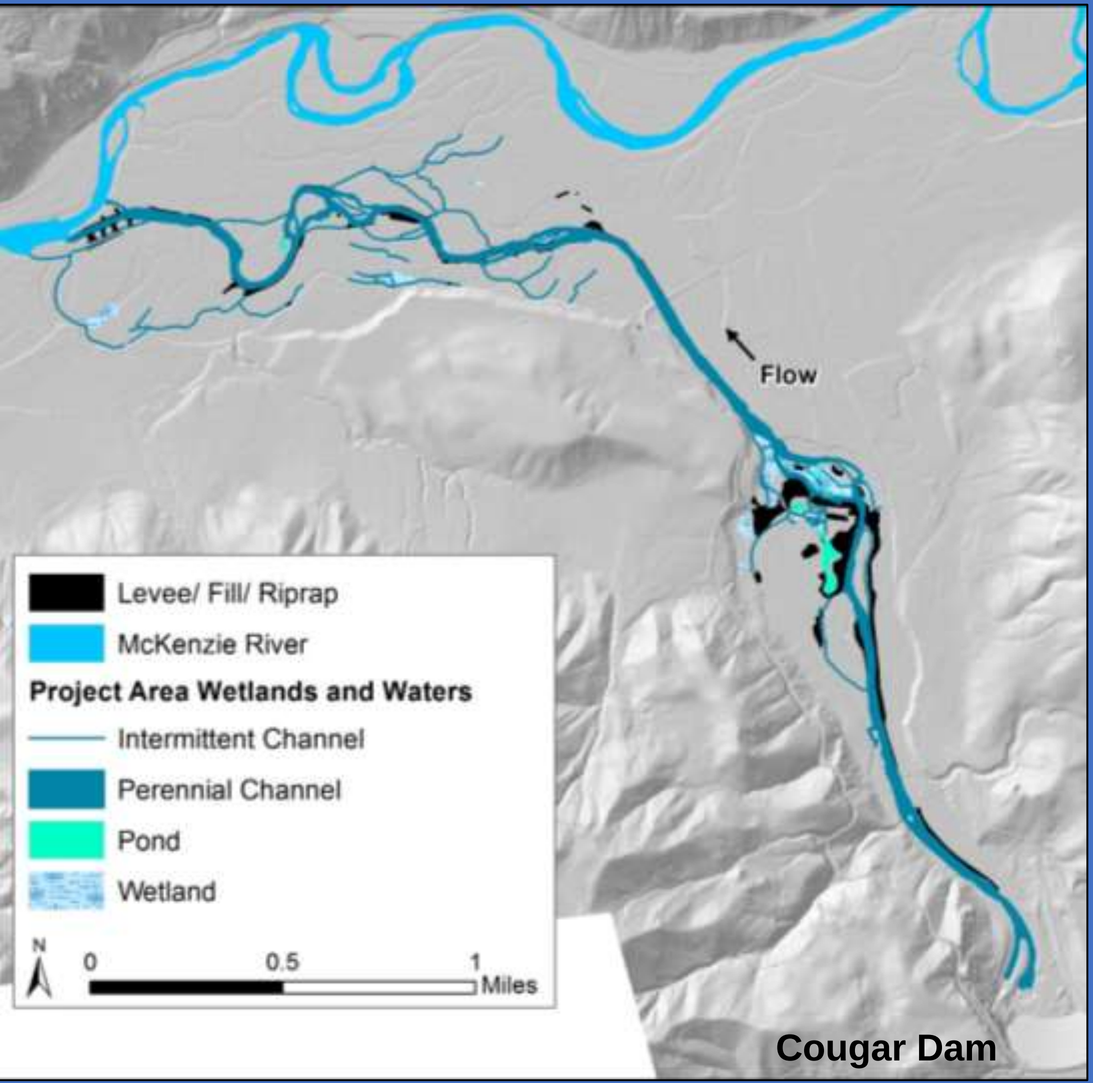
- Elevation – 1,900 ft
- Valley slope – 1.8%
- Valley Width – 300 ft
- Acreage - 35
- Fill – 20,000 cyds
- West Cascades
- McKenzie River Confluence grade control and higher gradient transport reach
- USFS Ownership

- **South Fork McKenzie (Phase I)**

Landscape

- Elevation – 1,100 ft
- Valley slope – 1%
- Valley width – 1,500 ft
- Acreage - 150 with 12 acres of cut
- Fill – 90,000 cyds
- West Cascades
- McKenzie River Confluence grade control
- Cougar Dam 3 mi upstream
- USFS Ownership

Pre-project Conditions



- **Cougar Dam (RM 4.2)**
  - Cut off wood, sediment, nutrient supply
  - Altered flow, temperature regime
- **Levees/riprap/fill**
  - Straightened and channelized river
  - Disconnected floodplain and side channels up to 14 ft
- **Stream cleaning/logging**
  - Removed wood and left legacy roads, berms, ditches


2016 PRE-PROJECT
FLOW
2018 POST-PROJECT

Base Flow Wetted Area

BEFORE, dewatered

AFTER, 330 cfs

Newly Wetted Floodplain Channels

1,350 cfs December 2018

1,350 cfs December 2018

3200 cfs

3200 cfs

3200 cfs

Summary

- Widespread Distribution of successful stage 0 projects
- Gradients 0.1 – 6%
- High precipitation to low precipitation areas
- Works at all elevations
- Restricted to Depositional or response areas but areas can be a few acres to several hundred acres
- Multi-phase adaptive projects can be accomplished
- Remember that not all sections of stream function the same
- 2-5 yr return interval flooding is not Stage 0

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DOI: 10.1002/rra.3378

RESEARCH ARTICLE

WILEY

A process-based approach to restoring depositional river valleys to Stage 0, an anastomosing channel network

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[2]United States Forest Service, Willamette National Forest, Middle Fork Ranger District, Westfir, Oregon

[3]Department of Civil Engineering, Gonzaga University, Spokane, Washington

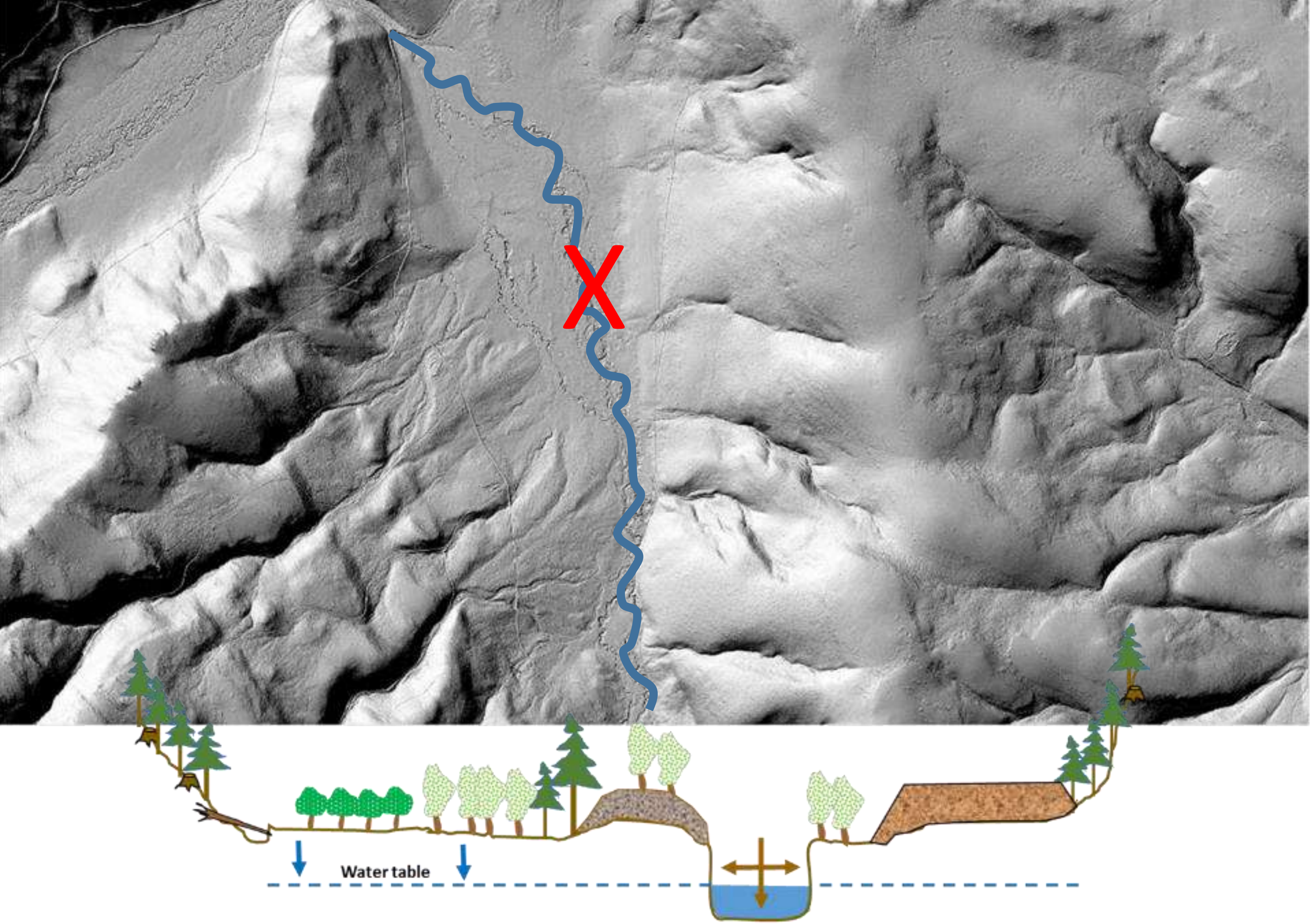
Correspondence

Paul D. Powers, District Fisheries Biologist, United States Forest Service, Deschutes National Forest, Crescent Ranger District, Crescent, OR.

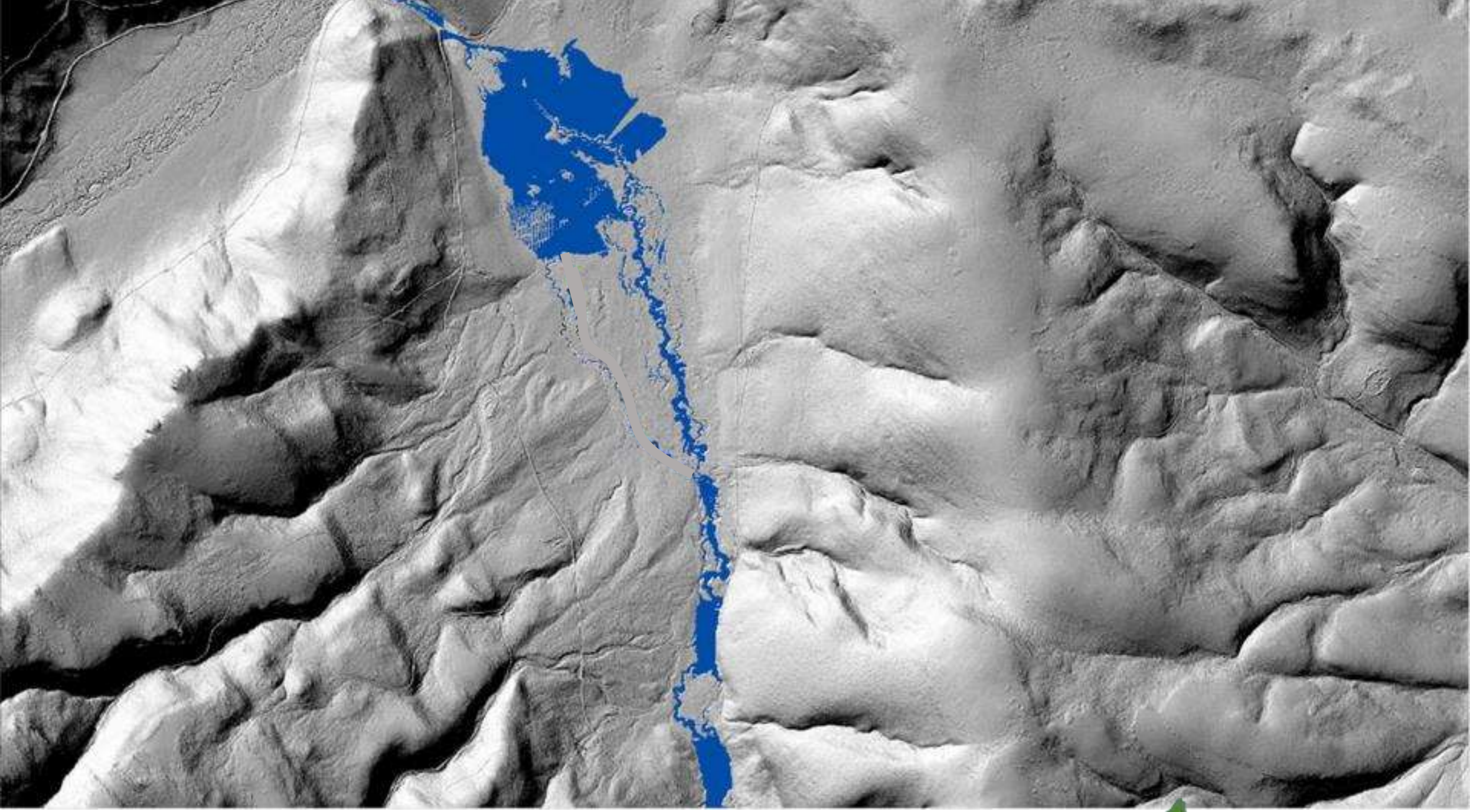
Email: ppowers@fs.fed.us

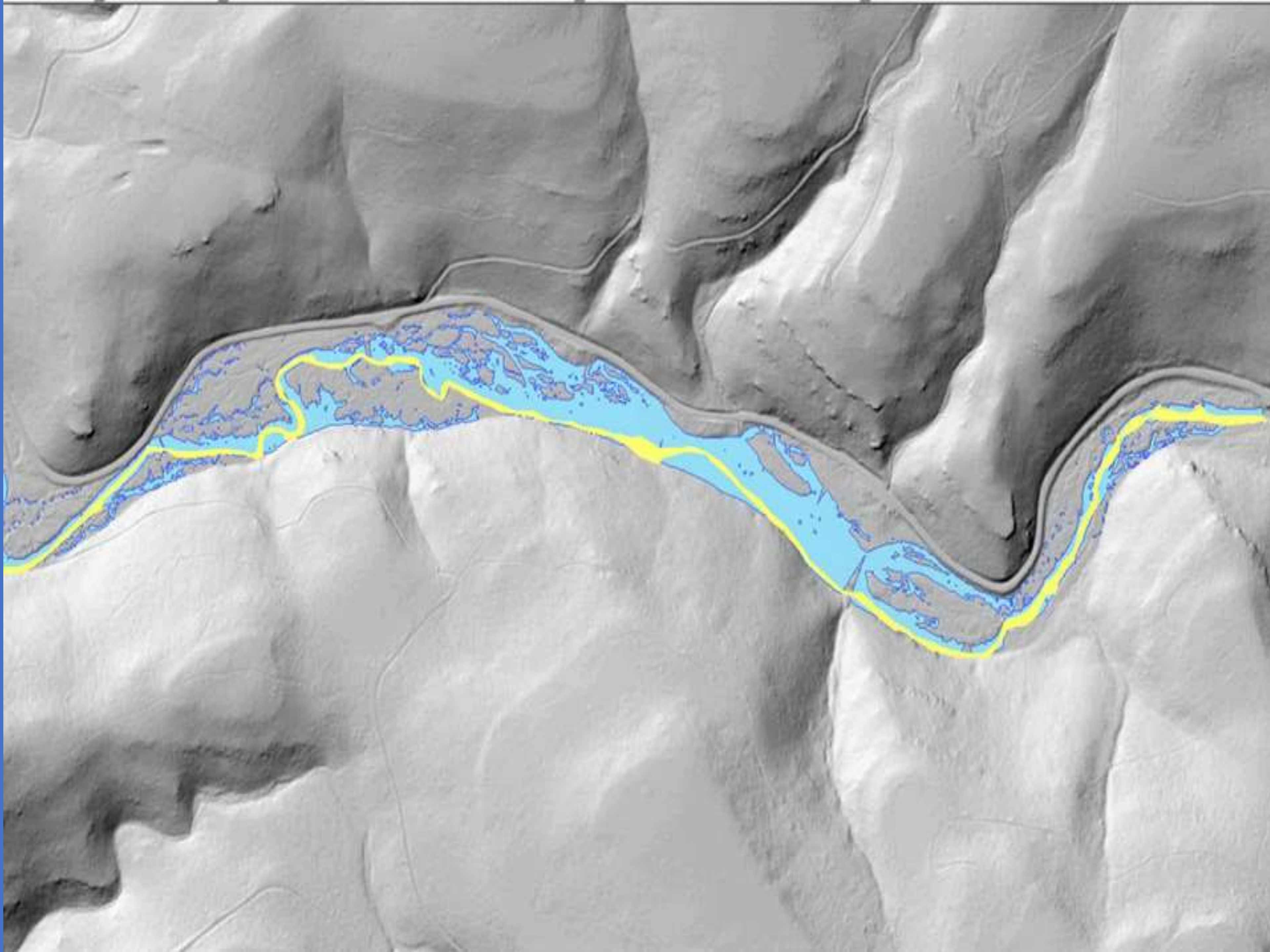
Abstract

Stream restoration approaches most often quantify habitat degradation, and therefore recovery objectives, on aquatic habitat metrics based on a narrow range of species needs (e.g., salmon and trout), as well as channel evolution models and channel design tools biased toward single-threaded, and "sediment-balanced" channel patterns. Although this strategy enhances perceived habitat needs, it often fails to properly identify the underlying geomorphological and ecological processes limiting species recovery and ecosystem restoration. In this paper, a unique process-based approach to restoration that strives to restore degraded stream, river, or meadow systems to the premanipulated condition is presented. The proposed relatively simple



Stream Evolution Model, Stages 2-5
Cluer and Thorne, 2013



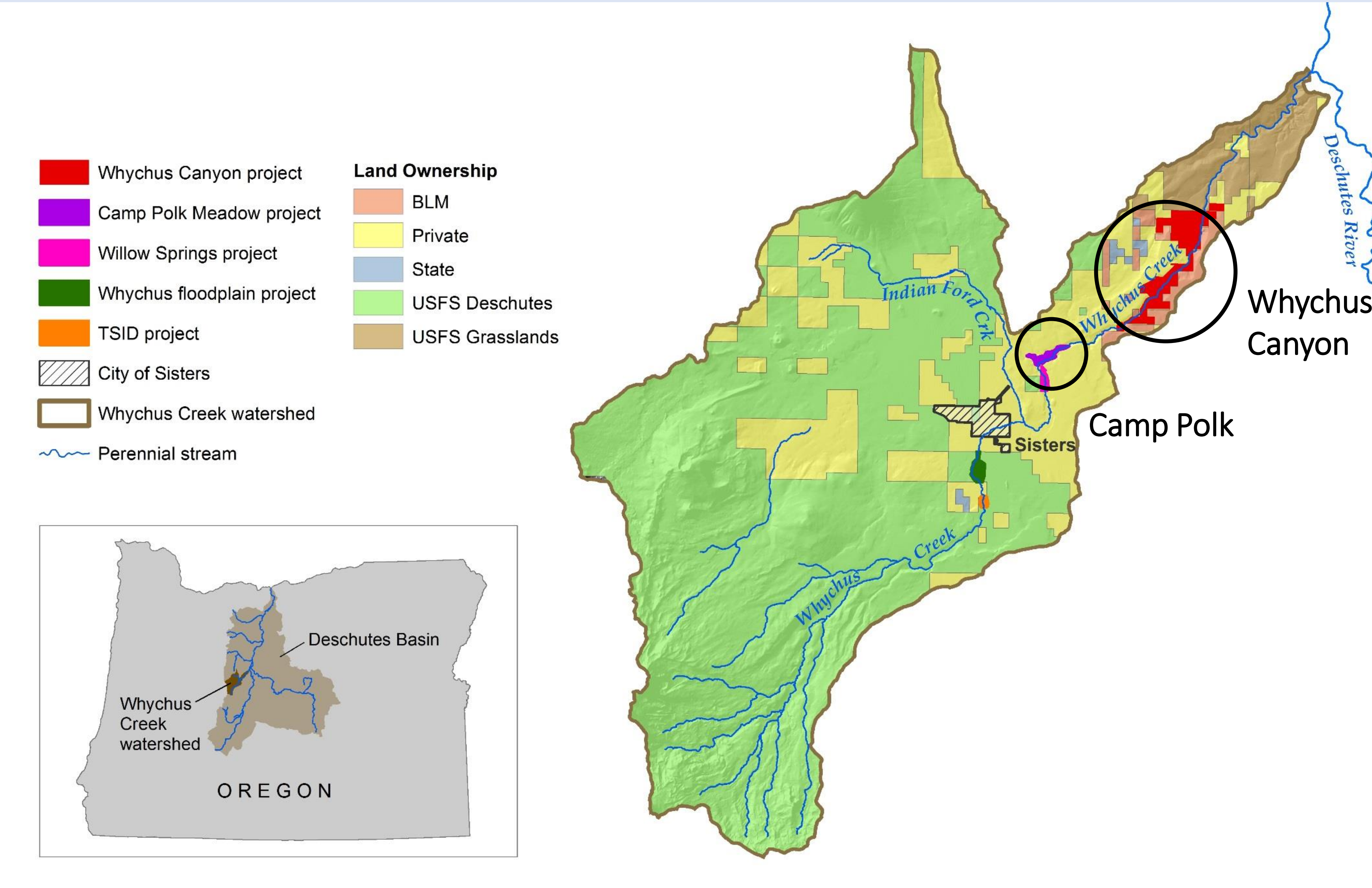


Aquatic Organism Relocation 2016-18 Fivemile Project

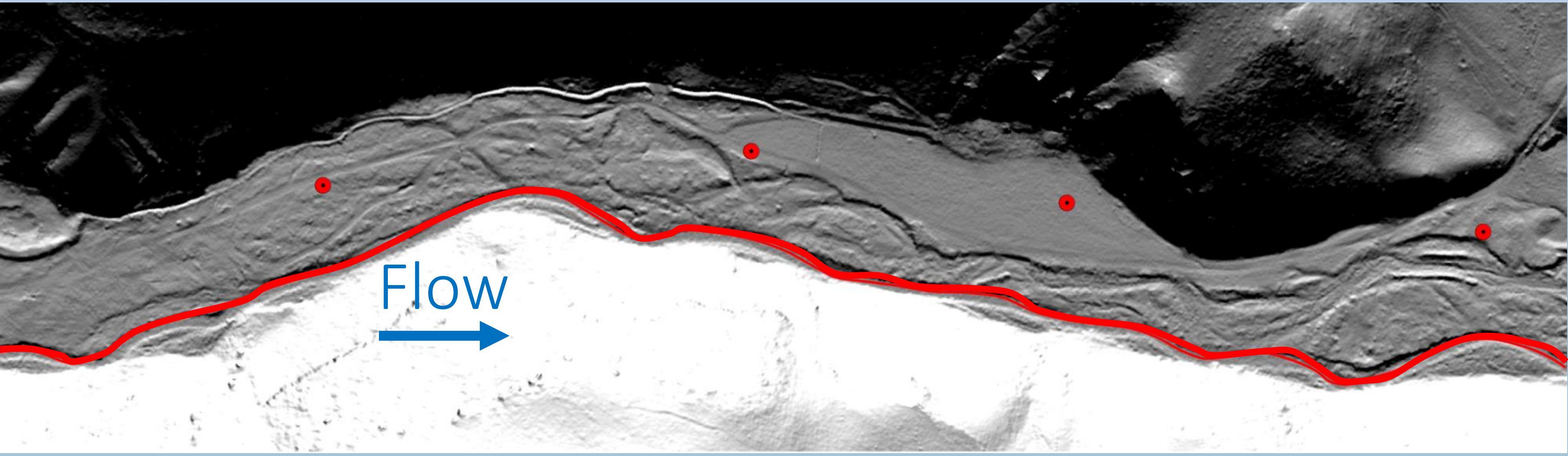
- 62,000 lamprey ammocetes
- 28,000 sculpin sp
- 19,000 Western Pearlshell mussels
- 30,000 3 spine stickleback
- 20,000 coho juveniles
- Plus 11 other species

Evolution, Monitoring, and Lessons Learned on a Stage 0 Restoration Project

Mathias Perle, Upper Deschutes Watershed Council
Lauren Mork, Upper Deschutes Watershed Council
Colin Thorne, University of Nottingham


Whychus Canyon project
Camp Polk Meadow project
Willow Springs project
Whychus floodplain project
TSID project
City of Sisters
Whychus Creek watershed
Perennial stream
Land Ownership
BLM
Private
State
USFS Deschutes
USFS Grasslands
Deschutes Basin
Whychus Creek watershed
OREGON
Indian Ford Crk
Whychus Creek
Deschutes River
Sisters
Whychus Canyon
Camp Polk

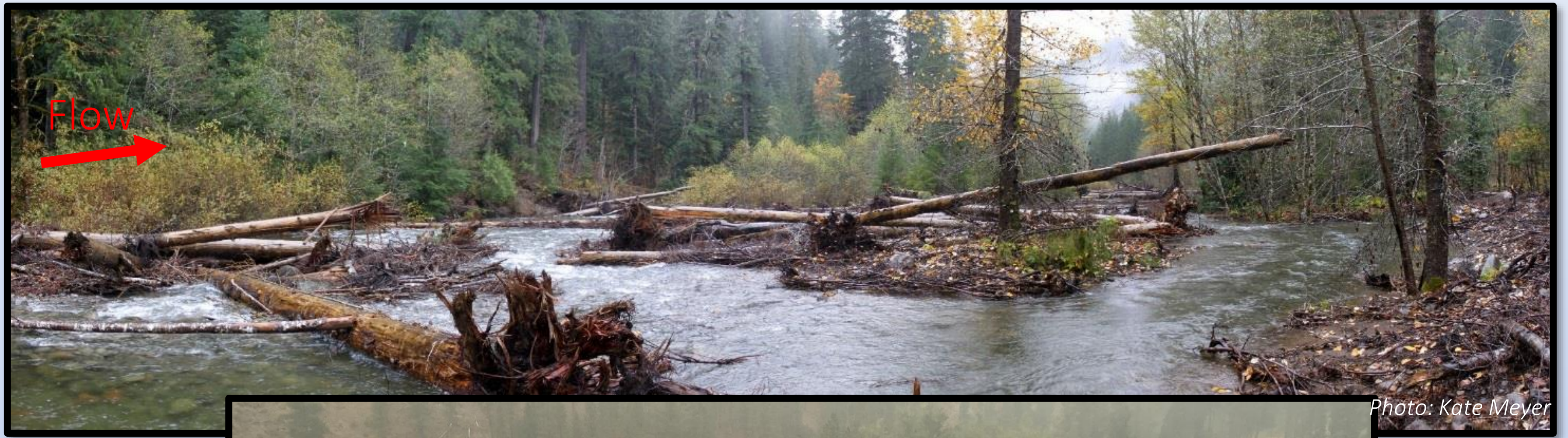
Whychus Canyon - 2015




July 2015


October 2016


Flow
July 2018


Flow
Photo: Kate Meyer


Flow


Flow
Photo: Matt Helstab

Single Thread

- Narrow linear features
- Comparitively Simple
- Channel and fish habitat attributes specific to sinuous single-thread

Stage 0

- Large spatial extent
- Complex, heterogeneous, diverse
- **Single-thread channel and habitat attributes do not describe range of conditions**

What are the metrics? (at baseflow)

PHYSICAL

Groundwater
- Depth

Channel morphology
- Number of channels
- Channel elevation
- Total channel length
- Ratio of primary : secondary
- Total wetted area

Stream temperature
- July rate of change

Geomorphic units / habitat
- Total number of units
- Number of types of units
- Percent riffle
- Percent pool
- Pool number, types, area, dimensions
- Pieces of wood
- Substrate sizes, proportions

BIOLOGICAL

Riparian and wetland vegetation
- Area
- Species richness and type

Algae and diatoms
- Species richness and abundance

Macroinvertebrates
- Taxa richness and abundance

Fish
- Juvenile density
- Juvenile growth rate and condition

Groundwater Depth

HYPOTHESIS	OBJECTIVE
Average depth to groundwater will decrease	Average depth of ≤2 ft below floodplain surface July 15-Aug 31

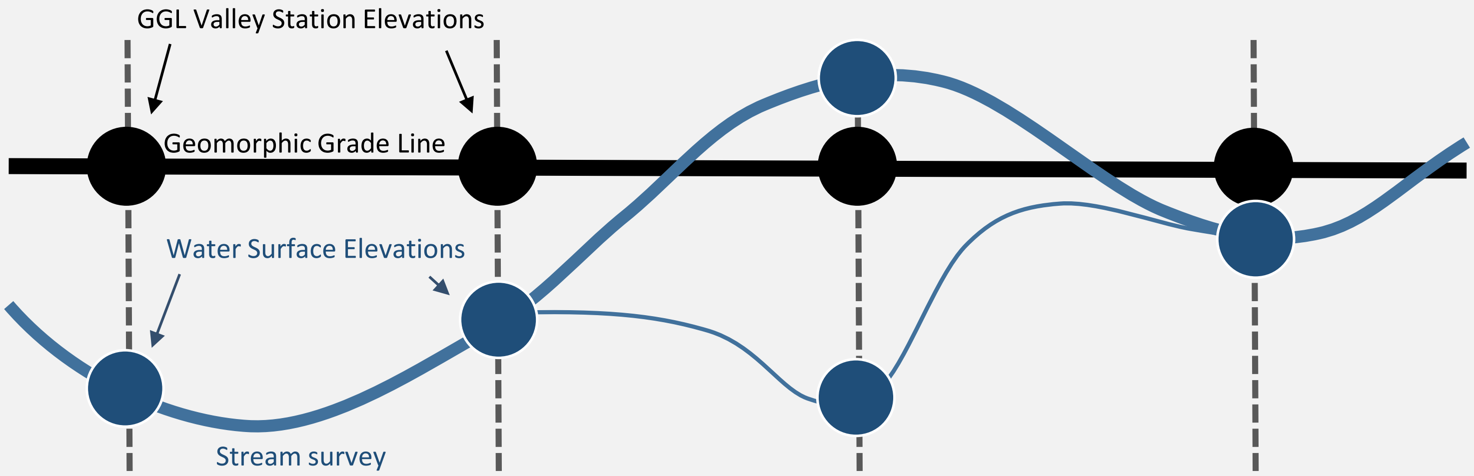
METRIC	BEFORE	1 YEAR AFTER	2 YEARS AFTER
Average depth July 15 – Aug 31	-7.2 ft	-1.0 ft	-1.5 ft

Channel morphology

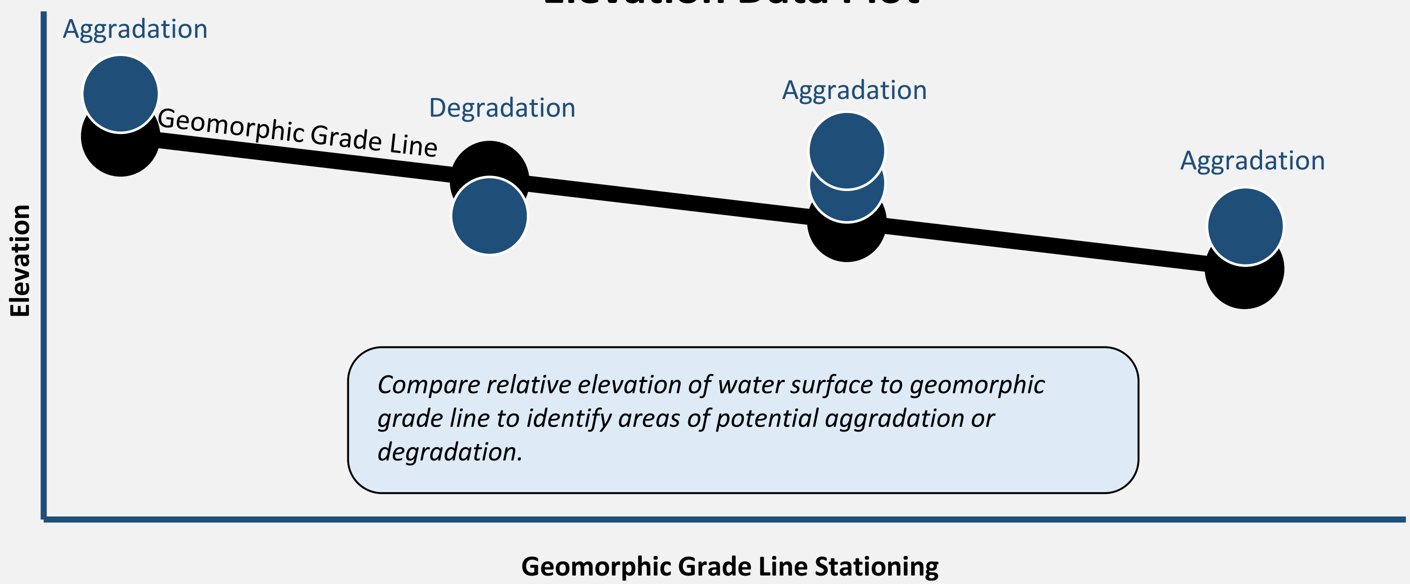
HYPOTHESIS	OBJECTIVE
Channels will remain within 1 ft below the target GGL elevation	Flow is dispersed among multiple channels and elevations remain not more than 1 ft below target GGL elevation
Number of channels wetted at base flow will increase	Increase average number of channels at each cross-section by > 1

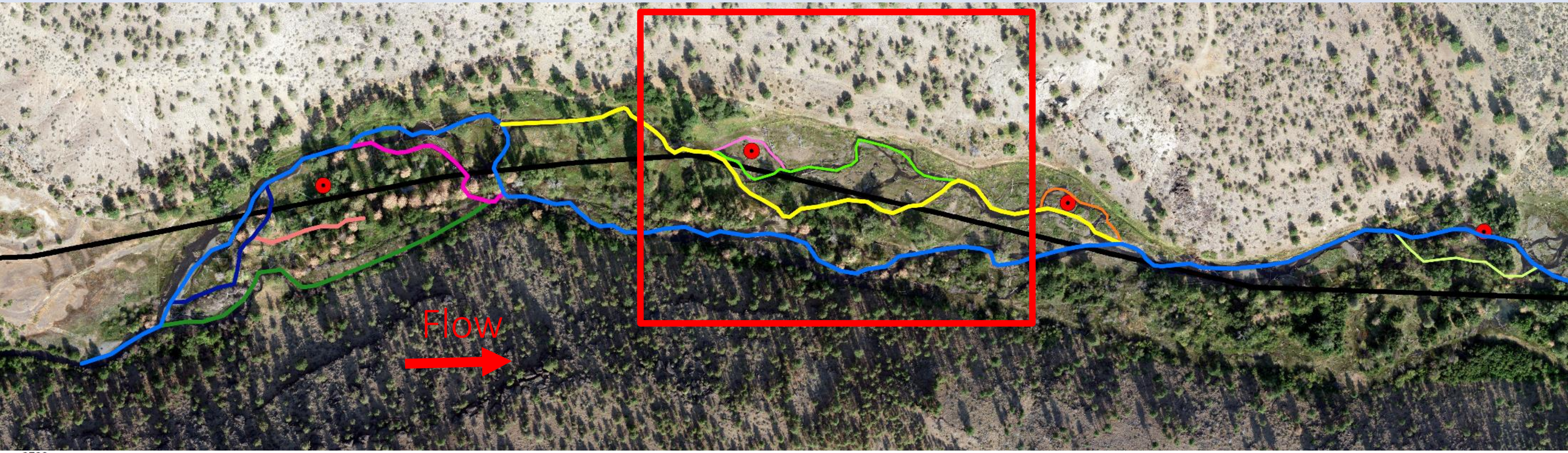
Powers PD, Helstab M, Niezgoda SL.
A process-based approach to restoring depositional river valleys to Stage 0, an anastomosing channel network.
River Res Applic. 2018;1–11. https://doi.org/10.1002/rra.3378

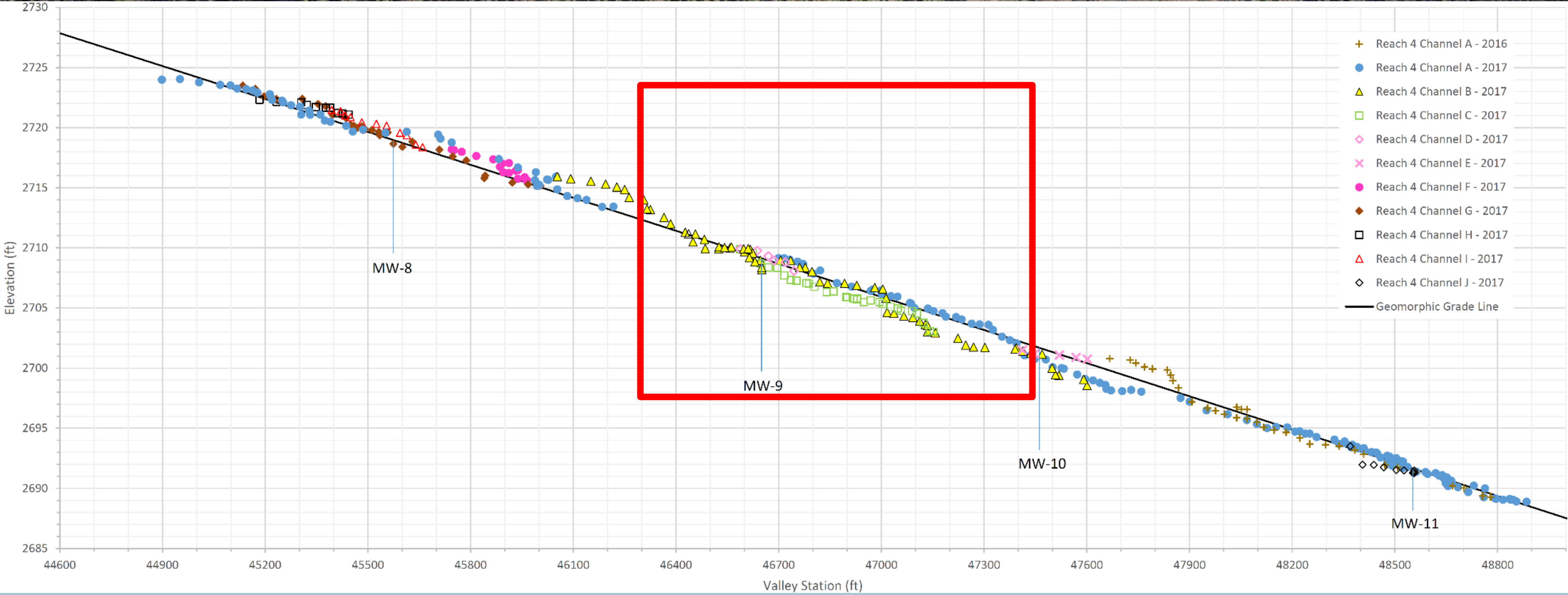
Plan View of Valley



Elevation Data Plot




Flow


Elevation (ft)
Valley Station (ft)
2730
2725
2720
2715
2710
2705
2700
2695
2690
2685
44600
44900
45200
45500
45800
46100
46400
46700
47000
47300
47600
47900
48200
48500
48800
MW-8
MW-9
MW-10
MW-11
Reach 4 Channel A - 2016
Reach 4 Channel A - 2017
Reach 4 Channel B - 2017
Reach 4 Channel C - 2017
Reach 4 Channel D - 2017
Reach 4 Channel E - 2017
Reach 4 Channel F - 2017
Reach 4 Channel G - 2017
Reach 4 Channel H - 2017
Reach 4 Channel I - 2017
Reach 4 Channel J - 2017
Geomorphic Grade Line

Channel morphology

HYPOTHESIS	OBJECTIVE
Total channel length will increase	Total channel length > 3 mi
Total wetted area at base flow will increase	Increase total wetted area
Ratio of lengths of secondary : primary channels will increase	Ratio > 2:1

METRIC	BEFORE	1 YEAR AFTER	DIFFERENCE
Total channel length	1.2 mi	3.8 mi	+ 3.2 x
Total wetted area at base flow	923 m^2/ 100m	2647 m^2/ 100m	+ 2.9 x
Ratio of lengths secondary: primary	0.1	2.4	+ 24 x

Geomorphic Units / Habitat

HYPOTHESIS	OBJECTIVE
Total number and richness (types) of habitat units will increase	Increase number and richness of habitat units
Percent riffle will decrease and percent pool will increase	Decrease % riffle and increase % pool

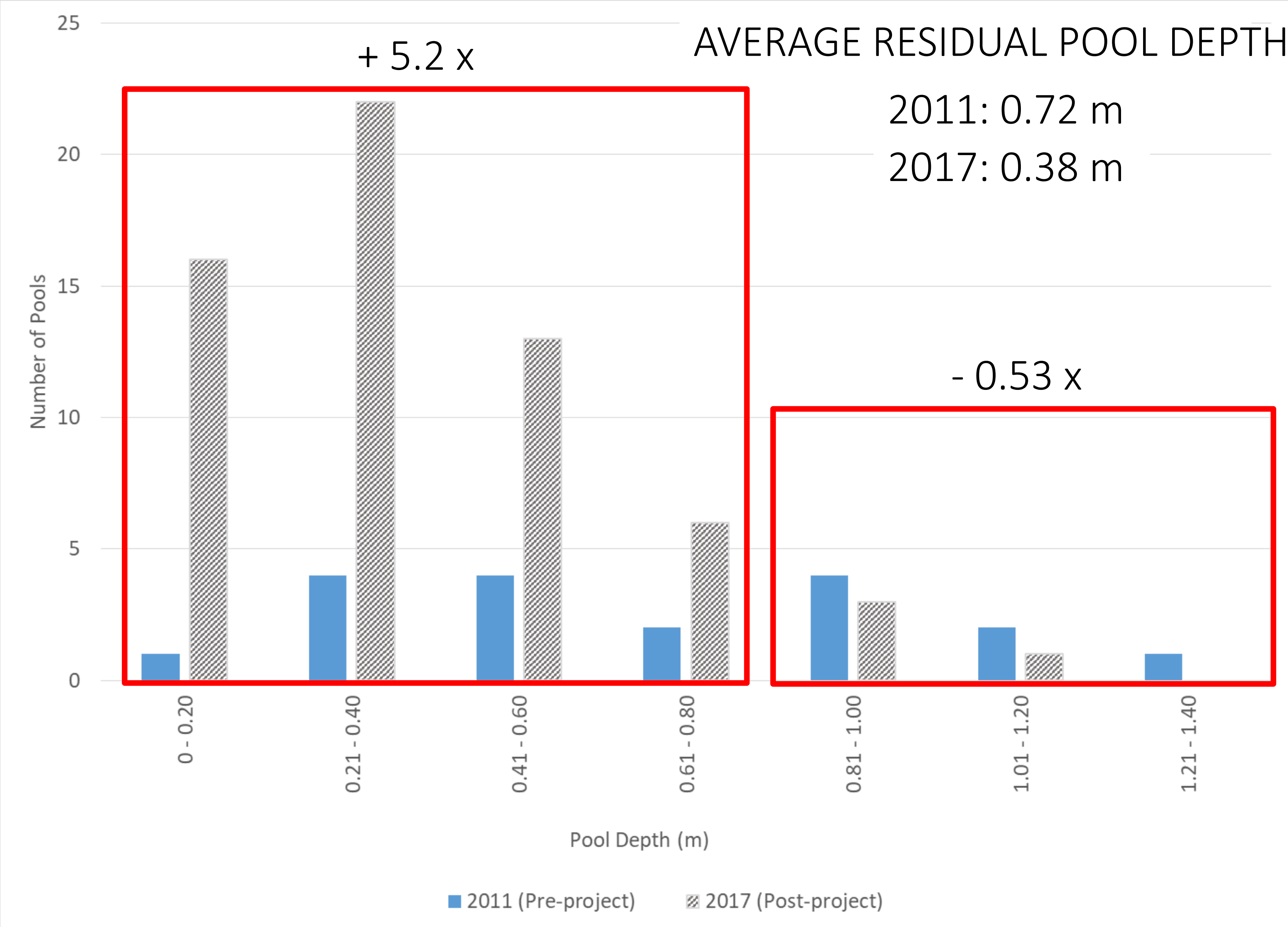
METRIC	BEFORE	1 YEAR AFTER	DIFFERENCE
Number of habitat units	56	304	+ 5.4 x
Habitat unit richness	11	16	+ 1.5 x
Percent riffle	63%	58%	- 0.9 x
Percent pool	27%	34%	+ 1.3 x

Wood and Pools

HYPOTHESIS	OBJECTIVE
Amount of large wood will increase	Increase amount of large wood
Type and character of pools will reflect low energy depositional	Increase number and total area of pools

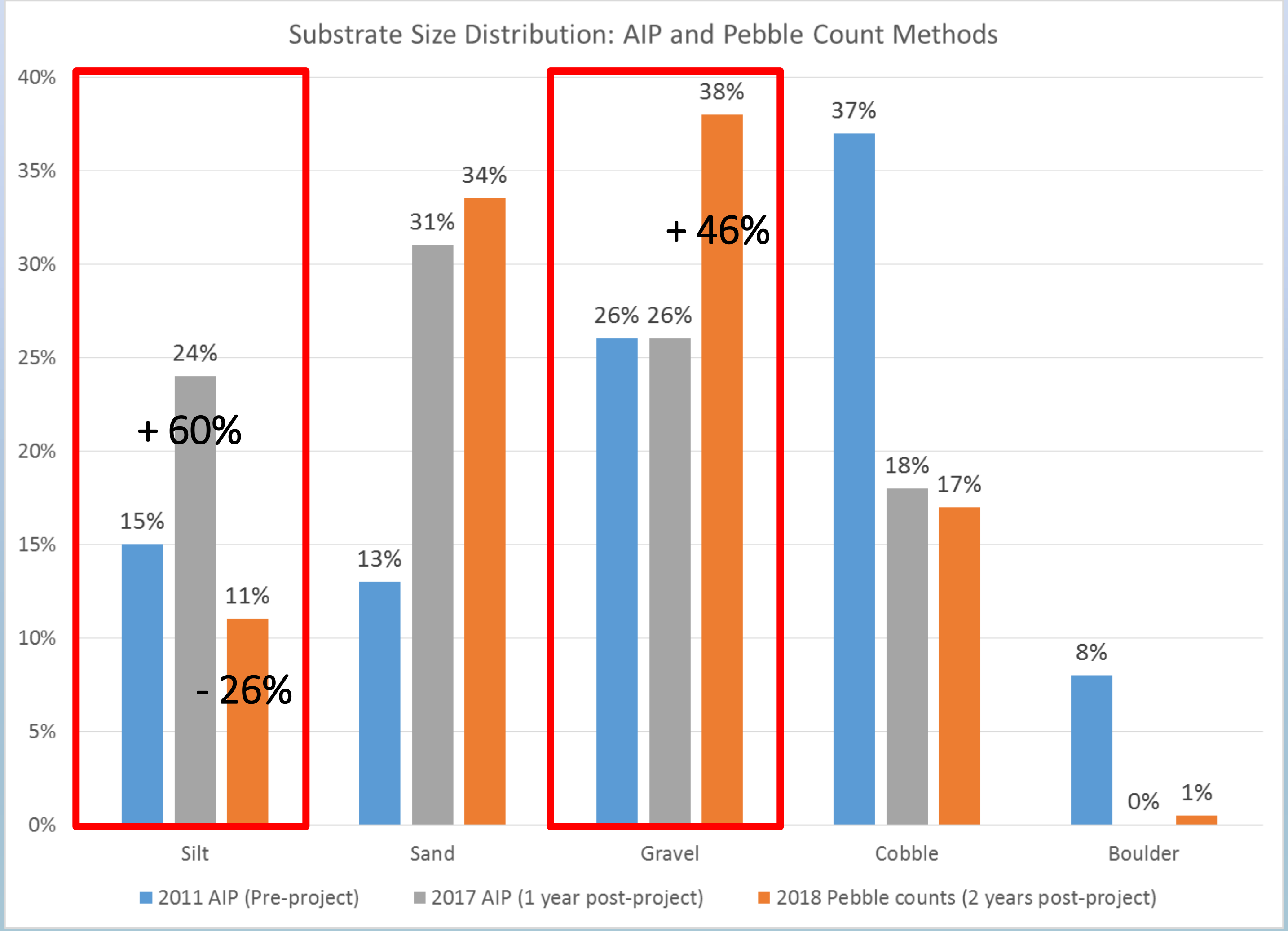
METRIC	BEFORE	1 YEAR AFTER	DIFFERENCE
# Pieces of wood per 100m	4	53	+ 13.2 x
# Pools per 100m	1.4	7.4	+ 5.3 x
Complex pools per 100m	0.3	2.4	+ 8 x
Pool area per 100m (m^2)	249	900	+ 3.6 x
Average size of pools (m^2)	217	118	- 0.54 x
Average residual pool depth (m)	0.72	0.38	- 0.53 x

Photos: P. Powers

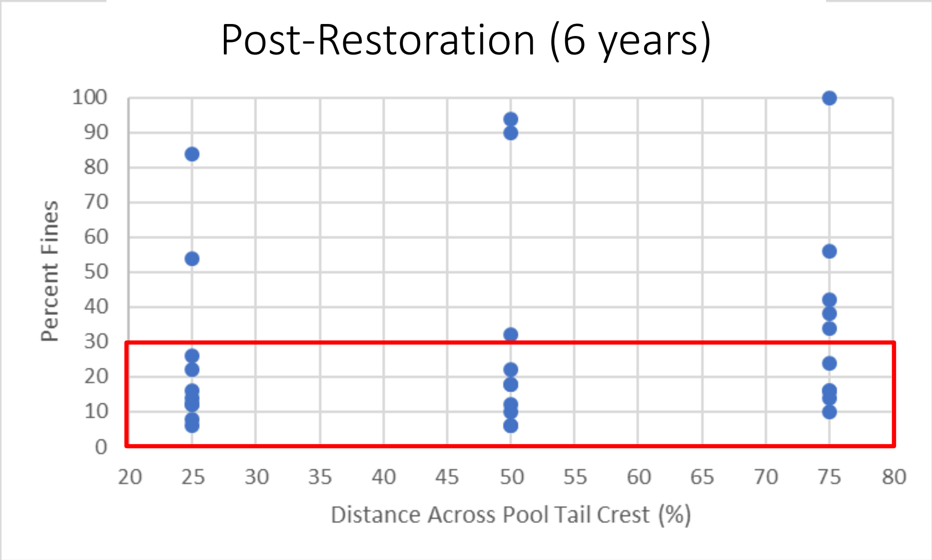

AVERAGE RESIDUAL POOL DEPTH
2011: 0.72 m
2017: 0.38 m
+ 5.2 x
- 0.53 x
Number of Pools
25
20
15
10
5
0
0 - 0.20
0.21 - 0.40
0.41 - 0.60
0.61 - 0.80
0.81 - 1.00
1.01 - 1.20
1.21 - 1.40
Pool Depth (m)
2011 (Pre-project)
2017 (Post-project)

Substrate Size Distribution

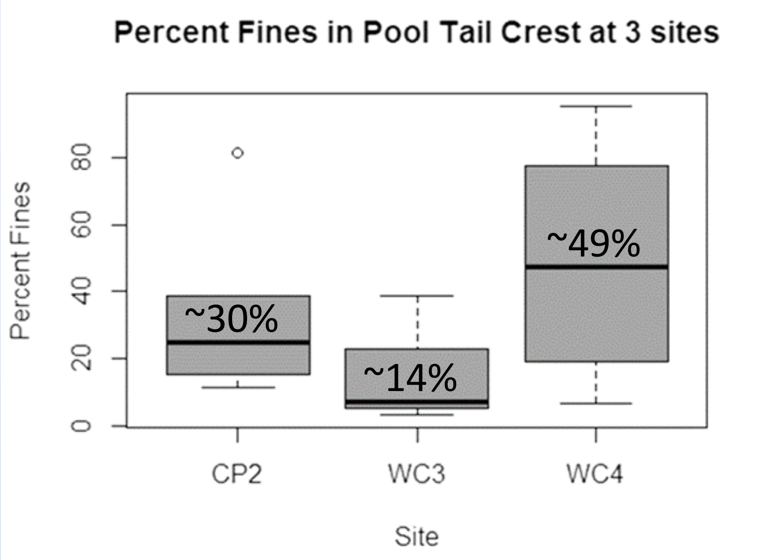
HYPOTHESIS	OBJECTIVE
Substrate size distribution will reflect shift toward low energy depositional	Shift distribution toward smaller size classes



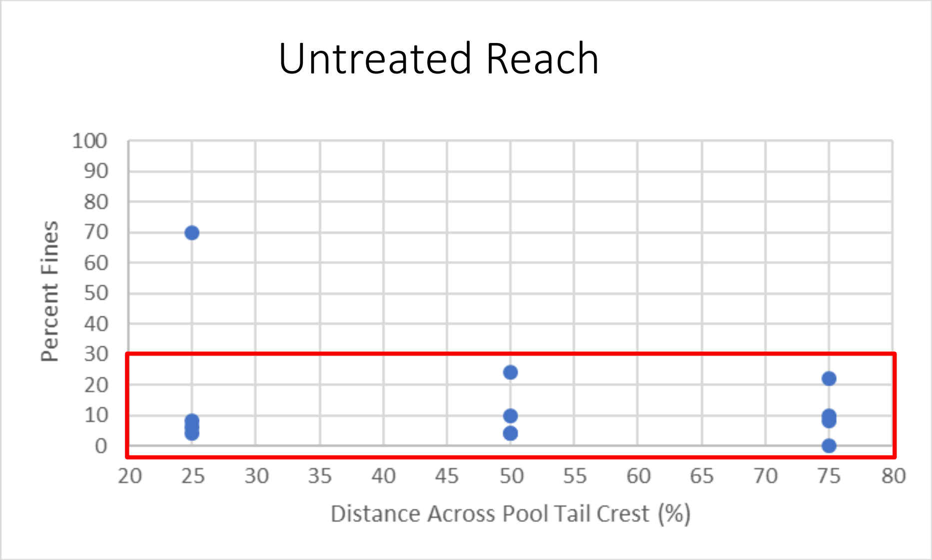
Fines (< 2 mm)



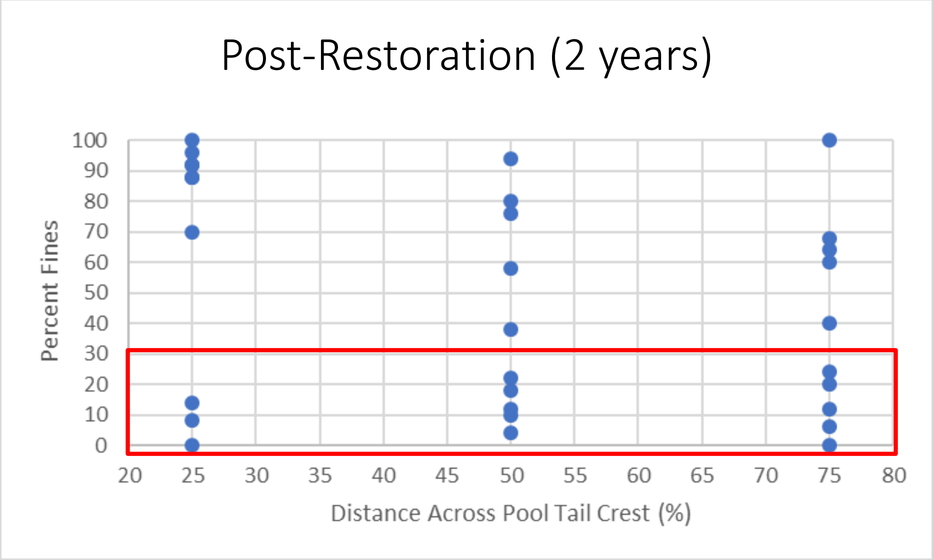
Post-Restoration (6 years)
Percent Fines
100
90
80
70
60
50
40
30
20
10
0
20 25 30 35 40 45 50 55 60 65 70 75 80
Distance Across Pool Tail Crest (%)



Percent Fines in Pool Tail Crest at 3 sites
Percent Fines
0
20
40
60
80
~30%
~14%
~49%
CP2
WC3
WC4
Site



Untreated Reach
Percent Fines
100
90
80
70
60
50
40
30
20
10
0
20 25 30 35 40 45 50 55 60 65 70 75 80
Distance Across Pool Tail Crest (%)



Post-Restoration (2 years)
Percent Fines
100
90
80
70
60
50
40
30
20
10
0
20 25 30 35 40 45 50 55 60 65 70 75 80
Distance Across Pool Tail Crest (%)

Riparian and Wetland Vegetation

HYPOTHESIS	OBJECTIVE
Total acreage of desired riparian and wetland vegetation will increase	Increase acreage of desired plant communities by > 20 ac

METRIC	BEFORE	AFTER	DIFFERENCE
Acres of riparian vegetation	23.47	28.32	+ 1.2 x
Species richness	27	67	+ 2.5 x
# native species	19	41	+ 2.2 x
# non-native species	8	19	+ 2.4 x
# facw or obl species	10	24	+ 2.4 x

Algae and Diatoms

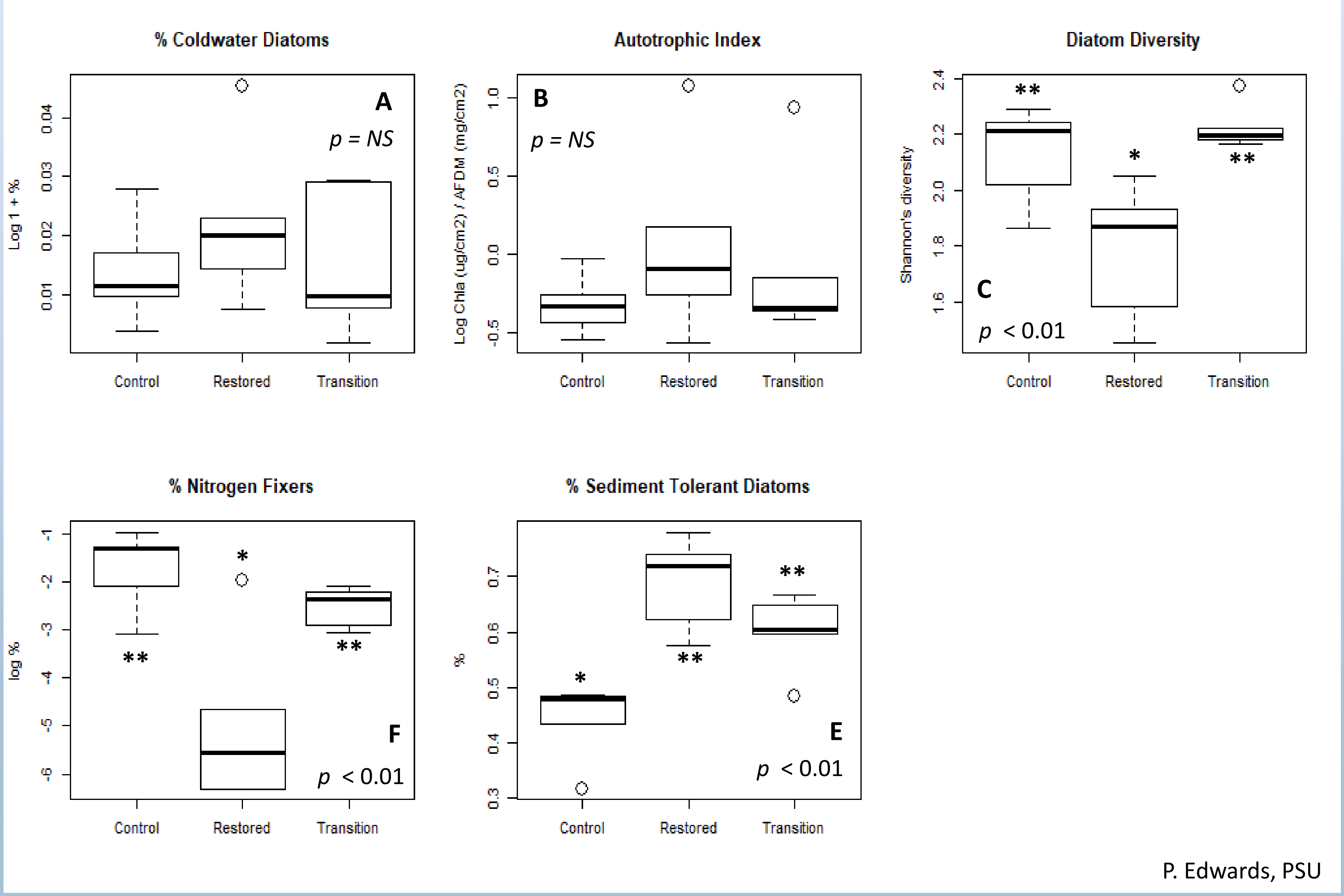


Figure 4: Boxplots of primary productivity data and diatom traits. P values were generated with a one-way ANOVA. Asterisks show which sites are significantly different.

Macroinvertebrates (a.k.a. Fish Food)

HYPOTHESIS
Total number of taxa, number of EPT taxa, and total macroinvertebrate abundance will increase

METRIC	BEFORE	1 YEAR AFTER	2 YEARS AFTER	DIFFERENCE
Richness	30	14	48	x 1.6
# Sensitive (EPT) Taxa	13	5	19	x 1.5

Fish

HYPOTHESES
Juvenile fish density in the project reach will increase

METRIC	UNTREATED	BEFORE	2 YEARS AFTER	DIFFERENCE
O. mykiss per $100m^2$	16	11	34.5	+ 2.2 x
O. mykiss per 100m	120	108	455	+ 3.8 x
Channel area (m^2) per km	1019	1352	2397	+ 2.4 x

METRIC	UNTREATED	PROJECT REACH	% DIFFERENCE
Chinook per 100m	3	112	+ 37 x
Chinook per $100m^2$	< 1	9	+ 9 x

Photo: J. Hogervorst

What are the metrics? (at baseflow)

PHYSICAL

Groundwater
- Depth **+**

Channel morphology
- Number of channels **+**
- Channel elevation **+ / -**
- Total channel length **+**
- Ratio of primary : secondary **+**
- Total wetted area **+**

Stream temperature
- July rate of change **+**

Geomorphic units / habitat
- Total number of units **+**
- Number of types of units **+**
- Percent riffle **+**
- Percent pool **+**
- Pool number, types, area, dimensions **+ / -**
- Pieces of wood **+**
- Substrate sizes, proportions **+ / -**

BIOLOGICAL

Riparian and wetland vegetation
- Area **+ / -**
- Species richness and type **+**

Algae and plankton
- Species richness and abundance **+**

Macroinvertebrates
- Taxa richness and abundance **+**

Fish
- Juvenile density **+**

Stakeholder Views

QUESTIONS?

Thanks To:

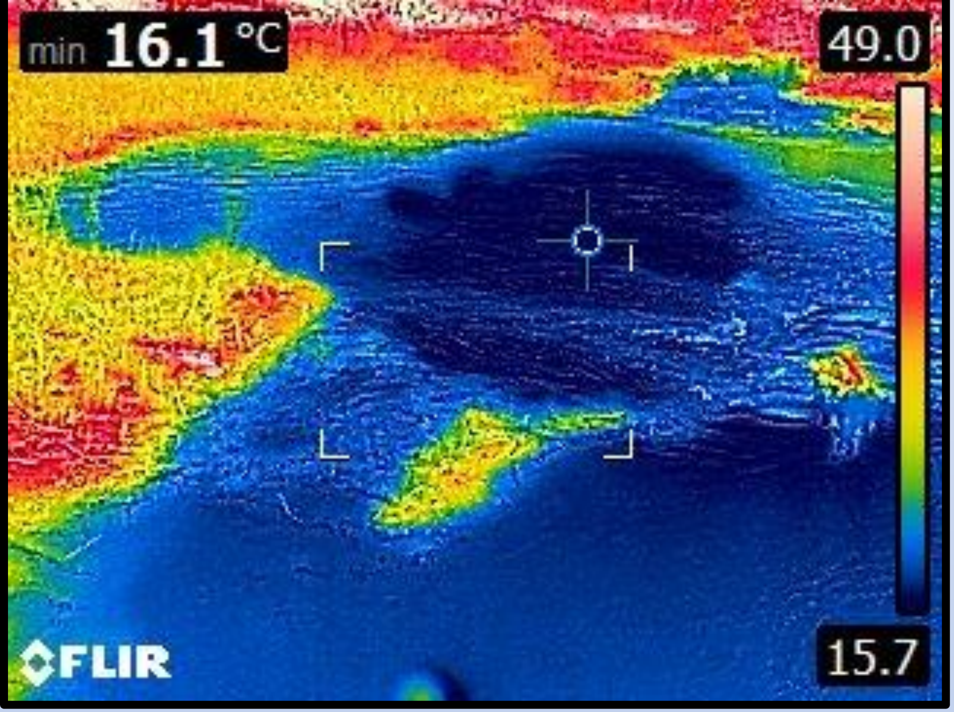
Deschutes Land Trust
PGE
CTWSRO
ODFW
USFS
USFWS
University of Nottingham Field Study
Wolf Water Resources
Portland State University
2018 UDWC Interns
Stream Sampling Volunteers

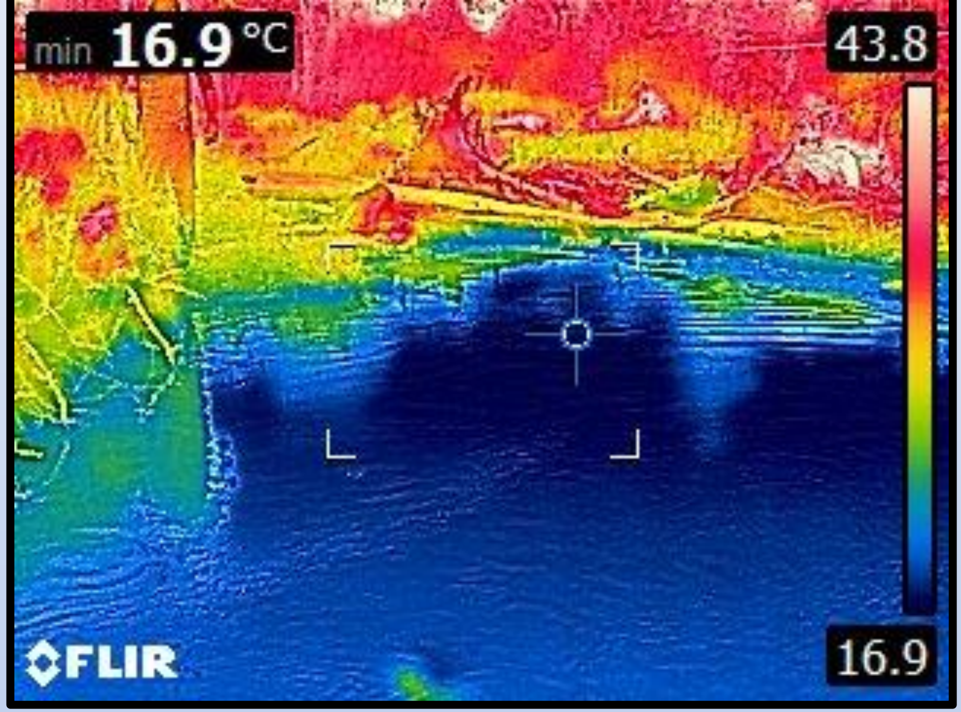
Photo: Russ McMillan

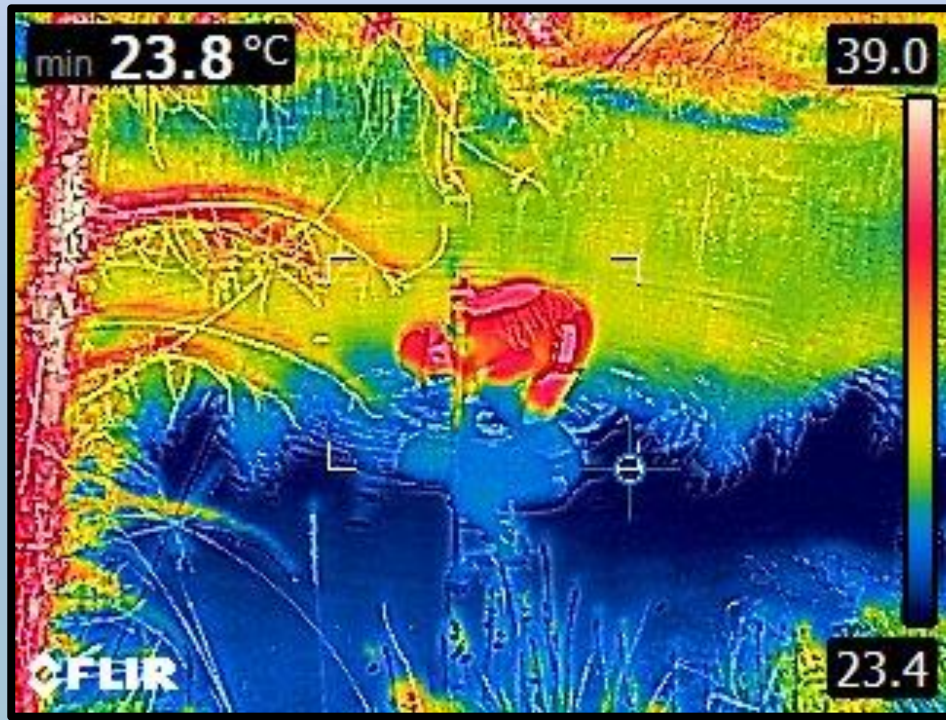
Stream Temperature

HYPOTHESIS	OBJECTIVE
Stream temperature rate of warming will remain below 0.3°C / mile	July average rate of warming remains below 0.3°C

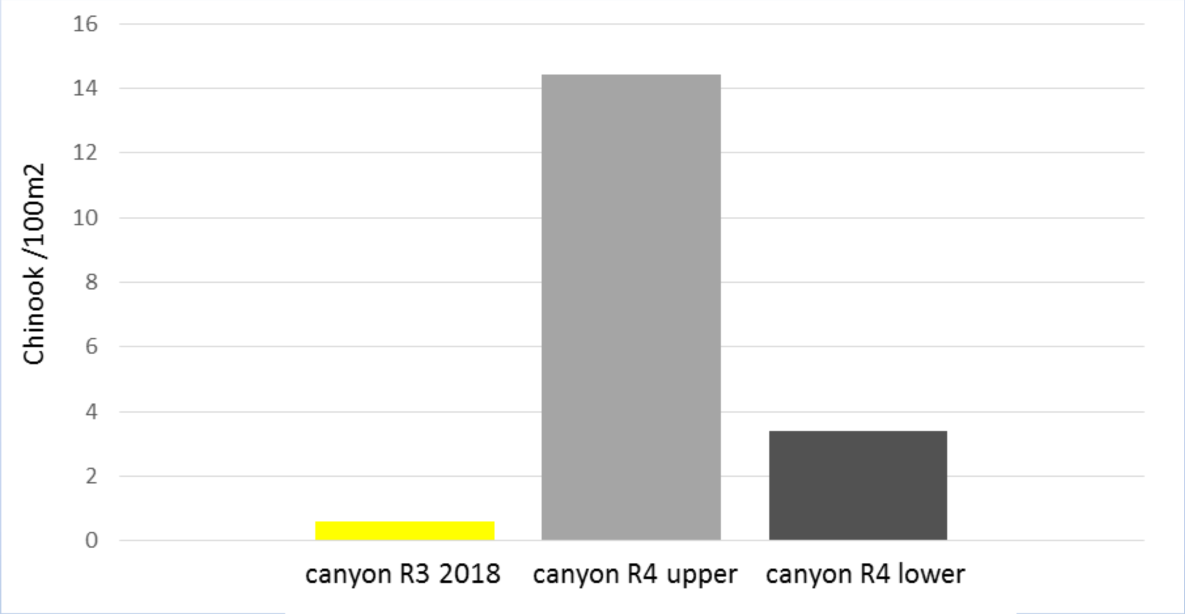
PRE-PROJECT 10-YR MAX	1 YEAR AFTER	2 YEARS AFTER
0.3°C	0.2°C	0.1°C


min 16.1 °C
49.0
15.7
FLIR

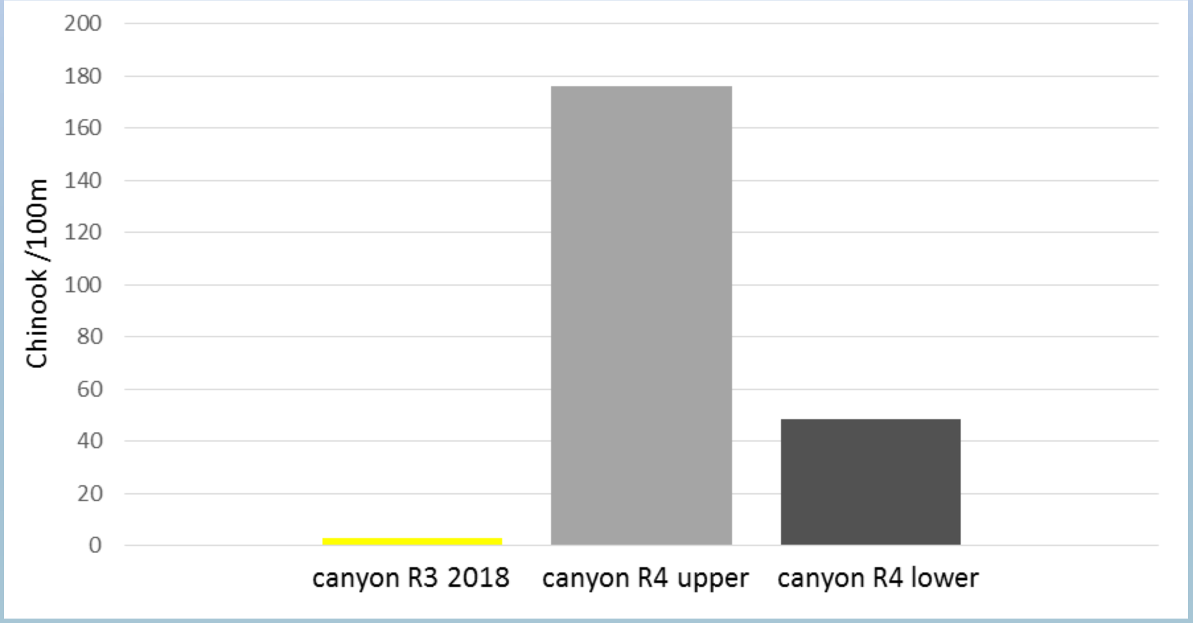

min 16.9 °C
43.8
16.9
FLIR


min 23.8 °C
39.0
23.4
FLIR

Fish



16
14
12
10
8
6
4
2
0
Chinook /100m2
canyon R3 2018
canyon R4 upper
canyon R4 lower



200
180
160
140
120
100
80
60
40
20
0
Chinook /100m
canyon R3 2018
canyon R4 upper
canyon R4 lower

Evolutionary Restoration

Design, Implementation, and Results in CA Stage 0 Projects

Jared McKee with help from Damion Ciotti and Michael Pollock

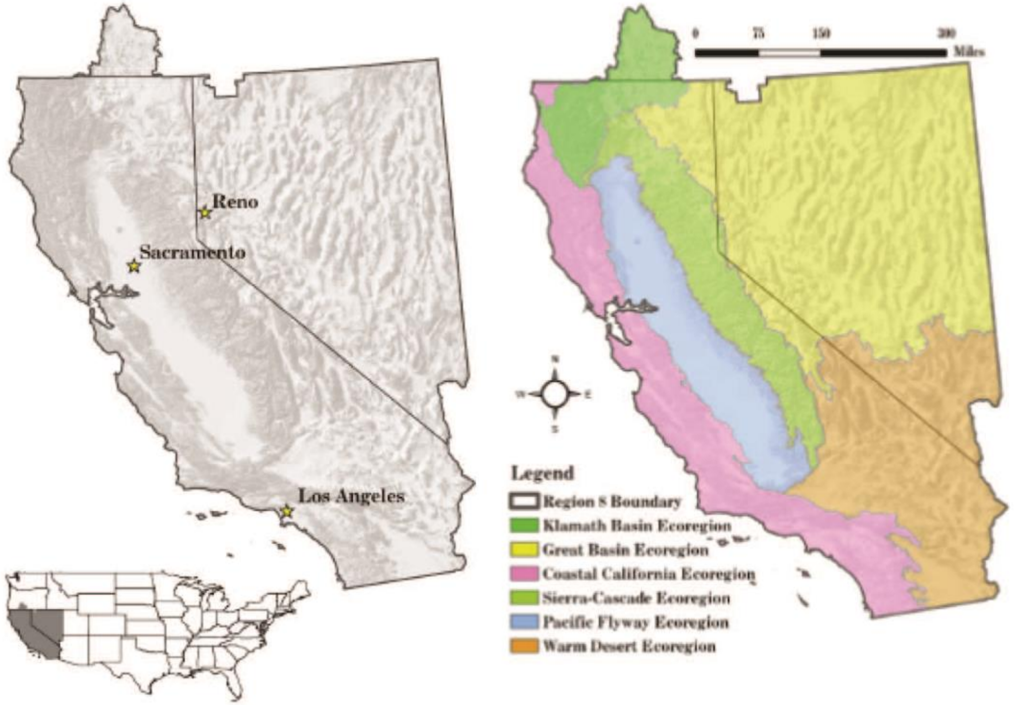
U.S. Fish and Wildlife Service
Partners for Fish & Wildlife

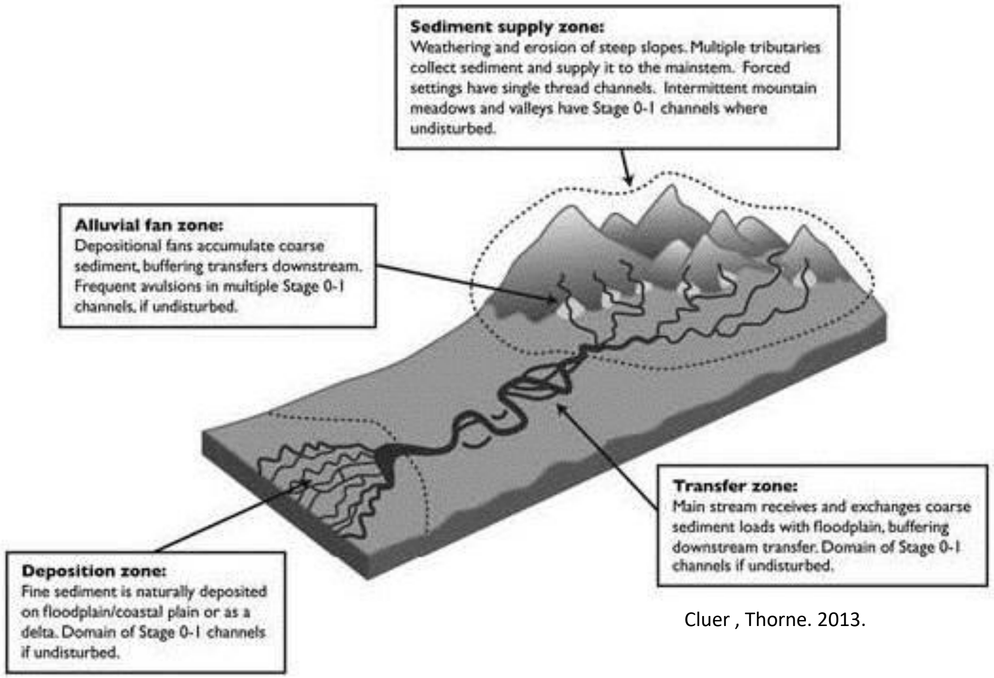
U.S. FISH & WILDLIFE SERVICE

Partners for Fish and Wildlife Program

Mission Statement

"working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American People"





Cluer , Thorne. 2013.

Since 1990 - 62,000 acres of <u>voluntary</u> habitat restoration

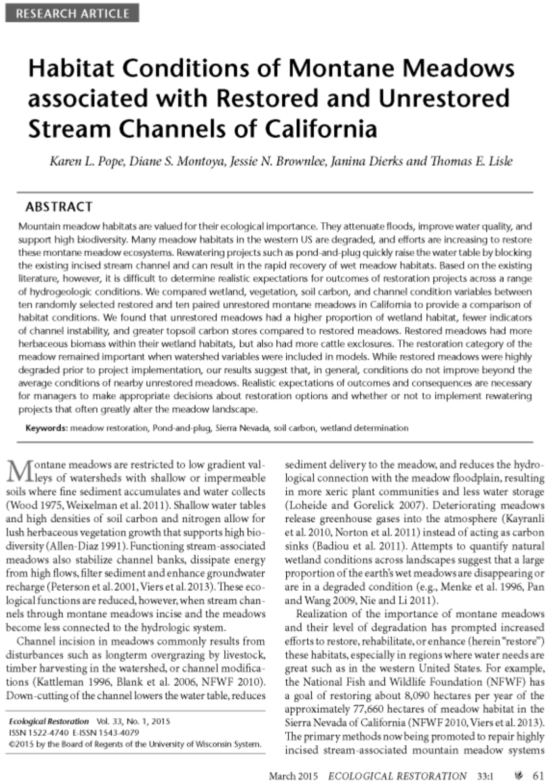
Goal - Focus restoration to promote a more robust, resilient, and dynamic stream/floodplain environment

Outline

- Background
- Scientific Basis
- Example Site – Doty Ravine Creek, Placer County, CA
- Criteria
  - Space
  - Energy
  - Matter
  - Time
- Discussion and Conclusion

Restoration Science is Young

Stream restoration projects were not meeting ecological standards, process based principles, or <u>providing anticipated biologic benefits</u>



RESEARCH ARTICLE

Habitat Conditions of Montane Meadows associated with Restored and Unrestored Stream Channels of California

Karen L. Pope, Diane S. Montoya, Jessie N. Brownlee, Janina Dierks and Thomas E. Lisle

ABSTRACT

Mountain meadow habitats are valued for their ecological importance. They attenuate floods, improve water quality, and support high biodiversity. Many meadow habitats in the western US are degraded, and efforts are increasing to restore these montane meadow ecosystems. Rewatering projects such as pond-and-plug quickly raise the water table by blocking the existing incised stream channel and can result in the rapid recovery of wet meadow habitats. Based on the existing literature, however, it is difficult to determine realistic expectations for outcomes of restoration projects across a range of hydrogeologic conditions. We compared wetland, vegetation, soil carbon, and channel condition variables between ten randomly selected restored and ten paired unrestored montane meadows in California to provide a comparison of habitat conditions. We found that unrestored meadows had a higher proportion of wetland habitat, fewer indicators of channel instability, and greater topsoil carbon stores compared to restored meadows. Restored meadows had more herbaceous biomass within their wetland habitats, but also had more cattle exclosures. The restoration category of the meadow remained important when watershed variables were included in models. While restored meadows were highly degraded prior to project implementation, our results suggest that, in general, conditions do not improve beyond the average conditions of nearby unrestored meadows. Realistic expectations of outcomes and consequences are necessary for managers to make appropriate decisions about restoration options and whether or not to implement rewatering projects that often greatly alter the meadow landscape.

Keywords: meadow restoration, Pond-and-plug, Sierra Nevada, soil carbon, wetland determination

Montane meadows are restricted to low gradient valleys of watersheds with shallow or impermeable soils where fine sediment accumulates and water collects (Wood 1975, Weixelman et al. 2011). Shallow water tables and high densities of soil carbon and nitrogen allow for lush herbaceous vegetation growth that supports high biodiversity (Allen-Diaz 1991). Functioning stream-associated meadows also stabilize channel banks, dissipate energy from high flows, filter sediment and enhance groundwater recharge (Peterson et al. 2001, Viers et al. 2013). These ecological functions are reduced, however, when stream channels through montane meadows incise and the meadows become less connected to the hydrologic system.

Channel incision in meadows commonly results from disturbances such as longterm overgrazing by livestock, timber harvesting in the watershed, or channel modifications (Kattleman 1996, Blank et al. 2006, NFWF 2010). Down-cutting of the channel lowers the water table, reduces sediment delivery to the meadow, and reduces the hydrological connection with the meadow floodplain, resulting in more xeric plant communities and less water storage (Loheide and Gorelick 2007). Deteriorating meadows release greenhouse gases into the atmosphere (Kayranli et al. 2010, Norton et al. 2011) instead of acting as carbon sinks (Badiou et al. 2011). Attempts to quantify natural wetland conditions across landscapes suggest that a large proportion of the earth's wet meadows are disappearing or are in a degraded condition (e.g., Menke et al. 1996, Pan and Wang 2009, Nie and Li 2011).

Realization of the importance of montane meadows and their level of degradation has prompted increased efforts to restore, rehabilitate, or enhance (herein "restore") these habitats, especially in regions where water needs are great such as in the western United States. For example, the National Fish and Wildlife Foundation (NFWF) has a goal of restoring about 8,090 hectares per year of the approximately 77,660 hectares of meadow habitat in the Sierra Nevada of California (NFWF 2010, Viers et al. 2013). The primary methods now being promoted to repair highly incised stream-associated mountain meadow systems

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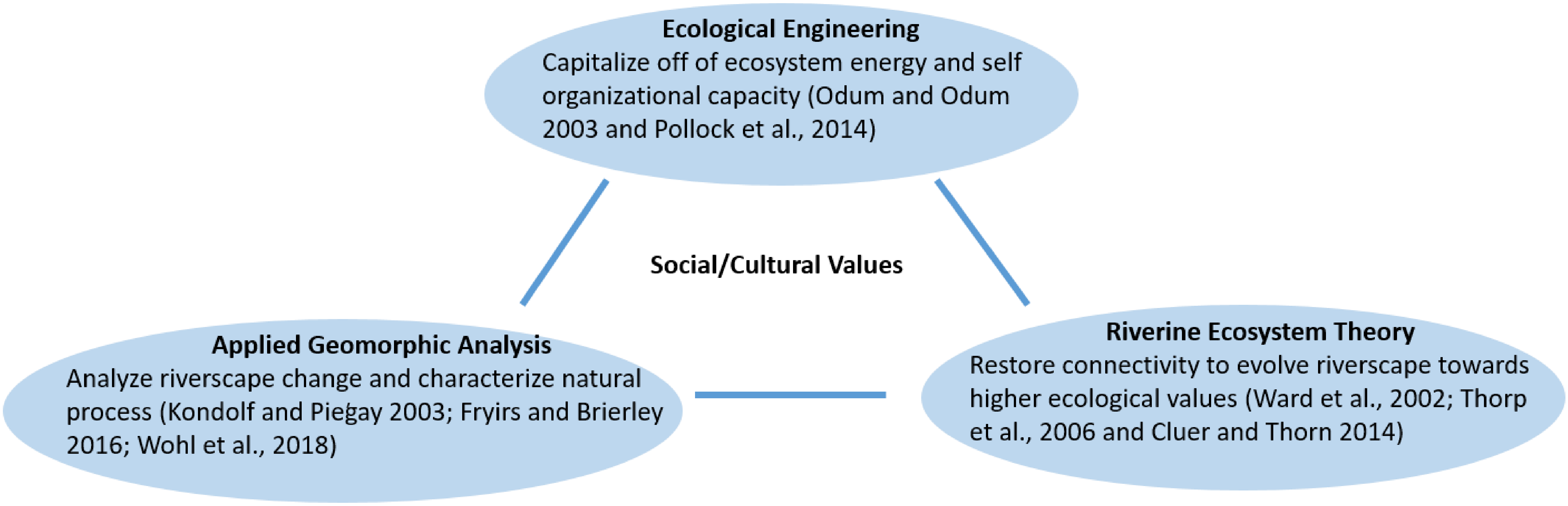
Incorporate geomorphology, ecological engineering and ecology to better manage these systems

It’s hard work restoring streams

Scientific Basis



Evolutionary Restoration Framework

New understanding of possibilities

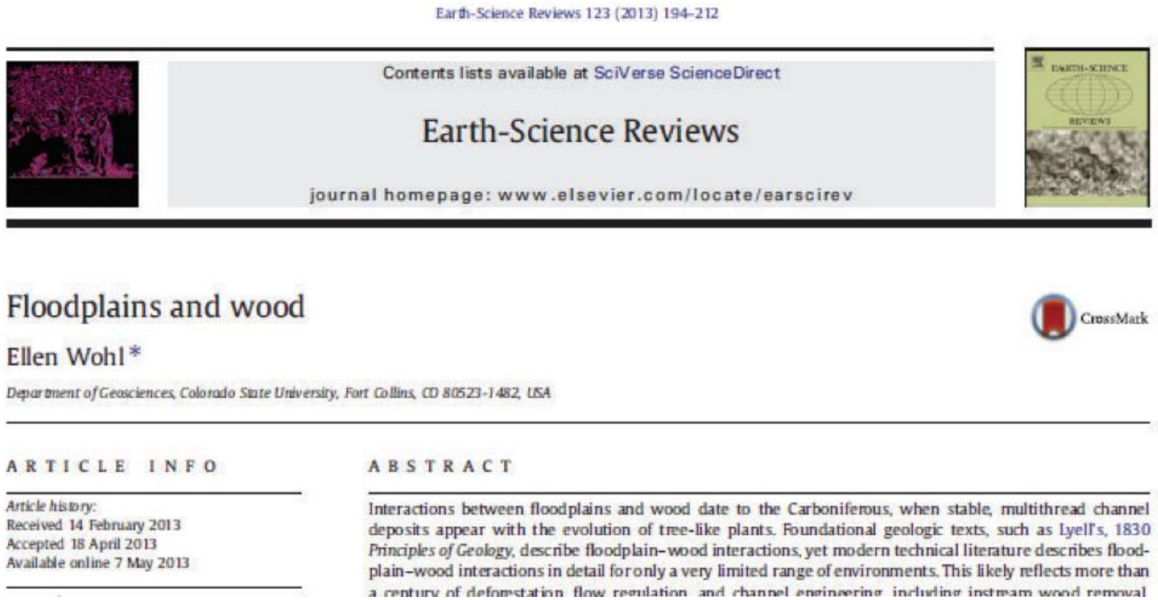
Wohl (2013)

- Wood-forced, multi-threaded planform
- Stepped nature of ‘forced’ floodplains

Cluer and Thorne (2014)

Pollock et al. (2014)

- Evolution of flowpaths is cyclical


Earth-Science Reviews 123 (2013) 194–212

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Earth-Science Reviews

journal homepage: www.elsevier.com/locate/earscirev

Floodplains and wood

Ellen Wohl *

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ARTICLE INFO

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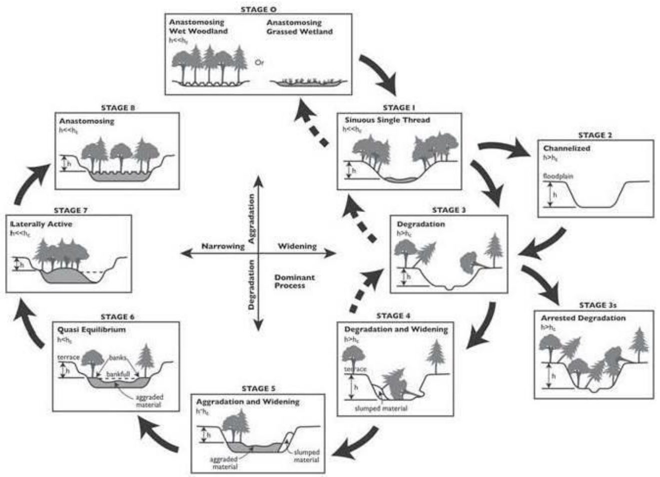
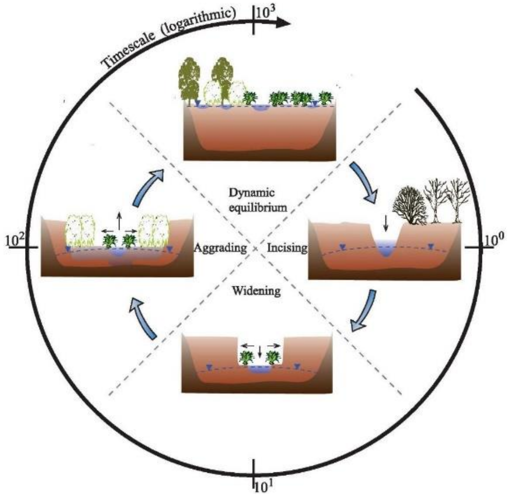
ABSTRACT

Interactions between floodplains and wood date to the Carboniferous, when stable, multithread channel deposits appear with the evolution of tree-like plants. Foundational geologic texts, such as Lyell's, 1830 Principles of Geology, describe floodplain–wood interactions, yet modern technical literature describes floodplain–wood interactions in detail for only a very limited range of environments. This likely reflects more than





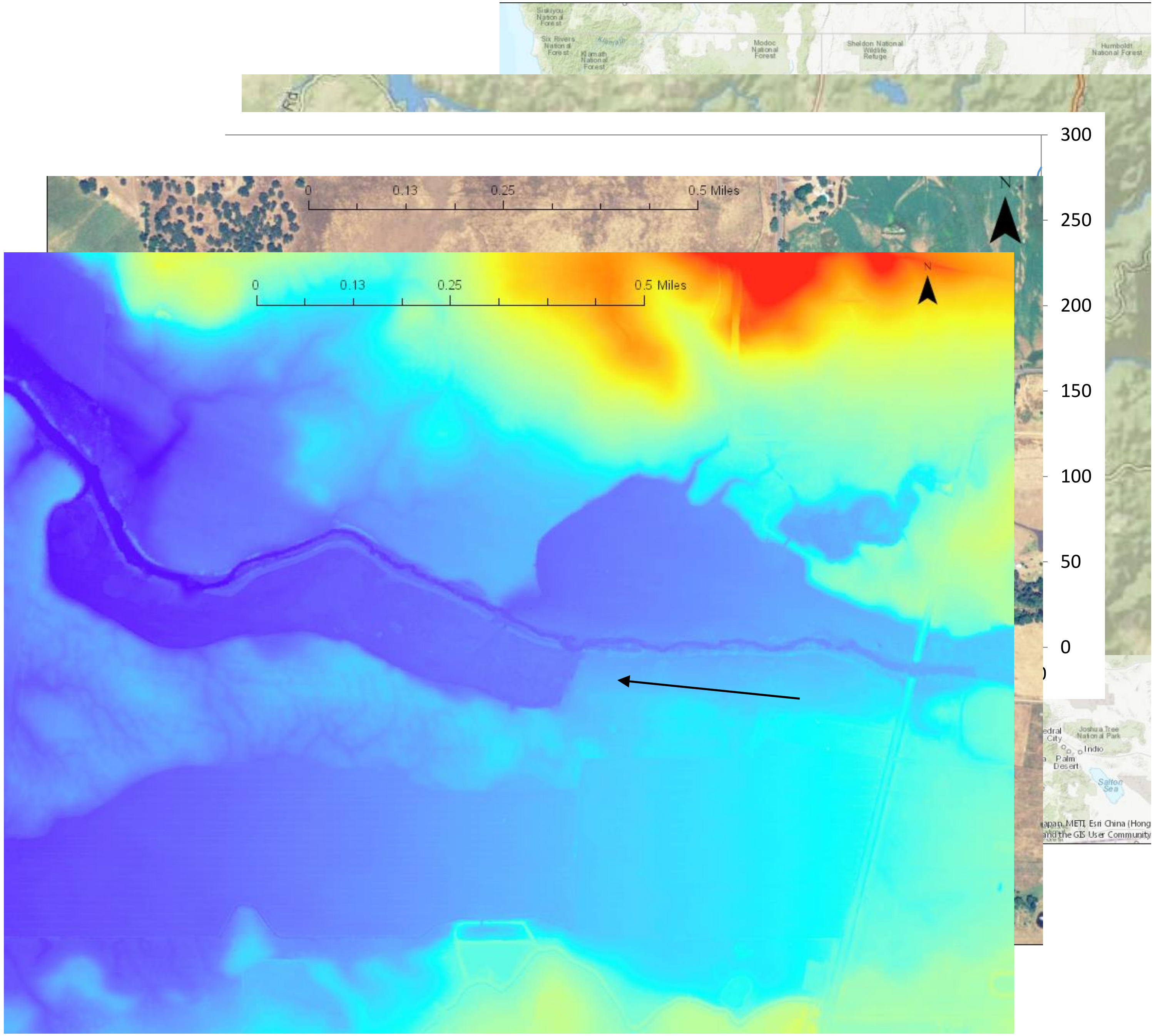
…to provide basic principles to help structure the restoration planning process, and to make them simple and practical enough to guide restoration practitioners toward more natural and sustainable restoration actions.

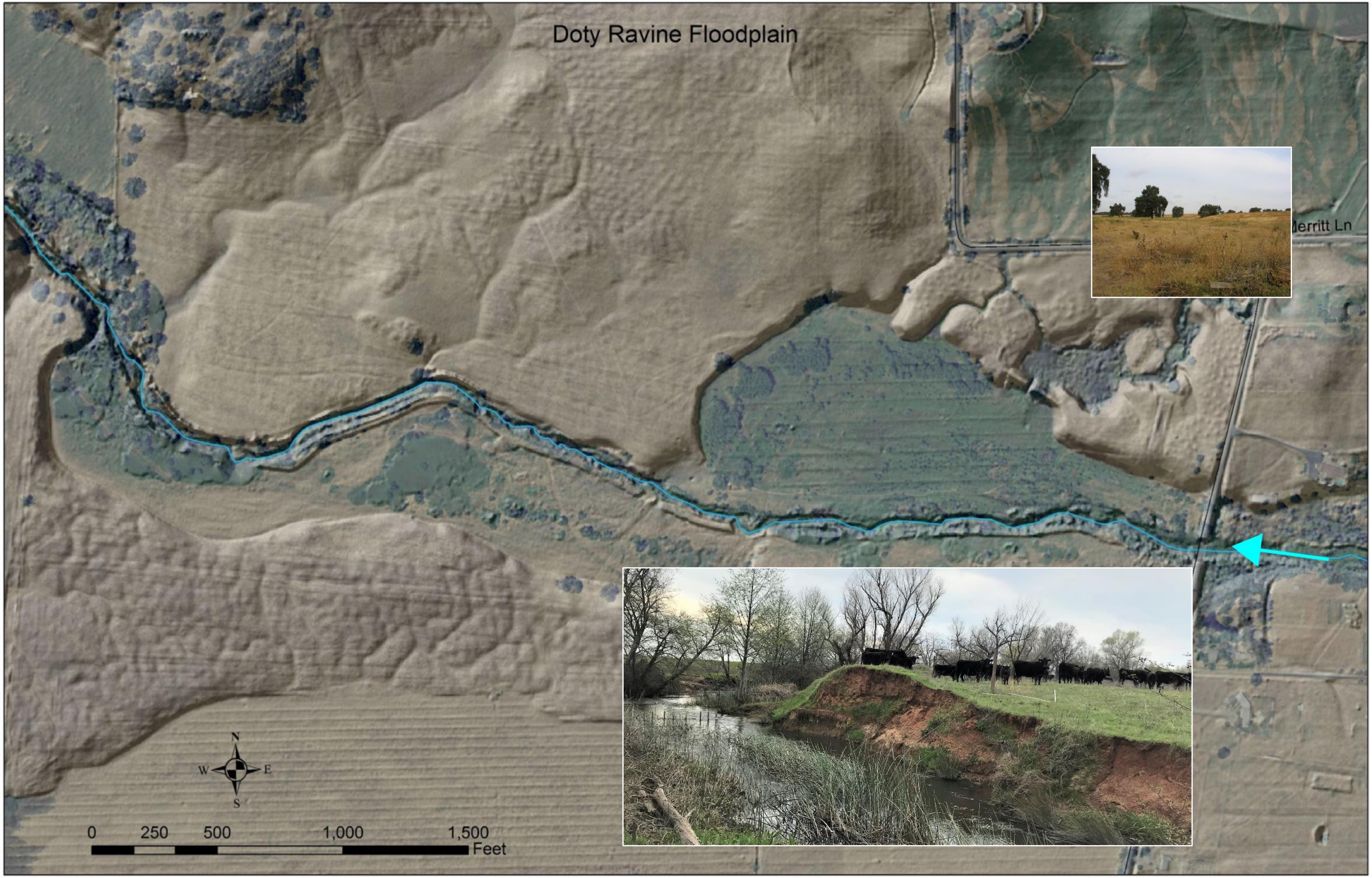
Beechie et al. (2010)

Doty Ravine

- Fast Facts
  - Owned by Placer Land Trust since 2005
  - 427 acres total
    - 55 acres of floodplain
  - 1 mile of Doty Ravine
    - Steelhead Critical Habitat

- Applied Evolutionary Restoration criteria to planning, design, and construction of restoration project



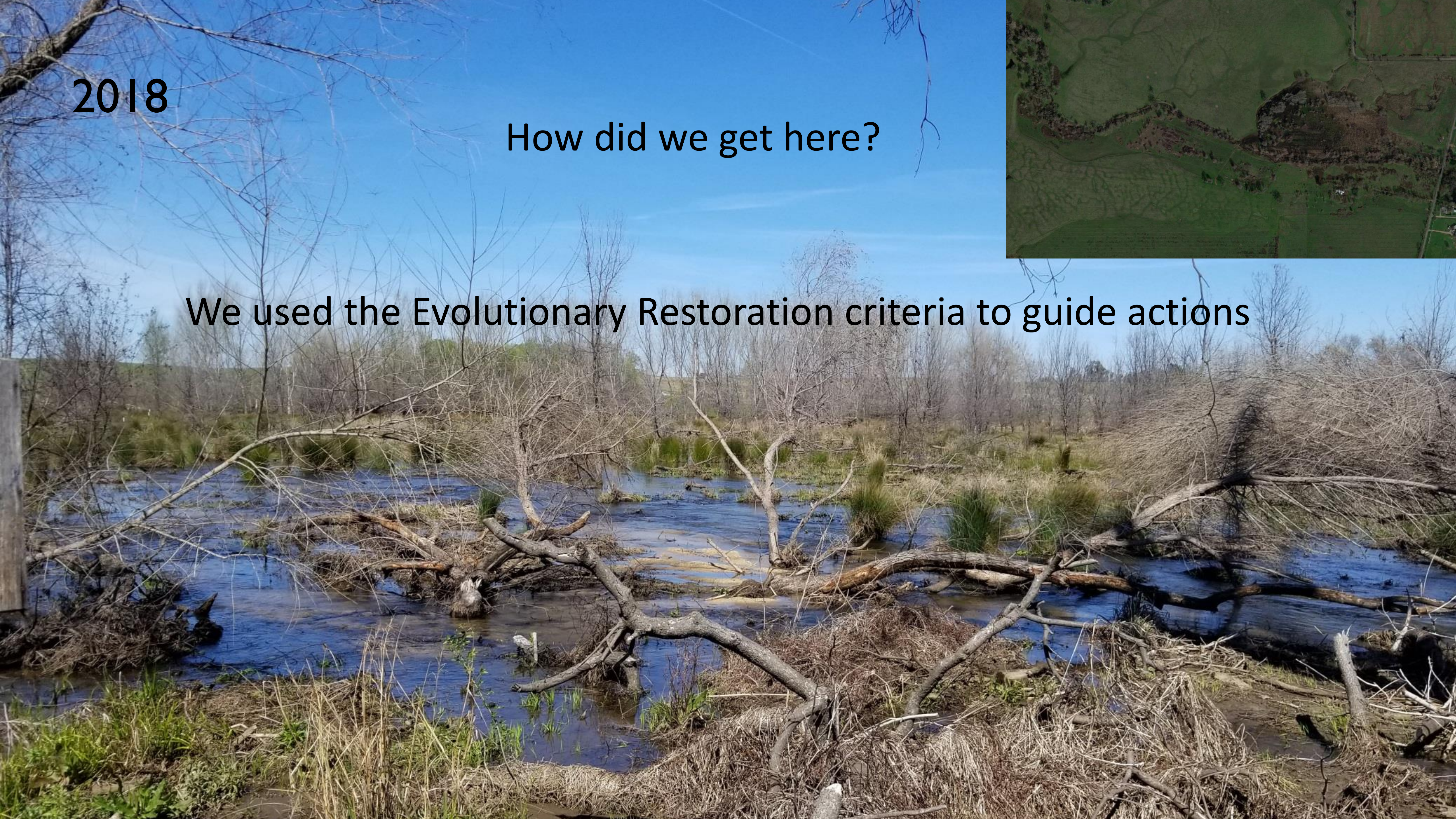

Doty Ravine Floodplain
Merritt Ln
N
W
E
S
0
250
500
1,000
1,500
Feet

2008

Doty Ravine Before

Doty Ravine

2008


2018
How did we get here?
We used the Evolutionary Restoration criteria to guide actions

Evolutionary Restoration Design Criteria

Restores habitats wherein native species and historic channel forms evolved by working with biological and geomorphic processes that evolve the habitat

- **Space**
- Energy
- Material
- Time

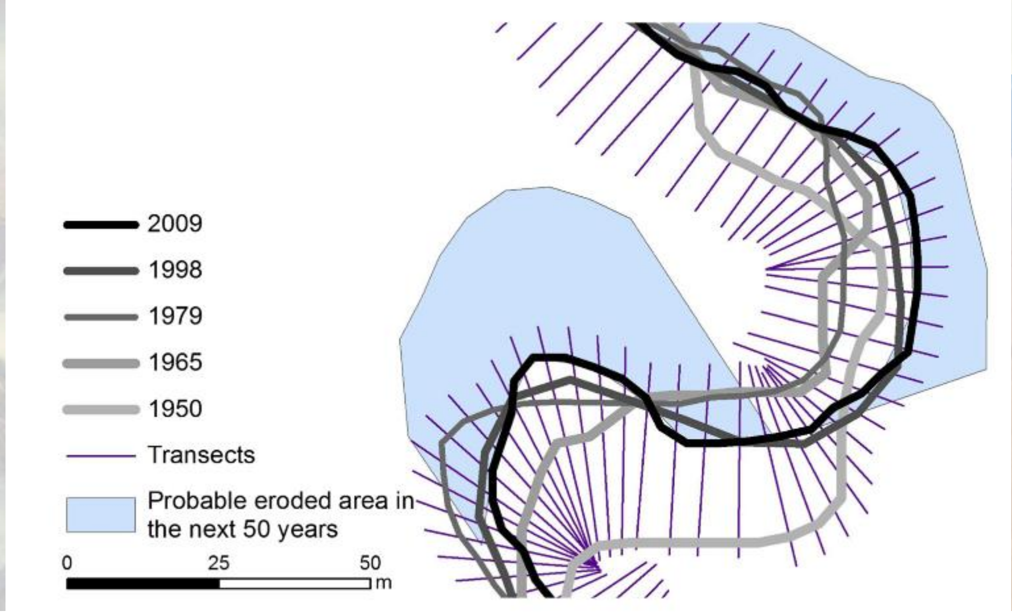
Space
Time
Energy
Material

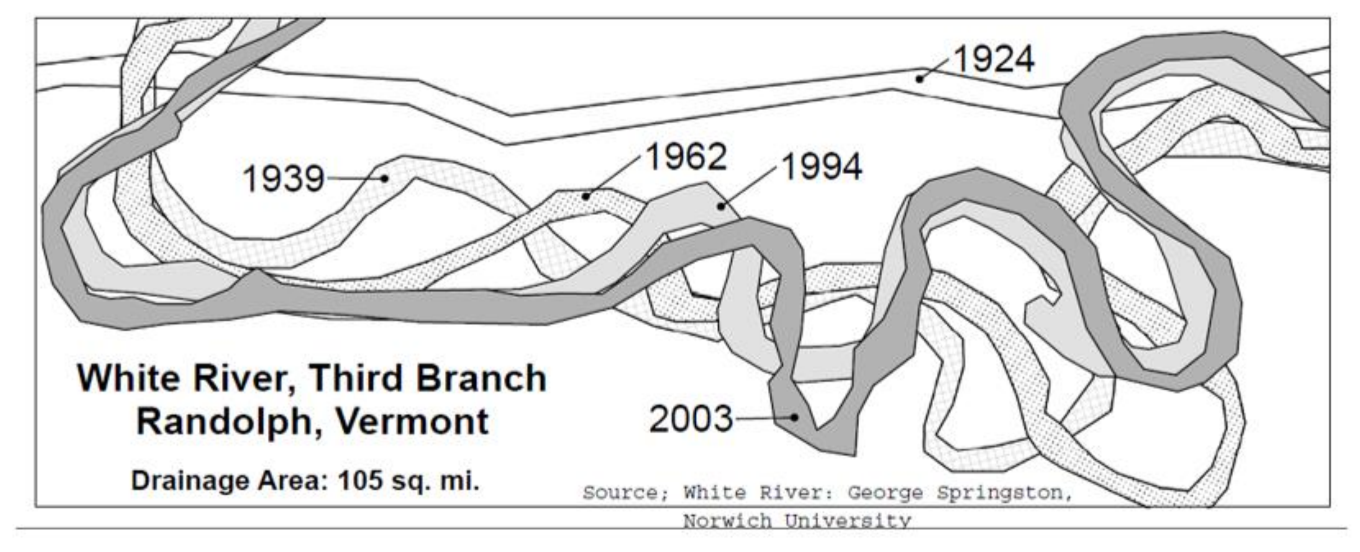
Space is essential for Stage Zero

Fluvial process space is fundamental to river management and restoration

Freedom Space (Espace d’ Liberte)
Room for the River (Ruimte voor de Rivier)
Process Domain
Functional Process Zone
Erodible Corridor
Channel Migration Zone

The floodplain is the river
- Eric Quaempts



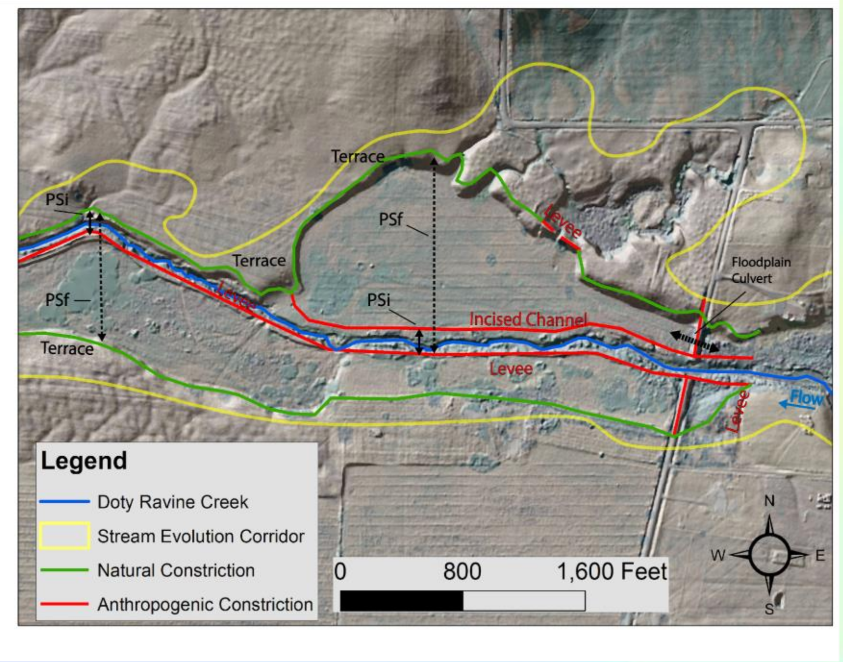


Straightened 1924 river channel regains natural sinuosity and meander migration pattern in subsequent decades.

Space Criterion

Stream Evolution Corridor explicitly emphasizes…

- Stream/floodplain/hillslope interactions
- Lateral space that is part of the river
- Dynamic state through time and space



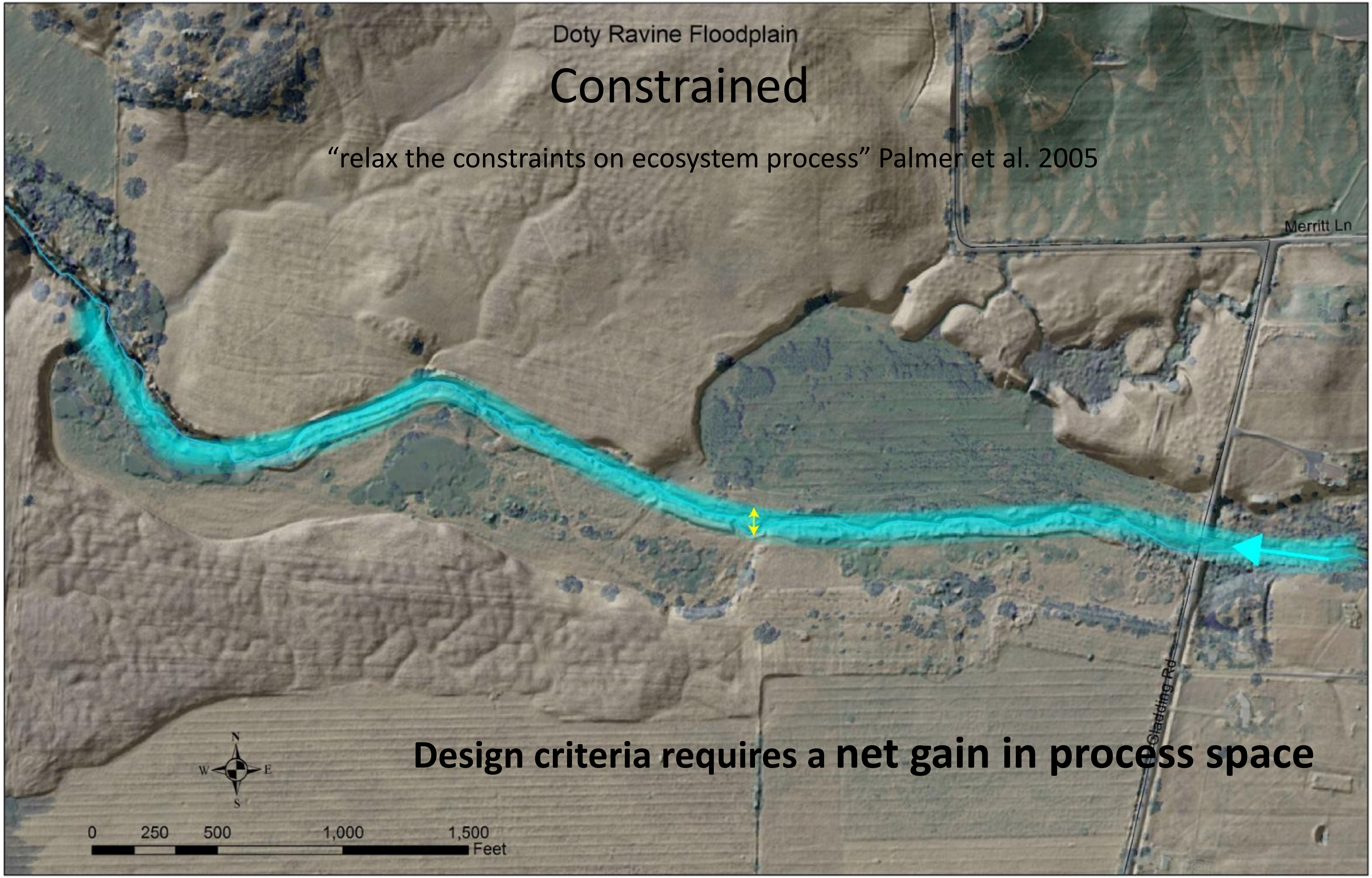
Pre Anthropogenic Influence $PS = PS_i$

Post Anthropogenic Influence $PS_i \ll PS$

Process Space (PS)
Initial Process Space (PS_i)
Final Process Space (PS_f)

Space Criterion $PS_f > PS_i$

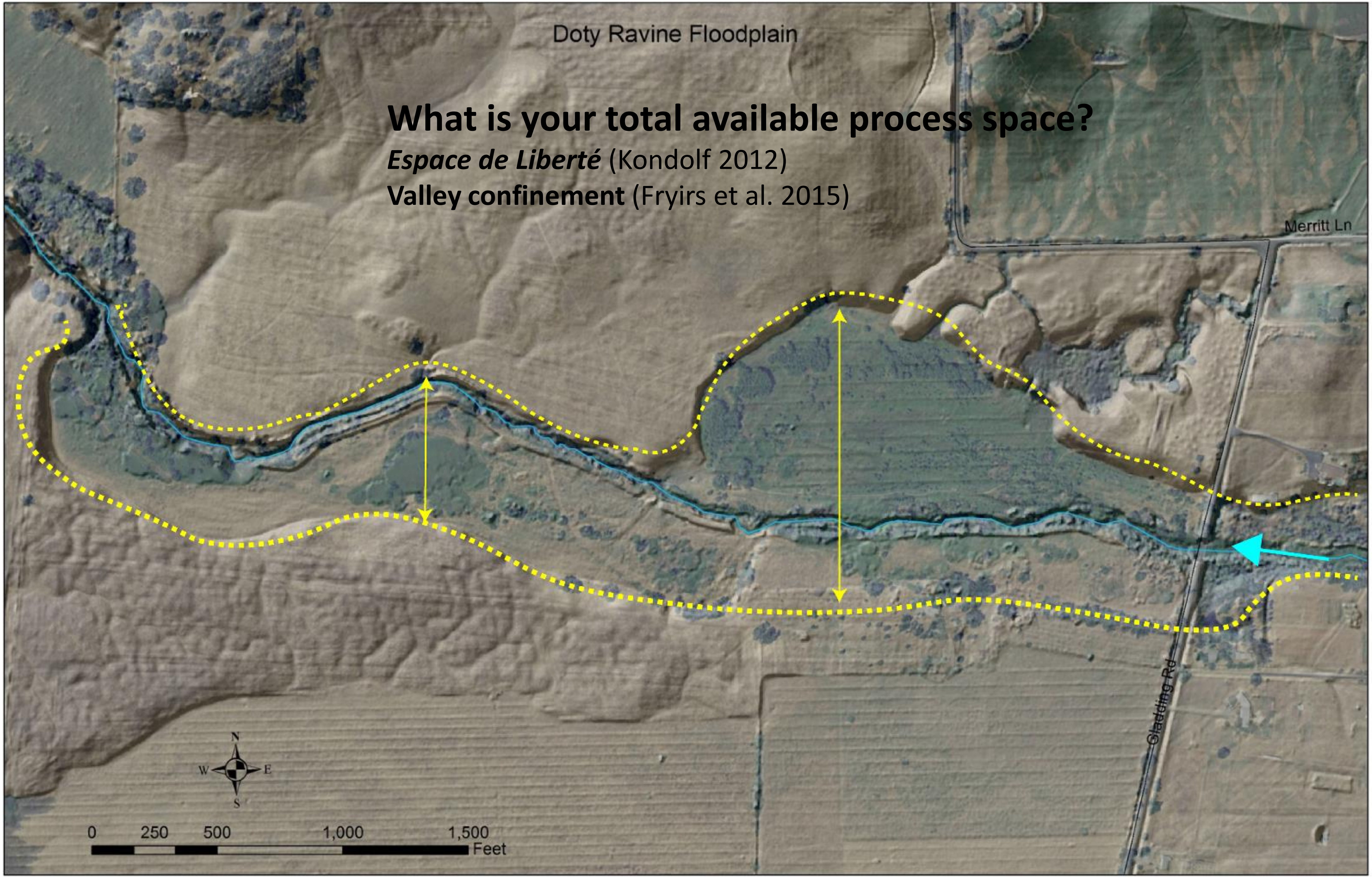
Project meet Space Criterion when Final Process Space is greater than Initial Process Space

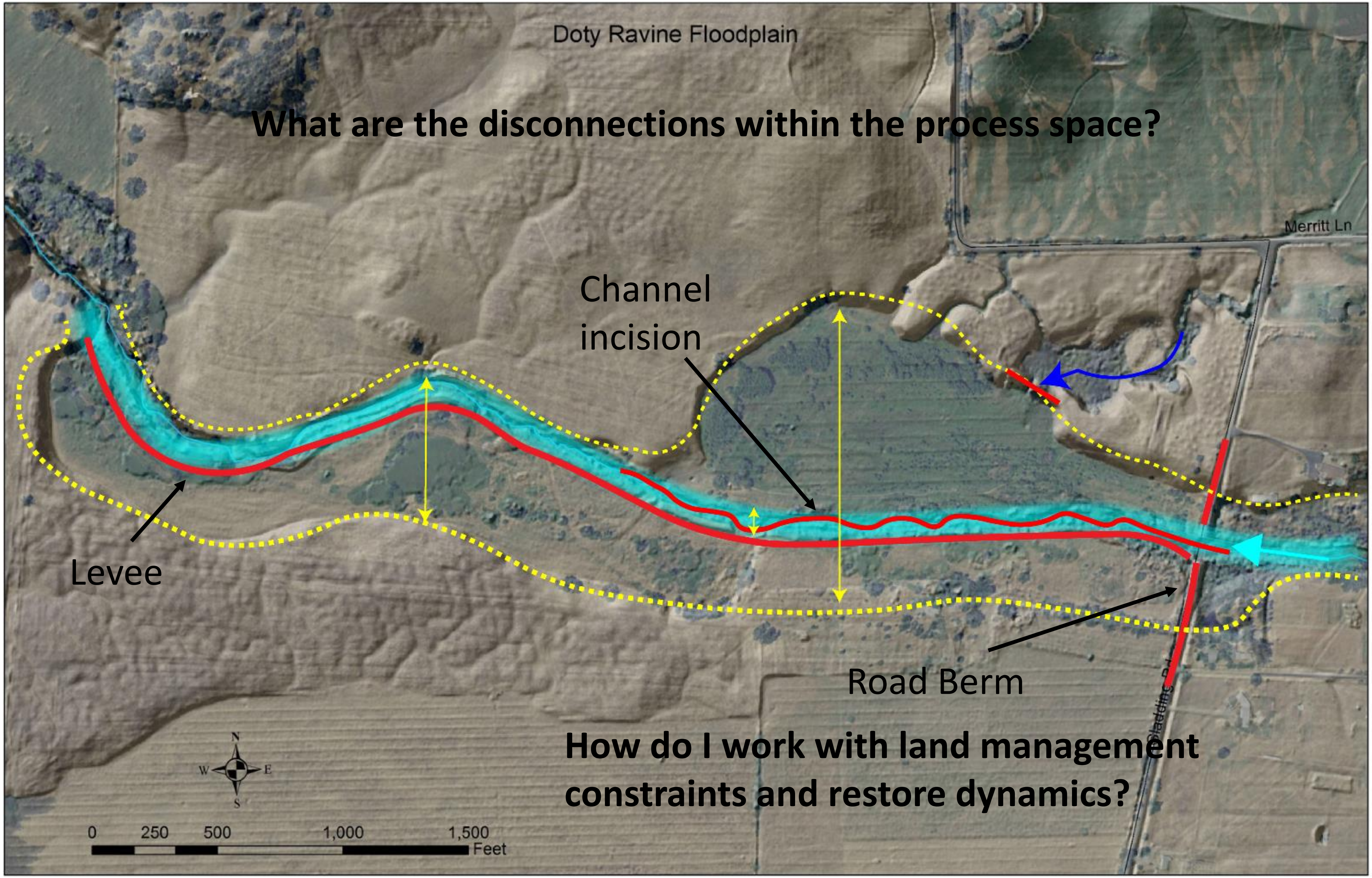

Doty Ravine Floodplain
Constrained
“relax the constraints on ecosystem process” Palmer et al. 2005
Merritt Ln
Gladding Rd
Design criteria requires a net gain in process space
N
W
E
S
0
250
500
1,000
1,500
Feet

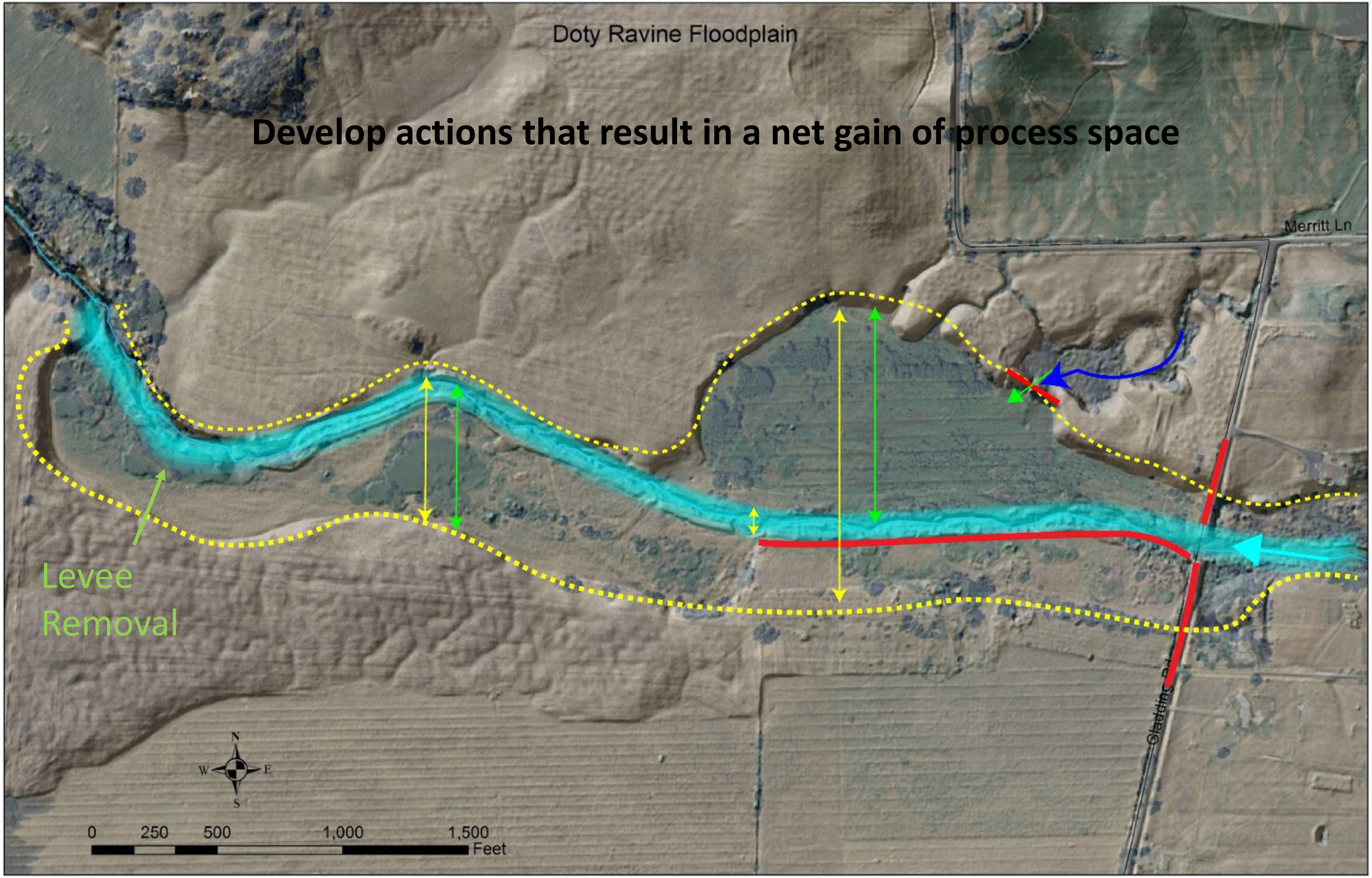
What is your total available process space?

Espace de Liberté (Kondolf 2012)

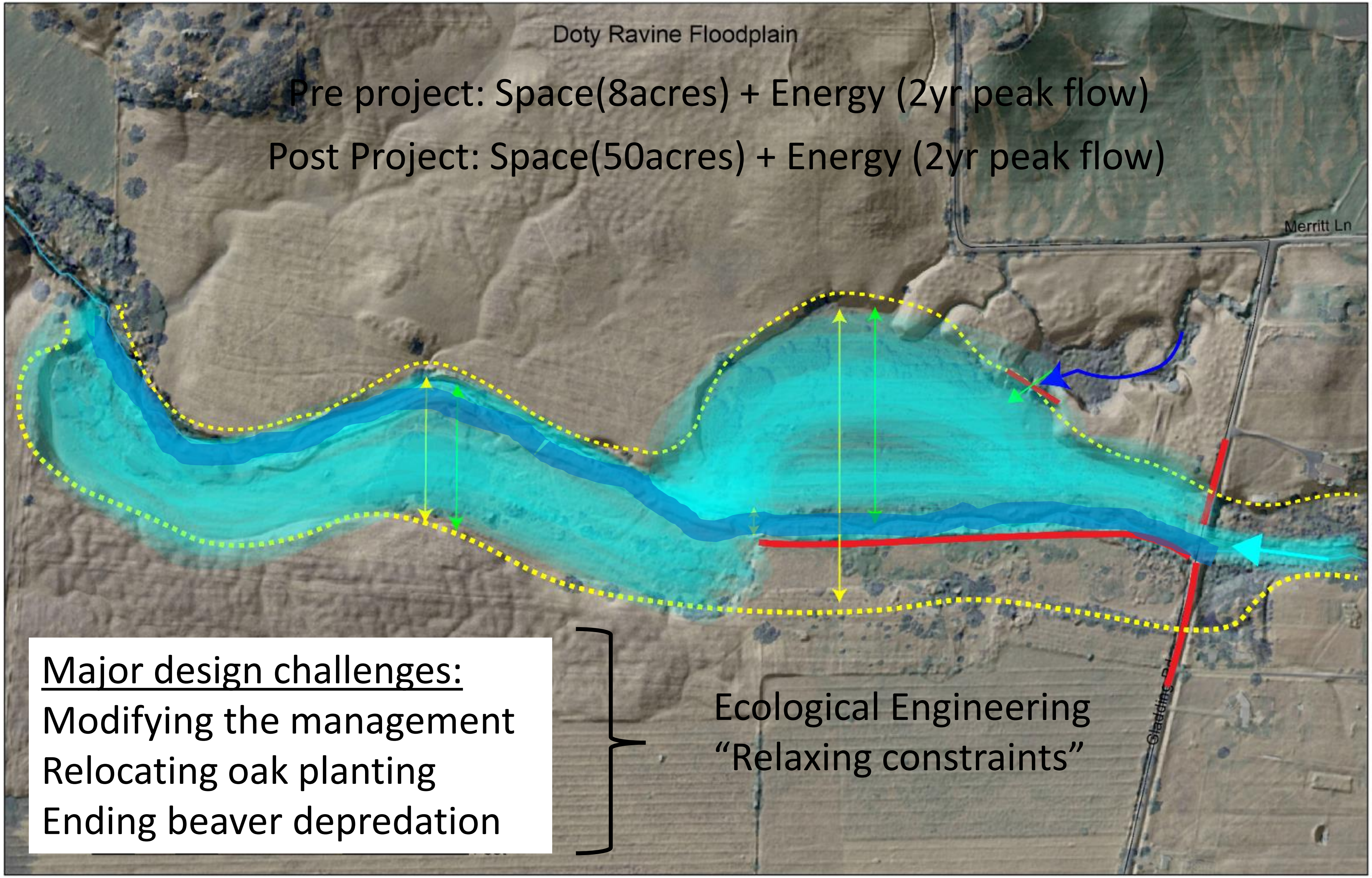
Valley confinement (Fryirs et al. 2015)




Doty Ravine Floodplain
What are the disconnections within the process space?
Merritt Ln
Channel
incision
Levee
Road Berm
How do I work with land management
constraints and restore dynamics?
N
W
E
S
0
250
500
1,000
1,500
Feet



Doty Ravine Floodplain
Develop actions that result in a net gain of process space
Merritt Ln
Levee
Removal
N
W
E
S
0
250
500
1,000
1,500
Feet



Pre project: Space(8acres) + Energy (2yr peak flow)

Post Project: Space(50acres) + Energy (2yr peak flow)

<u>Major design challenges:</u>

Modifying the management

Relocating oak planting

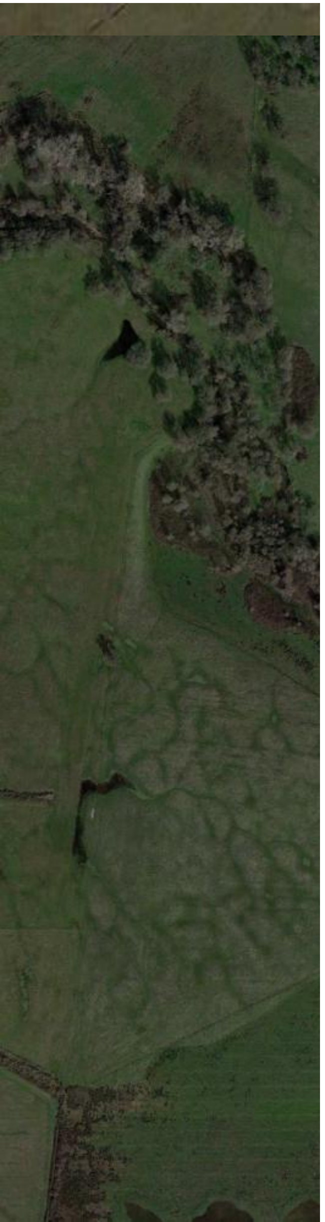
Ending beaver depredation

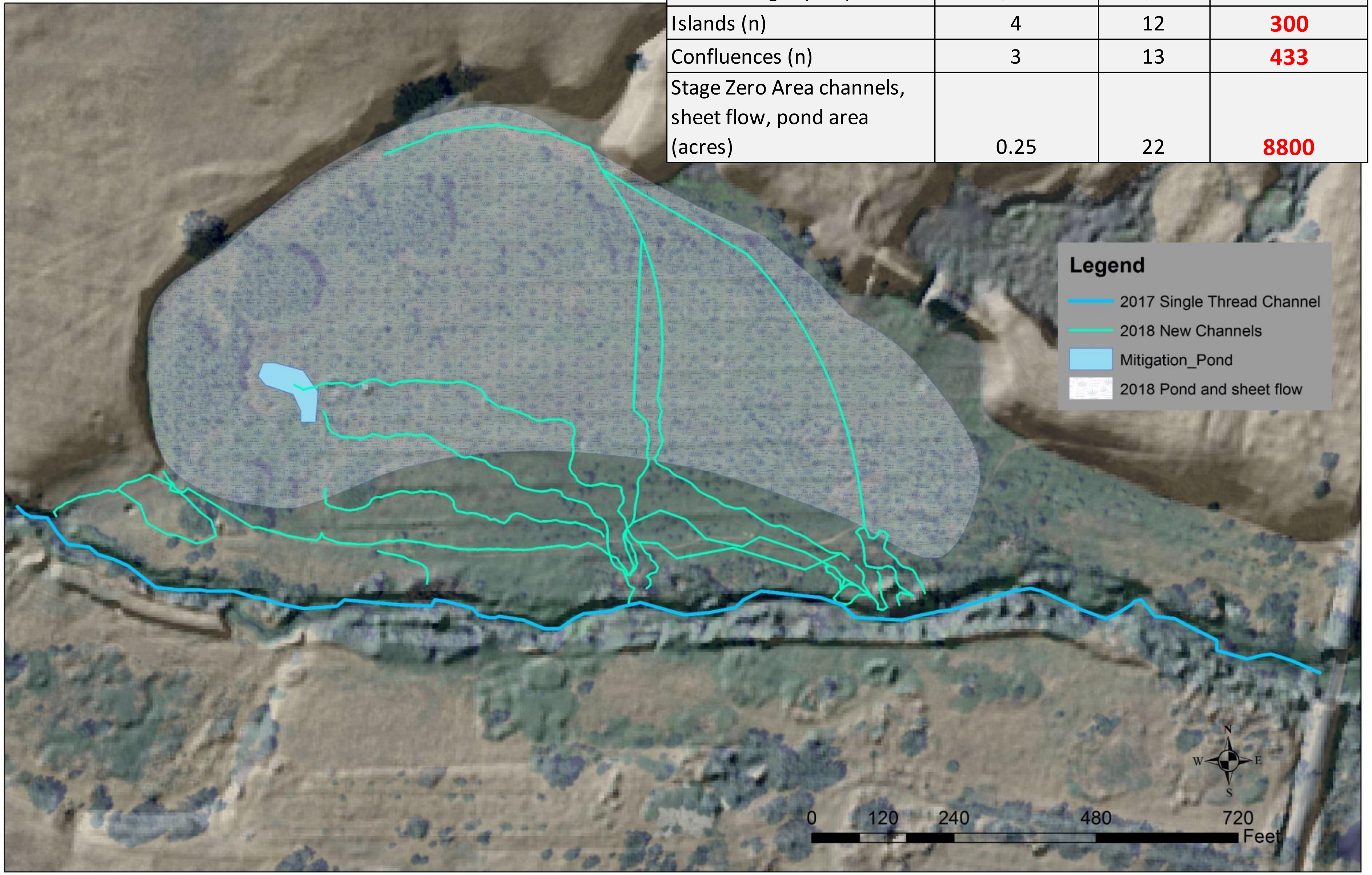
Ecological Engineering

“Relaxing constraints”

Space 2018

Gauging Evolution to Stage Zero			
Habitat Attributes	**2017**	**2018**	**% Increase**
Stream length (feet)	2,383	10,478	**440**
Islands (n)	4	12	**300**
Confluences (n)	3	13	**433**
Stage Zero Area channels, sheet flow, pond area (acres)	0.25	22	**8800**





Evolutionary Restoration Design Criteria

Restores habitats wherein native species and historic channel forms evolved by working with biological and geomorphic processes that evolve the habitat

- Space
- **Energy**
- Material
- Time

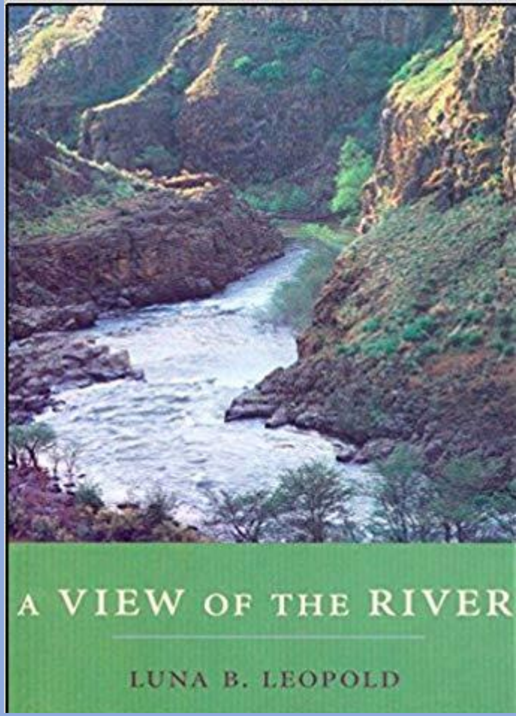
Energy

The work of restoration should come more from stream power than diesel power

- Identify anthropogenic constrictions and disconnections and relax constraints on dynamics (Roni et al. 2002, Palmer 2013)
- Short term immediate manipulation of stream energy is possible with biogenic or other geomorphically appropriate materials to restore roughness, stress partitioning, and overall habitat complexity (Roni et al. 2002, Manga and Kirchner 2000)
  - Adaptive
  - Low cost
  - Effective (Bouwes et al. 2016)
  - Lower disturbance footprint
  - Retain ecological value

Energy

In *A View of the River*, Luna Leopold describes the river as a machine because like any machine it involves **"the transformation of potential energy into kinetic form that accomplishes work in the process"** (Leopold, 1994)



Howard T. Odum

- Defined ecological engineering -
  those cases where the energy supplied by man is small relative to the natural sources but sufficient to produce large effects in the resulting patterns and processes (Odum 1962)
- Developed concept of self design

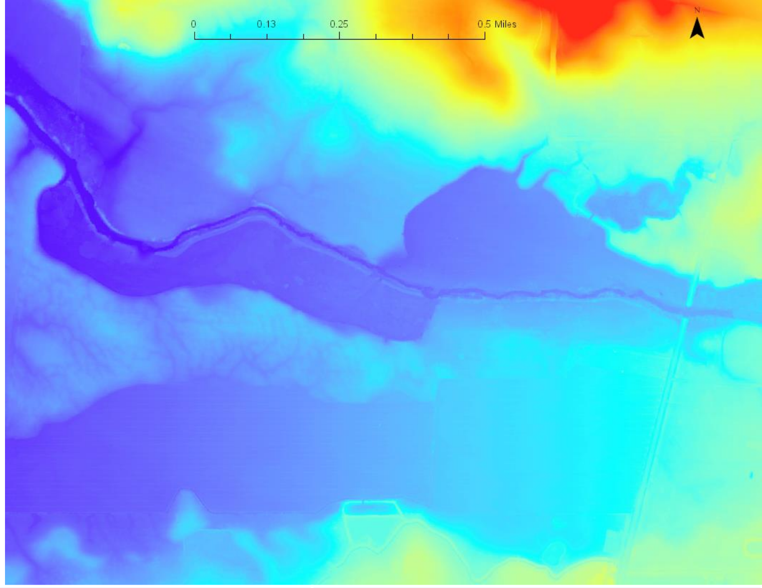
Energy

Skepticism prevails!

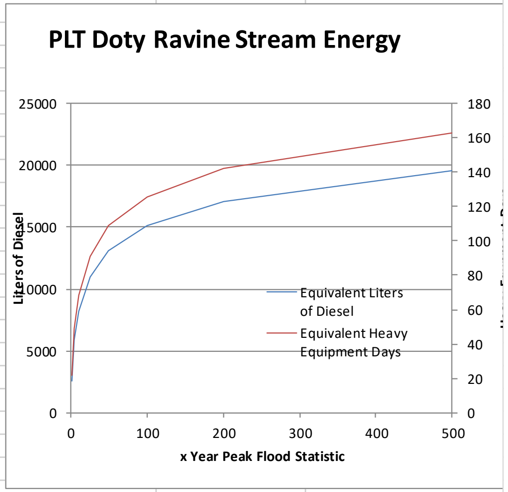
Energy

Communicate inherent stream energy

- Bagnold Stream Power
  - Integrated over reach length and time
- Units Analysis



Inputs	
Constants	
density of water (kg/m^3)	1000
gravity (m/s^2)	9.8
Variables	Metric for Calcs
flow (m^3/s)	0
Slope (m/m)	0.0024
Reach Length (m)	2333
Flood Duration (s)	86400
Conversions	
1 gal = 137452 btu	137452
1055.06 joule/btu	1055.06
1 gal = 3.78541 liter	3.78541
1 gallon of diesel (joules) =	145020107
1 liter of diesel (joules) =	38310277
Assumptions	
Fuel Consumption Rate (gal/hr)	3.170064
Fuel Consumption Rate (l/hr)	12
Work hours per day	10



Statistic	Flow Rate (m^3/s)	Liters of Diesel	Gallons of Diesel	Heavy Equipment Days
2 Year Peak Flood	21	2604	688	22
5 Year Peak Flood	48	5887	1555	49
10 Year Peak Flood	67	8235	2175	69
25 Year Peak Flood	88	10933	2888	91
50 Year Peak Flood	106	13071	3453	109
100 Year Peak Flood	122	15103	3990	126
200 Year Peak Flood	138	17066	4508	142
500 Year Peak Flood	158	19554	5166	163

Statistic	Flow Rate (ft^3/s)	Gallons of Diesel (per flow day)	Equipment Days (per flow day)
2 Year	694	688	22
5 Year	1570	1555	49
10 Year	2200	2175	69
25 Year	2930	2888	91
50 Year	3510	3453	109
100 Year	4060	3990	126
200 Year	4600	4508	142
500 Year	5290	5166	163


Feet

Evolutionary Restoration Design Criteria

Restores habitats wherein native species and historic channel forms evolved by working with biological and geomorphic processes that evolve the habitat

- Space
- Energy
- **Material**
- Time

Material Criterion

Use geomorphically appropriate material for restoration work

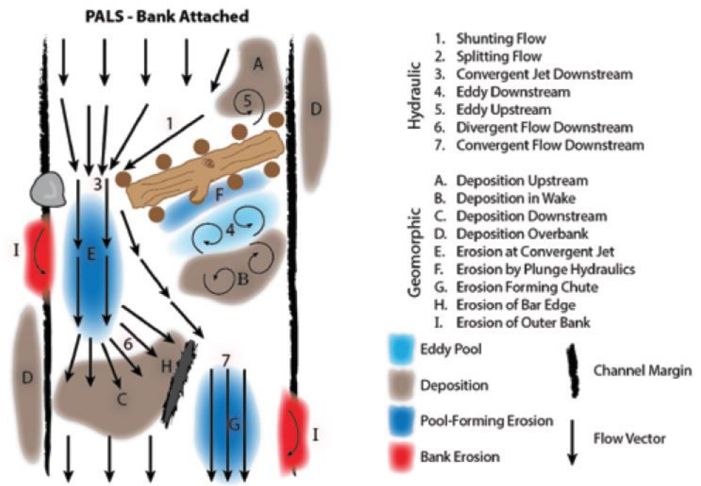
Space
Time
Energy
Material

- Practitioners ask what would naturally occur, form habitat, or create base level control for the project reach
  - North America – Beavers and LW
- Boulder riffles rarely end up in low gradient reaches
- If projects are using material to form habitat that is not geomorphically appropriate then they are asking for trouble

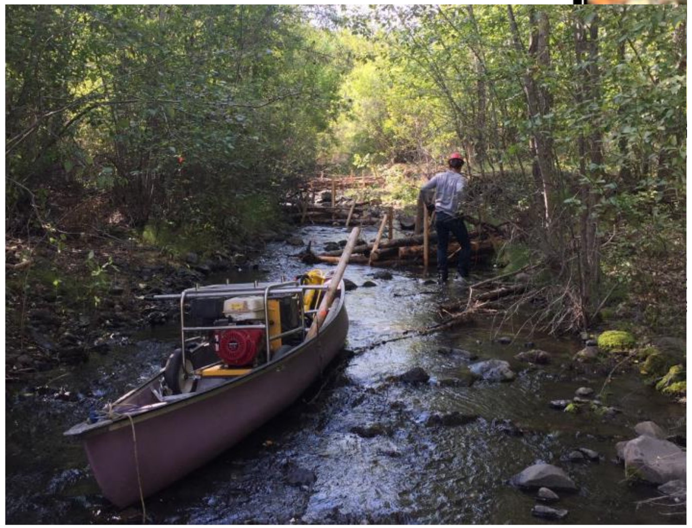
Material

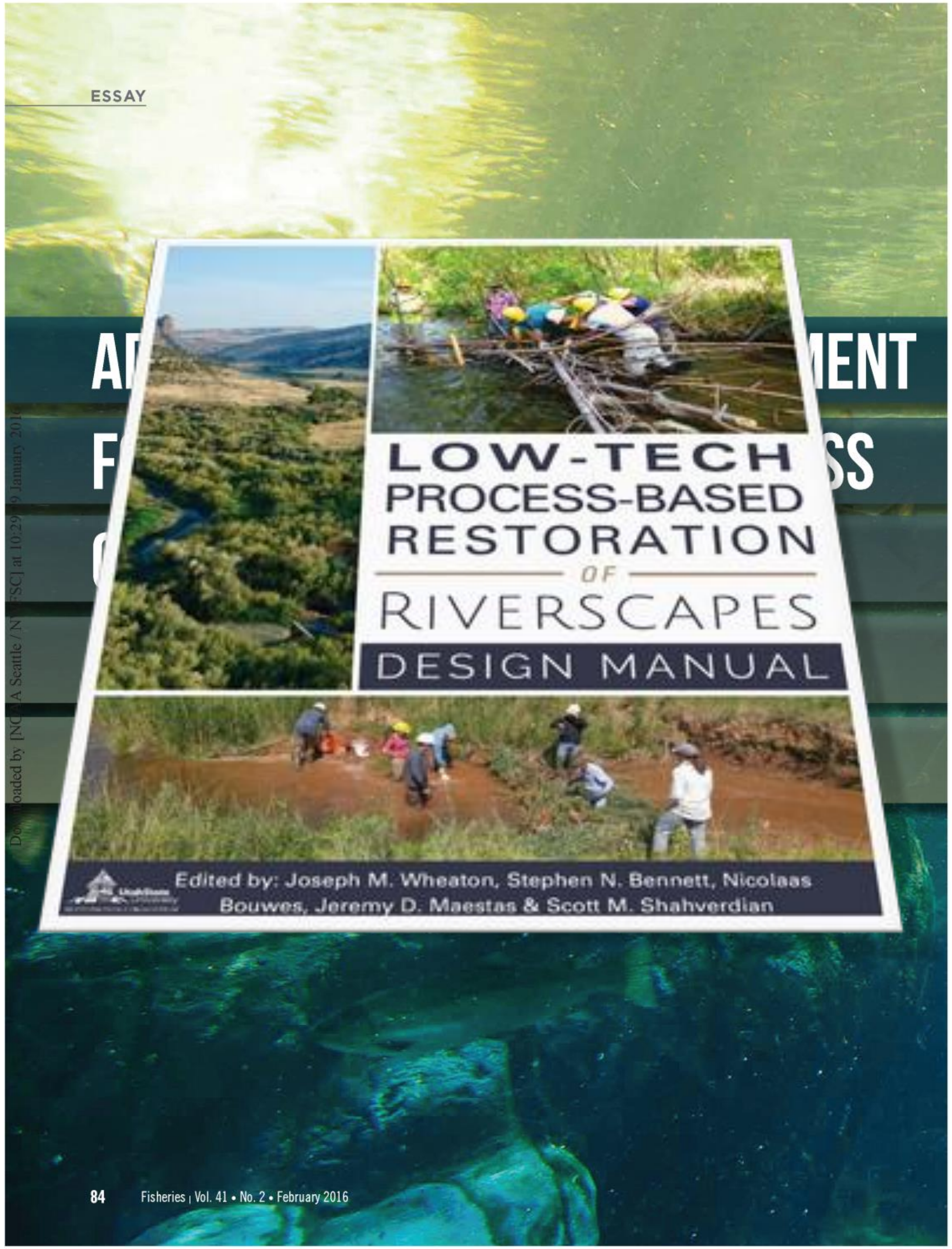
- BDAs
- LT-PBR, one man jams, etc.
- Large Wood
- Sod dams

Get to know your catchment and site



Bouwes et al., 2016





Evolutionary Restoration Design Criteria

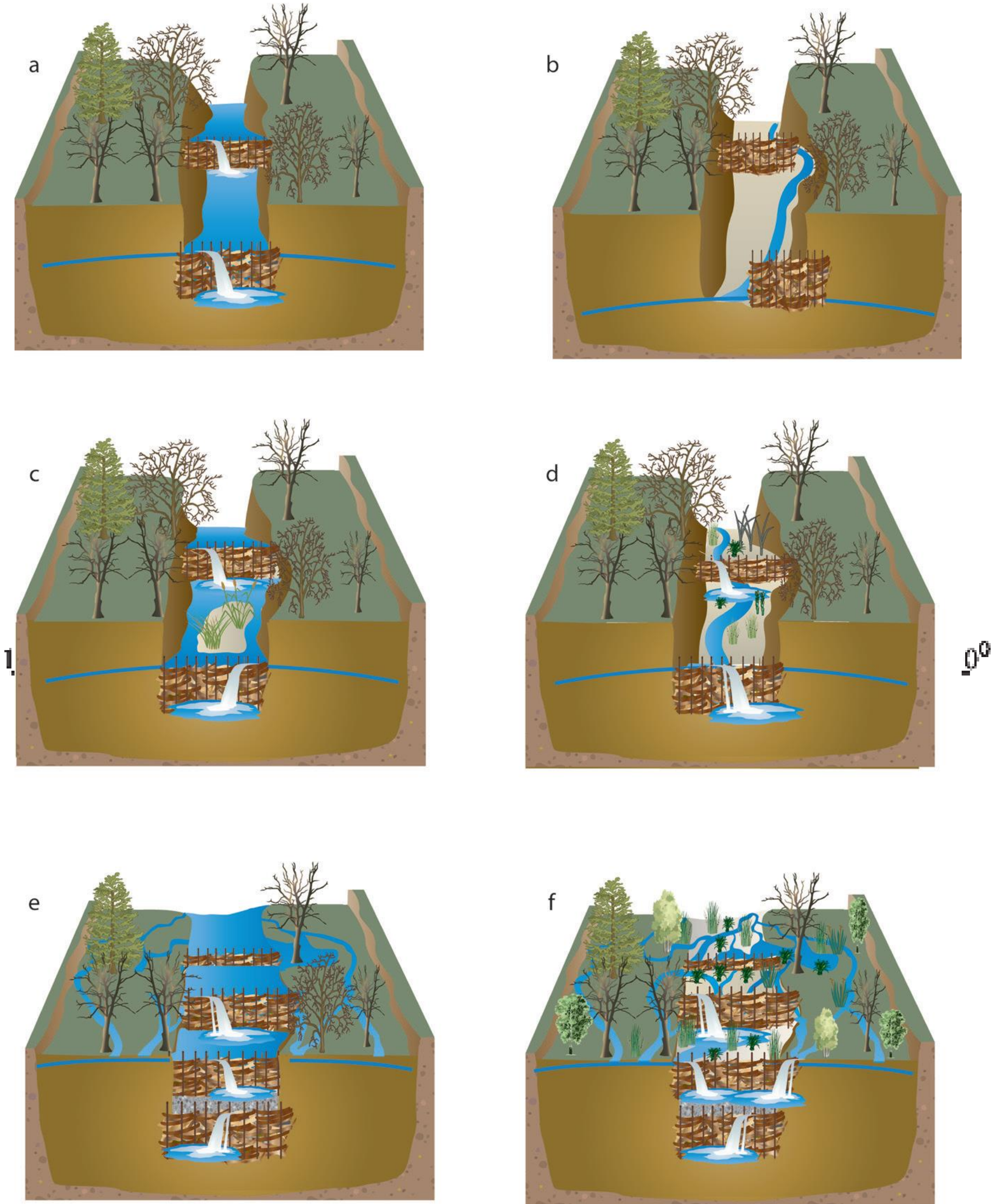
Restores habitats wherein native species and historic channel forms evolved by working with biological and geomorphic processes that evolve the habitat

- Space
- Energy
- Material
- **Time**

Time

Pollock et al. 2014

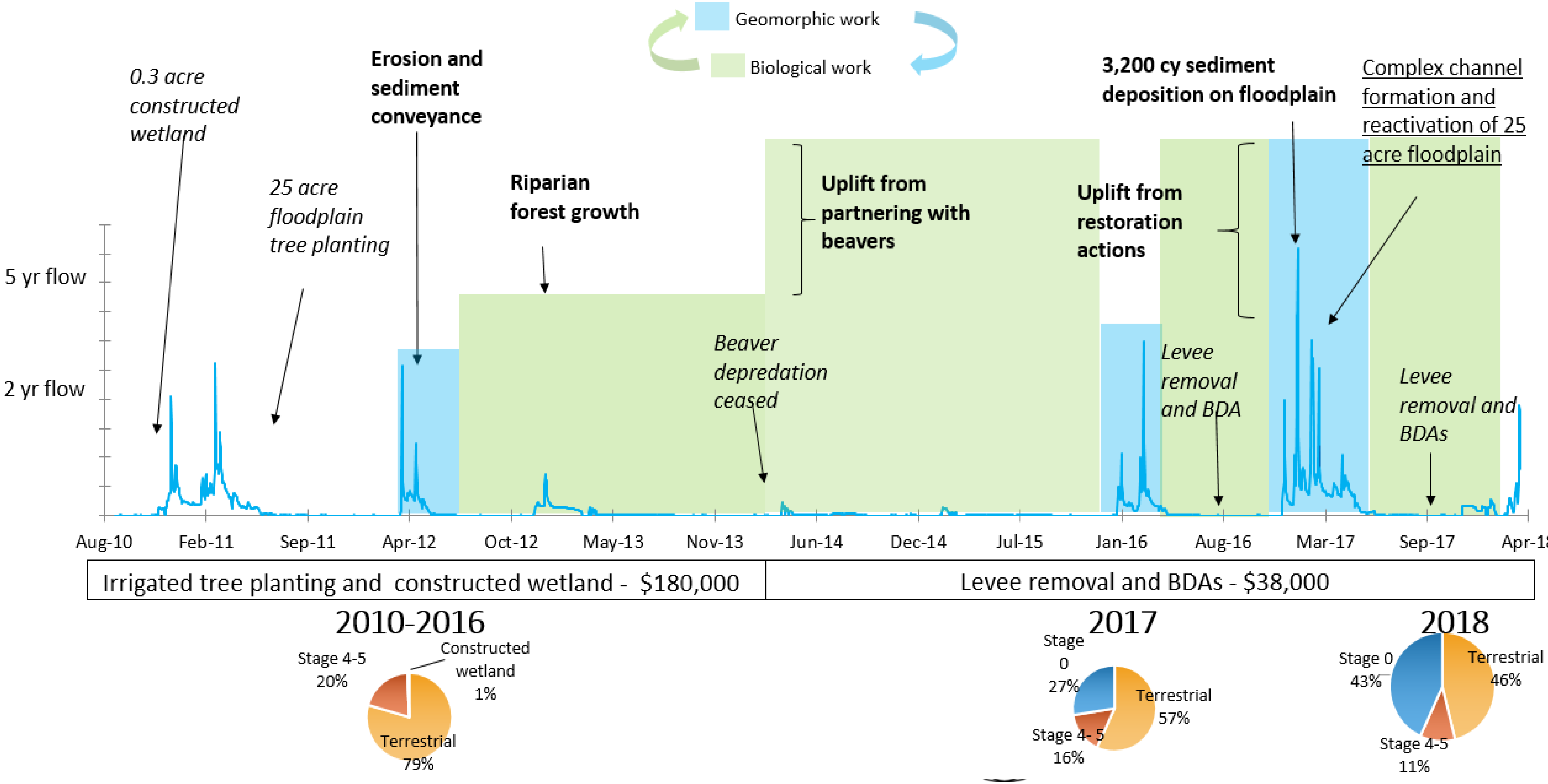
- Strategies that incorporate how features **interact dynamically** with fluvial geomorphic processes are more likely to be successful
- Sufficient restoration may consist of simply **removing the external stressors** that preclude the establishment of riparian vegetation and beaver colonies
- Construction of BDAs or similar structures can **substantially accelerate the recovery of incised streams**

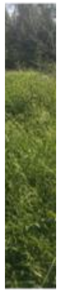


Self-system design
Self system organization (Odum and Odum 2003)
Biogeomorphic work

Bio-geomorphic Recovery Hydrograph

Actions, **Processes**, Results





Summary

The Evolutionary Restoration Criteria…

- … form a simple mental model applicable to all levels of restoration management
- … distill principles from geomorphology, ecology and engineering into tangible guidance for practitioner, stakeholders, funders, permitters and contractors.
- ... promote spatial heterogeneity, connectivity, resilience, and geomorphic and ecological integrity
- … encourage process based solutions to ecological problems.
- … allow work at a meaningful scale and cost efficient manner
- … are not a cookbook, but a lens, shaped from decades of peer reviewed research in a variety of disciplines with which to view restoration projects or programs

Take aways

- Address source problems and reclaim space for the river
    - Remove stressors and let the system do the work
- Defer decision making to natural processes
    - Stream power should do the work of restoration, not diesel
- Structures kickstart processes and are not themselves the solution

CHEAP AND FAST!

Conclusion

- Four criteria provide practitioners with quantitative and prescriptive measures to perform Evolutionary Restoration
- Focuses restoration on promoting habitats and processes wherein native species evolved and thrive
- Increase pace and scale of restoration by working with the inherent geomorphic and biologic self system design

One more thing…

How does this approach fit in with climate change and wildfire?

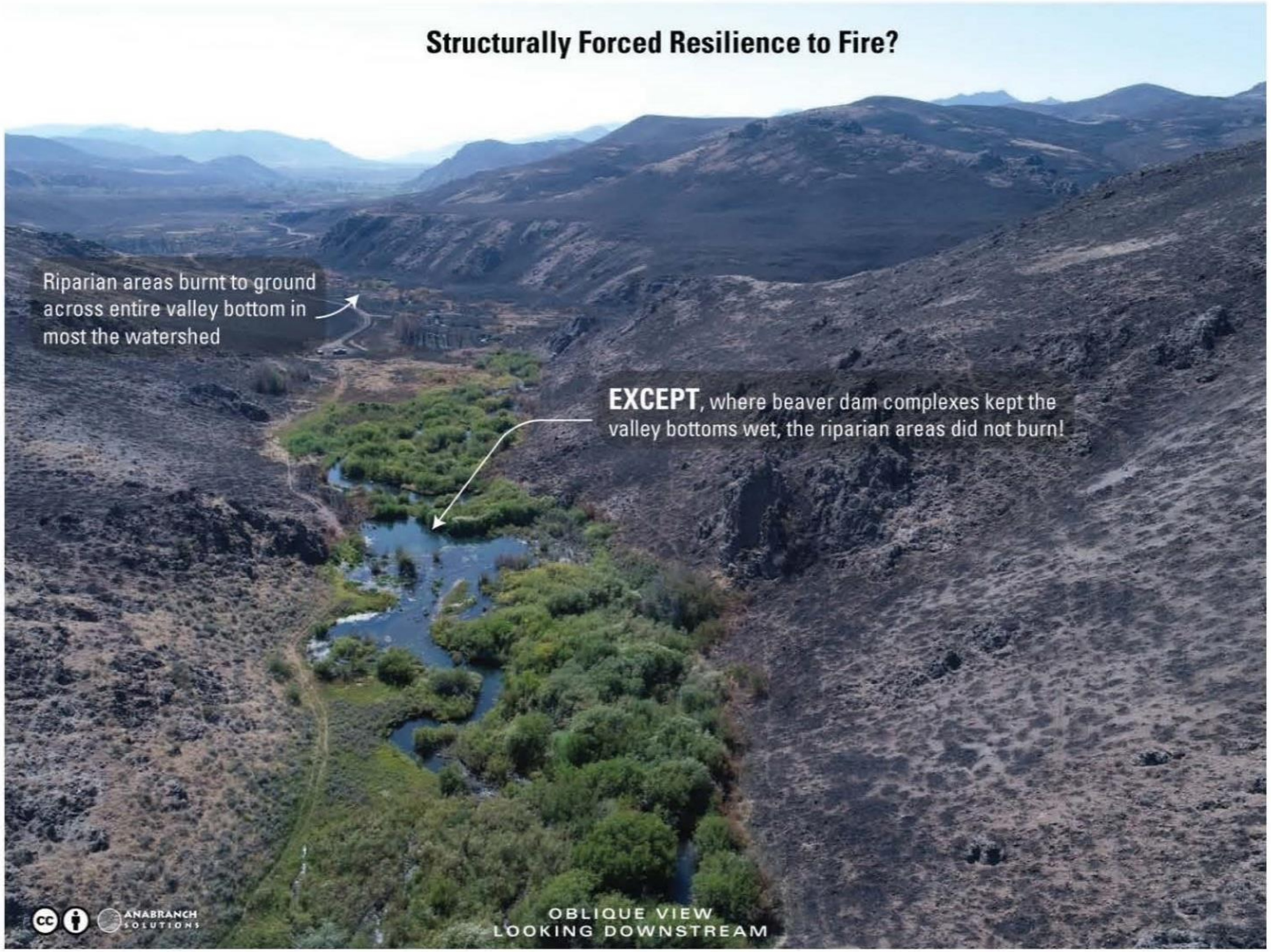


Figure 6 – Example of structurally-forced resilience to fire where beaver dam activity kept parts of the riverscape from burning, providing critical wildlife and livestock refugia during the fire, and assisting in post-fire recovery. Example from Baugh Creek, Idaho.

By Dr. Emily Fairfax
https://youtu.be/IAM94B73bzE

Wheaton J.M., Bennett S.N., Bouwes, N., Maestas J.D. and Shahverdian S.M. (Editors). 2019. Low-Tech Process-Based Restoration of Riverscapes: Design Manual. Version 1.0. Utah State University Restoration Consortium. Logan, UT. 286 pp. DOI: 10.13140/RG.2.2.19590.63049/1.

Take aways

- Address source problems and reclaim space for the river
  - Remove stressors and let the system do the work
- Defer decision making to natural processes
  - Stream power should do the work of restoration, not diesel
- Structures kickstart processes and are not themselves the solution

CHEAP AND FAST!

Restoration Construction: Bridging Muddy Waters-Lessons Learned from the PNW

Matt Koozer, Biohabitats, Portland, OR

Overview:

Valley-Scale projects come with different challenges

We all have a responsibility to lower overall restoration costs

Explore ways to reduce costs by involving contractors early in the design process

Communication: before, during, and after

Stories from the Field

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Johnson Creek Watershed Council

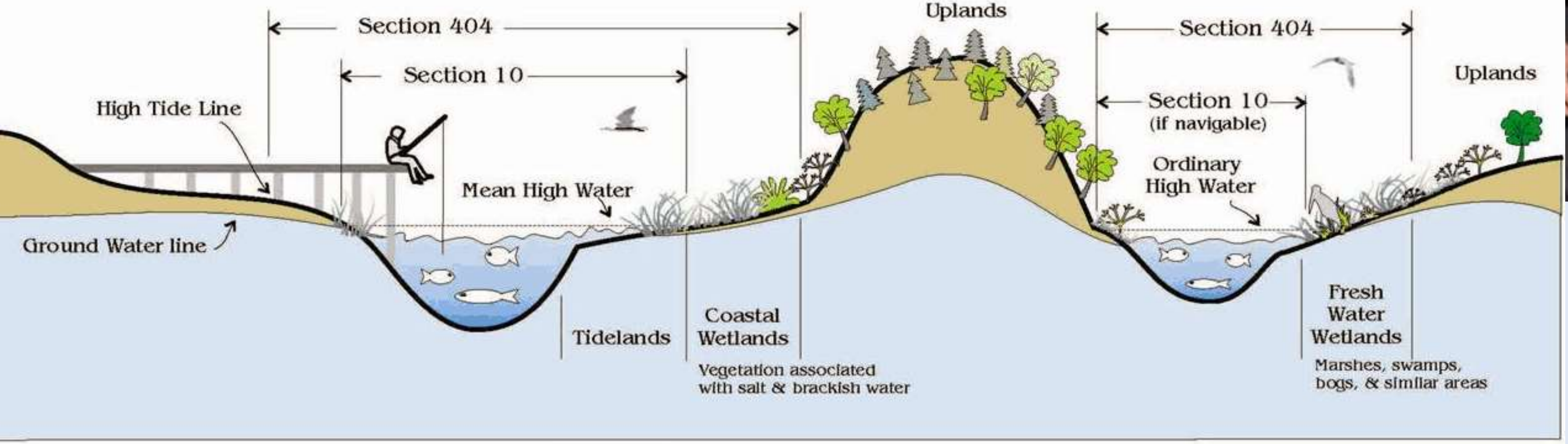
crest
COLUMBIA RIVER ESTUARY STUDY TASKFORCE

Columbia Soil & Water Conservation District
Clean Water, Healthy Earth

Corps of Engineers Regulatory Jurisdiction

Tidal Waters

Fresh Waters



Typical examples of regulated activities

Section 103
Ocean Disposal of Dredged Material

Ocean discharges of dredged material

Section 404
Discharge of Dredged or Fill Material (all waters of the U.S.)

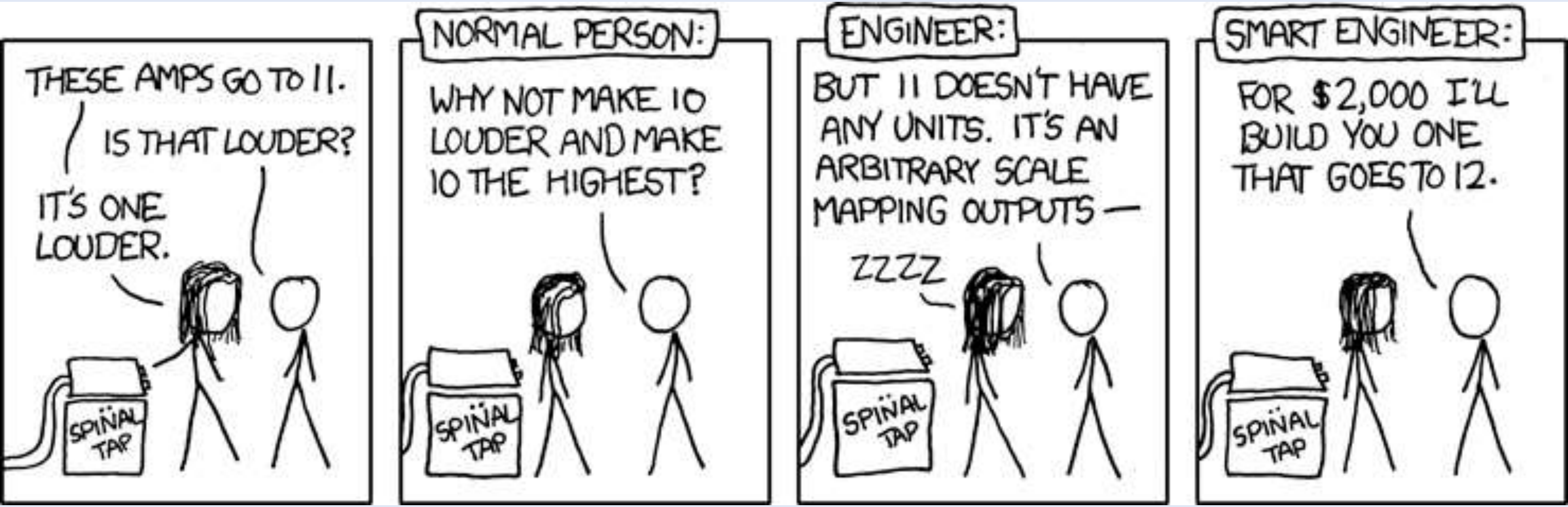
All filling activities, utility lines, outfall structures, road crossings, beach nourishment, riprap, jetties, some excavation activities, etc.

Section 10
All Structures and Work (navigable waters)

Dreding, marinas, piers, wharves, floats, intake / outtake pipes, pilings, bulkheads, ramps, fills, overhead transmission lines, etc.

State of Oregon
DEQ
Department of Environmental Quality

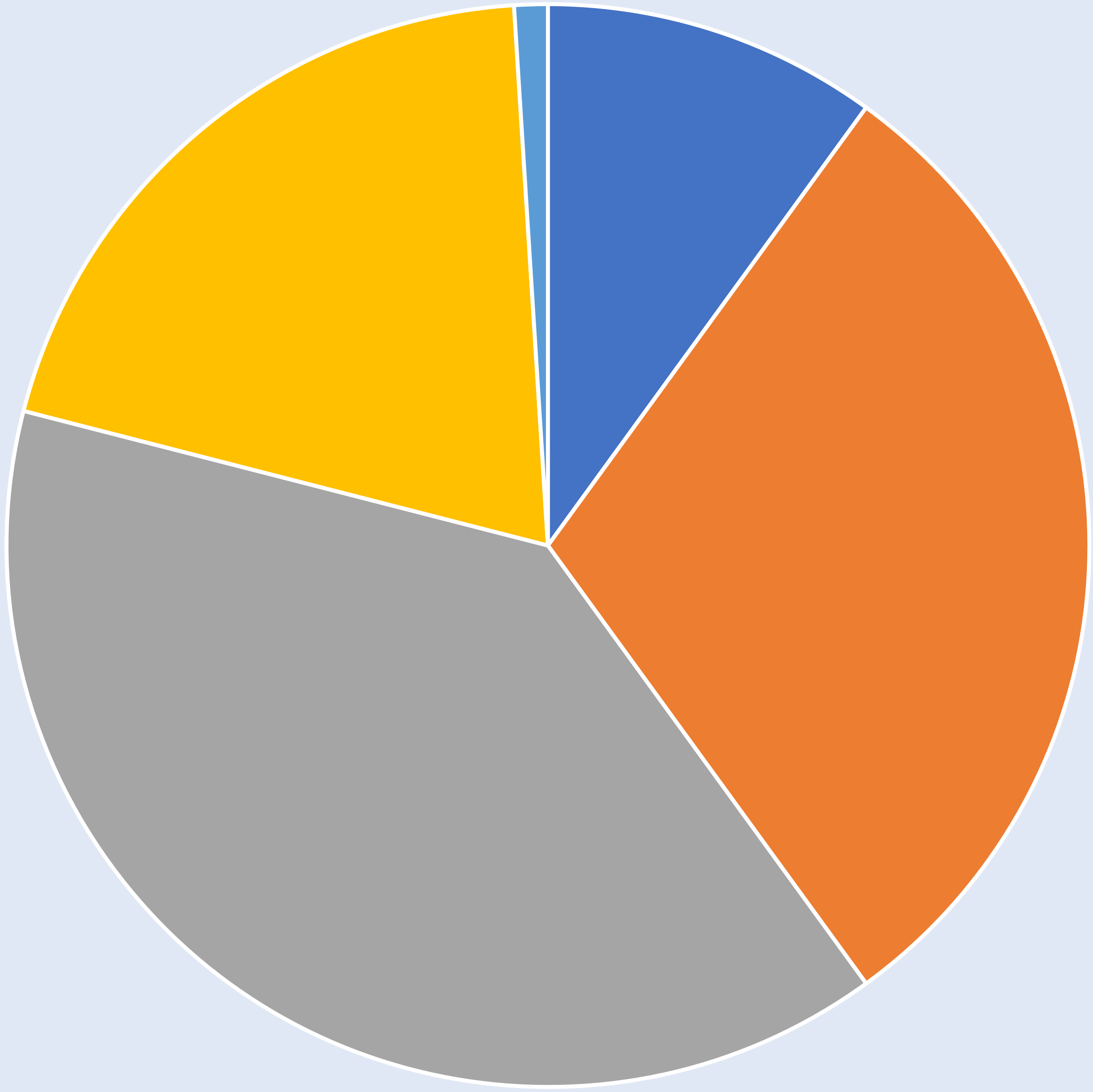

I'M NOT
A NERD
I'm just smarter
than you

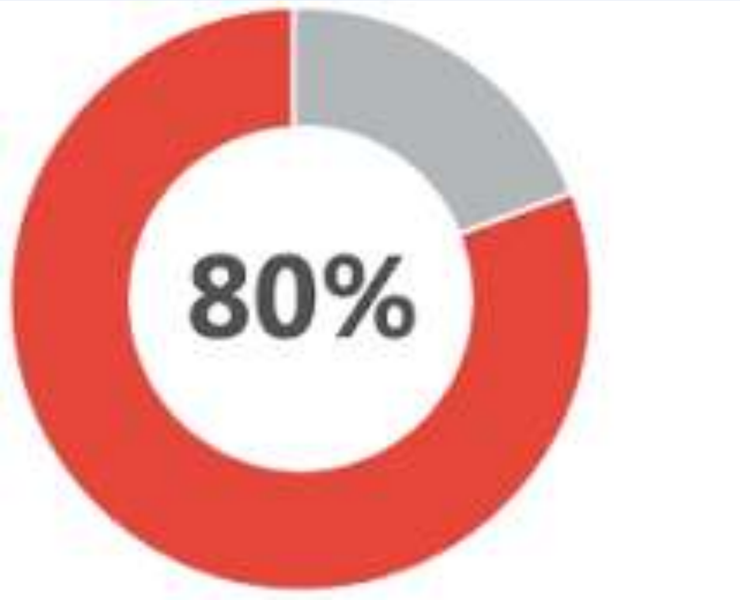

THESE AMPS GO TO 11.
IS THAT LOUDER?
IT'S ONE LOUDER.
SPINAL TAP
NORMAL PERSON:
WHY NOT MAKE 10 LOUDER AND MAKE 10 THE HIGHEST?
SPINAL TAP
ENGINEER:
BUT 11 DOESN'T HAVE ANY UNITS. IT'S AN ARBITRARY SCALE MAPPING OUTPUTS —
ZZZZ
SPINAL TAP
SMART ENGINEER:
FOR $2,000 I'LL BUILD YOU ONE THAT GOES TO 12.
SPINAL TAP

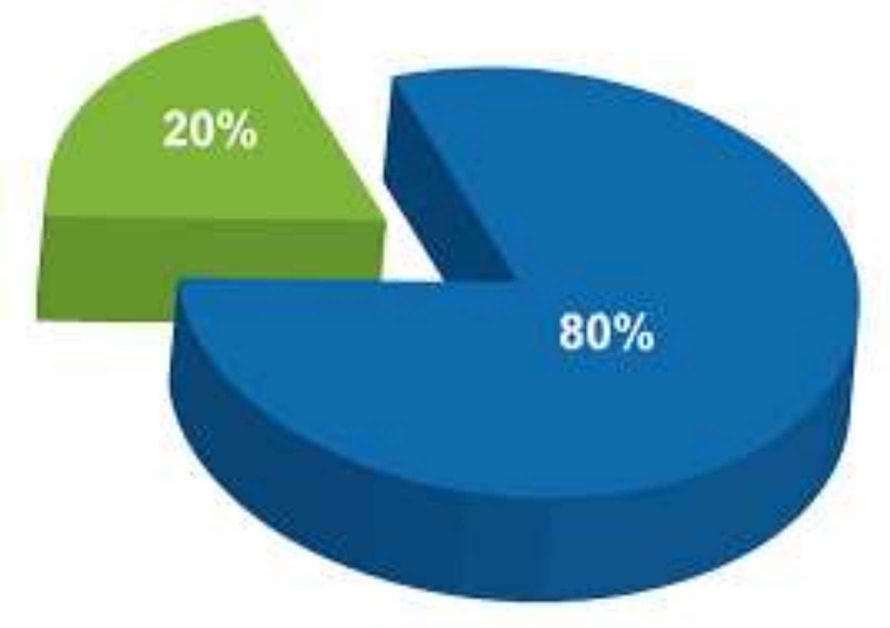

Trust me I'm a
"BIOLOGIST"

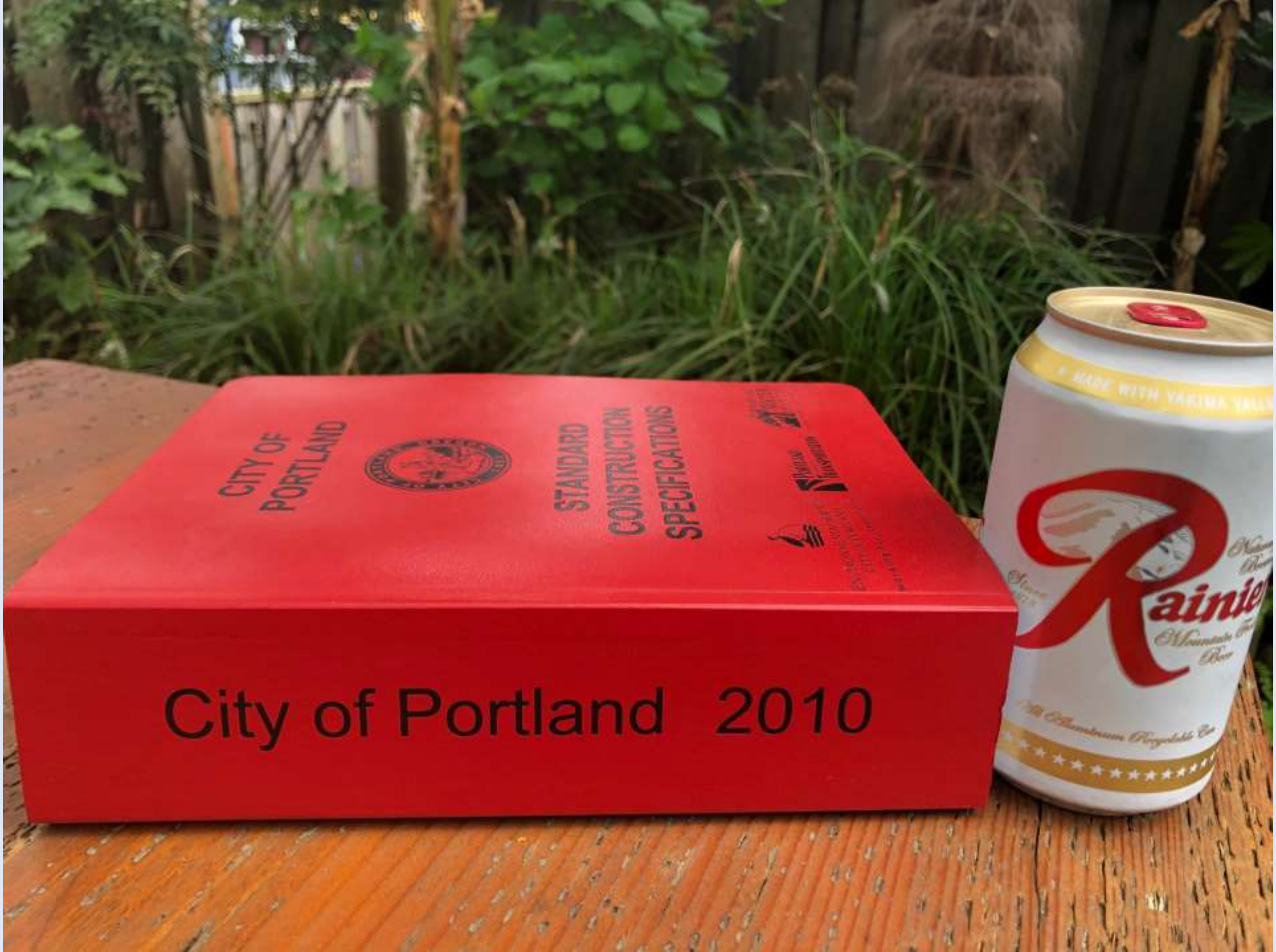



N185CH


80%


20%
80%



CITY OF PORTLAND
STANDARD CONSTRUCTION SPECIFICATIONS
City of Portland 2010
Rainier


PROFIT
RISK
LOSS


JCB

)ischarge, cubic feet per second

/ost recent instantaneous value:

27 09-20-2017   18:45 PDT

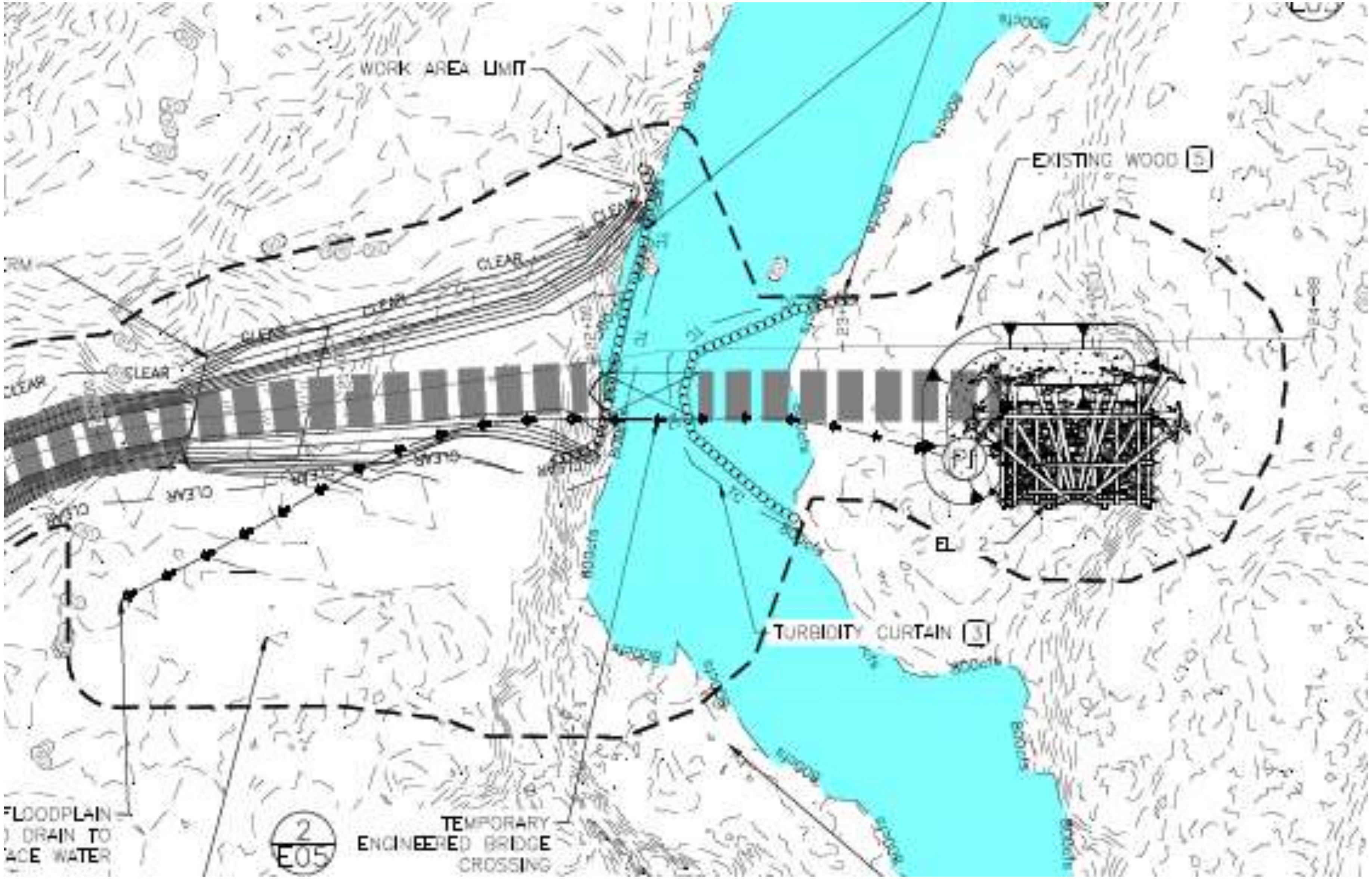
Dear people who take tree
down, I am very Disapont
that you are taking my
fayroit trees down. you cant
take them down. I wont
let you do it. Those trees are
so special special to me that
I will do so much stuff for
Them. The trees that im
writing about are the trees
and plants that have white
plastic thingy flags things on
them. If you are wondering
who I will look like I will
be the little girl who has
a very mad/dissapointed face
and ripped silver shoes and a
dirty blond messy bun

Sincerly
true.

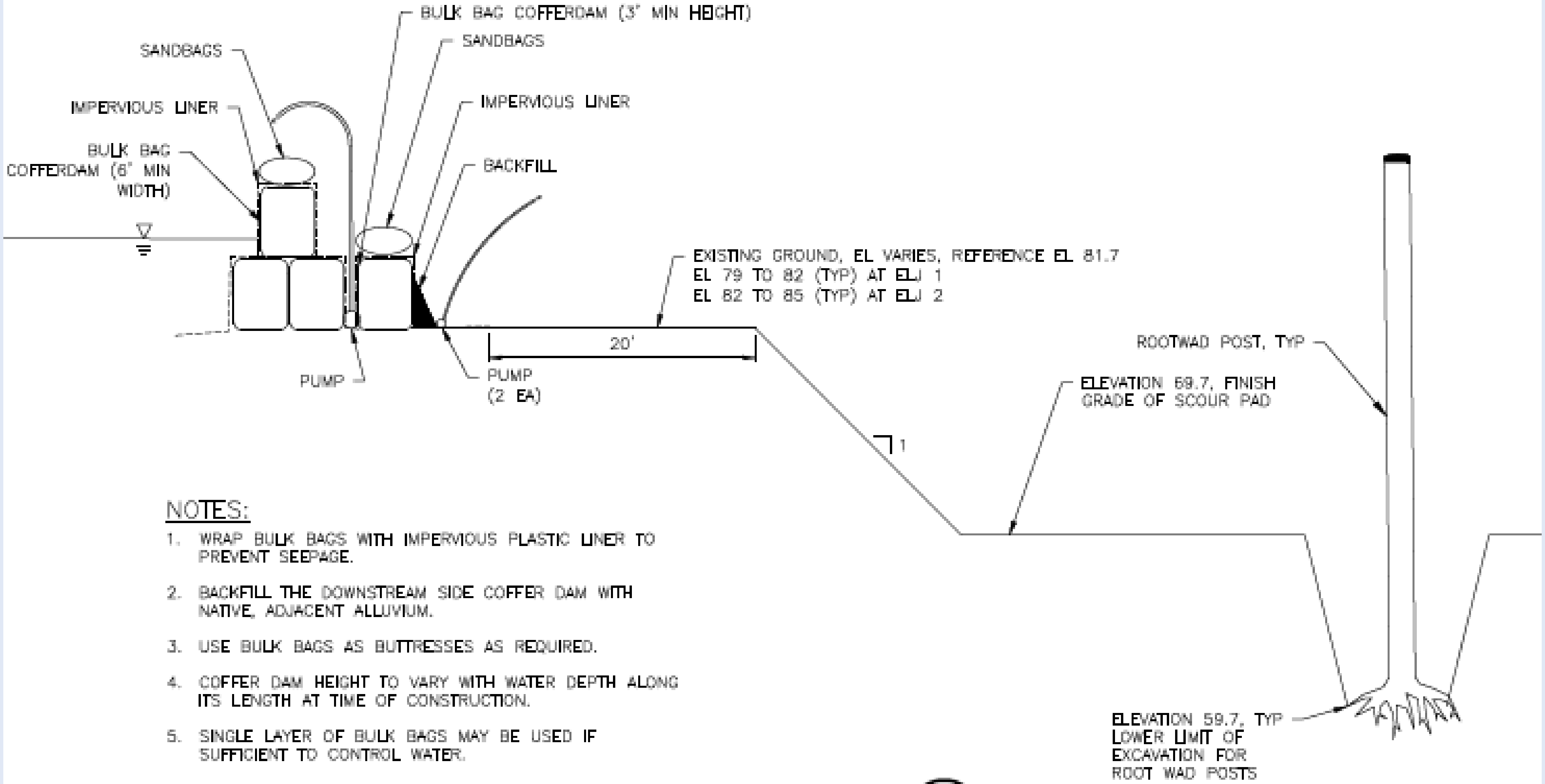
my adress and
phone # is 503-619
6207 7520 SW bonita
Rd #3 Tigird 97224

P.S. you won't take the
trees and plants down!!!!!!


Photo: Burke Strobel, Portland Water Bureau



WORK AREA LIMIT
EXISTING WOOD 5
CLEAR
TURBIDITY CURTAIN 3
EL 2
FLOODPLAIN
DRAIN TO
ACE WATER
TEMPORARY
ENGINEERED BRIDGE
CROSSING
2
E05



NOTES:

1. WRAP BULK BAGS WITH IMPERVIOUS PLASTIC LINER TO PREVENT SEEPAGE.
2. BACKFILL THE DOWNSTREAM SIDE COFFER DAM WITH NATIVE, ADJACENT ALLUVIUM.
3. USE BULK BAGS AS BUTTRESSES AS REQUIRED.
4. COFFER DAM HEIGHT TO VARY WITH WATER DEPTH ALONG ITS LENGTH AT TIME OF CONSTRUCTION.
5. SINGLE LAYER OF BULK BAGS MAY BE USED IF SUFFICIENT TO CONTROL WATER.

BULK BAG COFFERDAM 1/E02

NOT TO SCALE

Photo: Wolf Water Resources

Photo: Wolf Water Resources

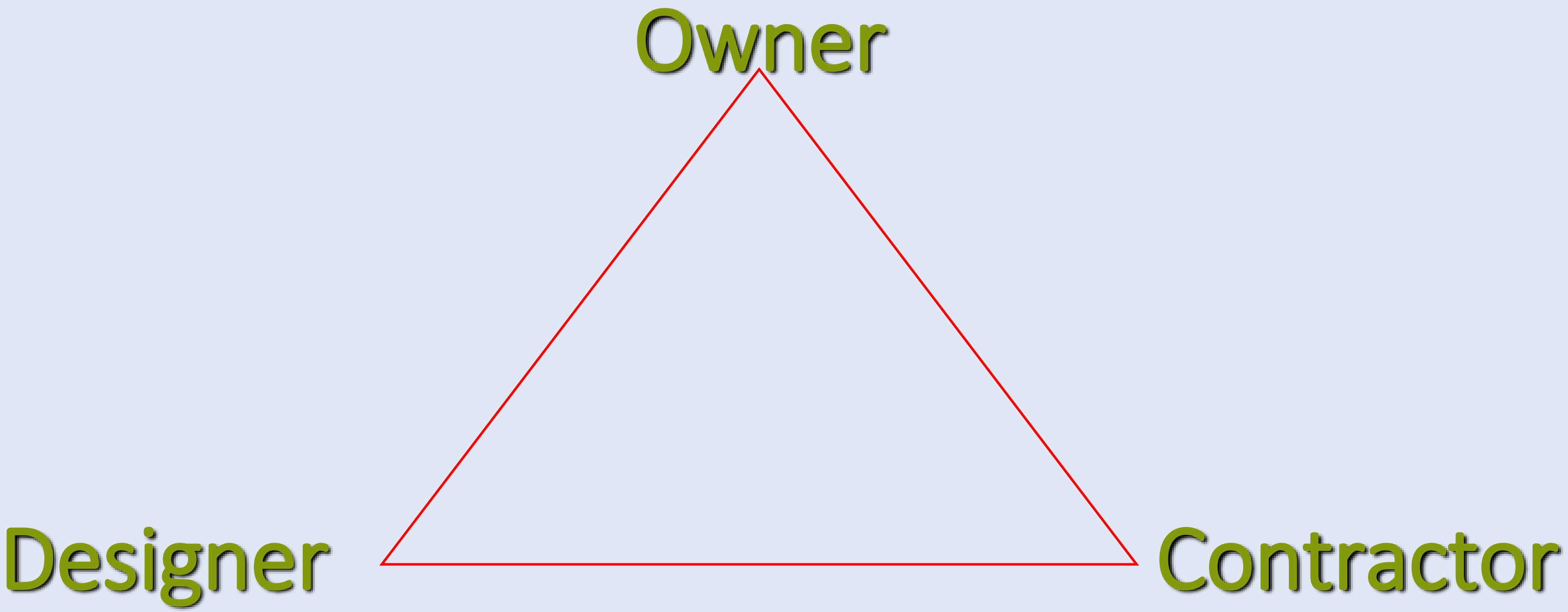

¡BOATERS BEWARE!
¡BOATERS BEWARE!


DEERE


WATER
PORTLAND


Change Order

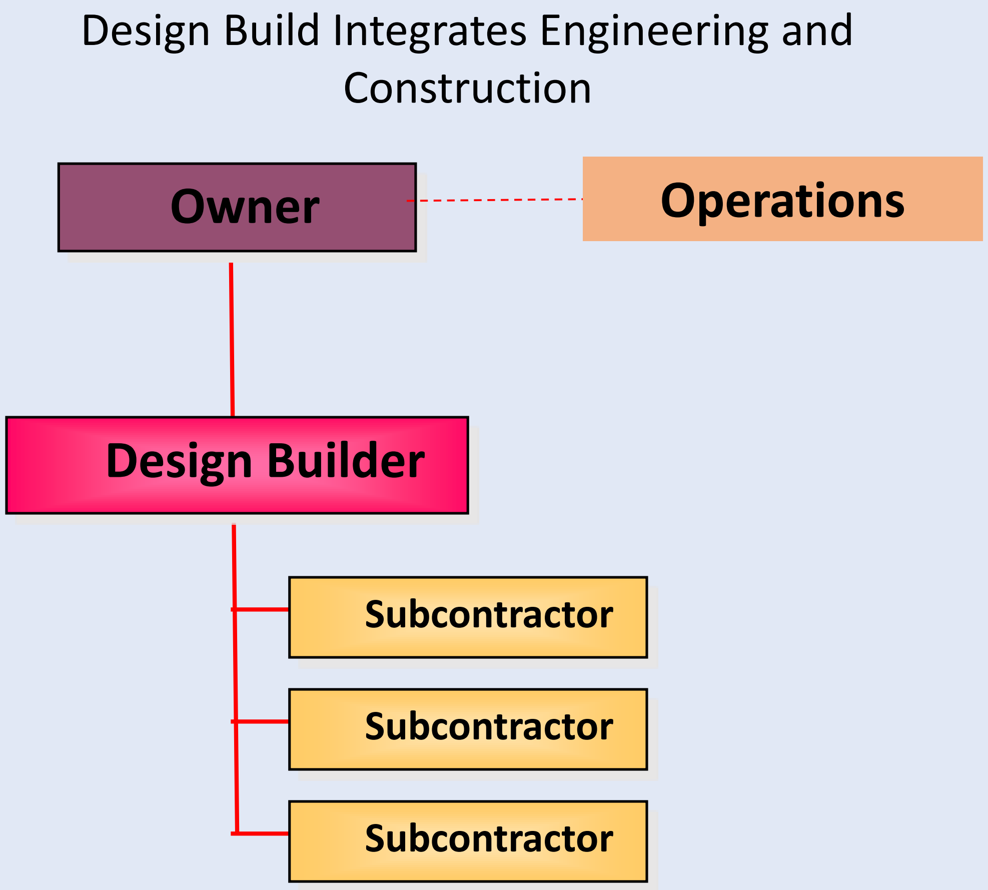
The Triangle of Power



Design-Build

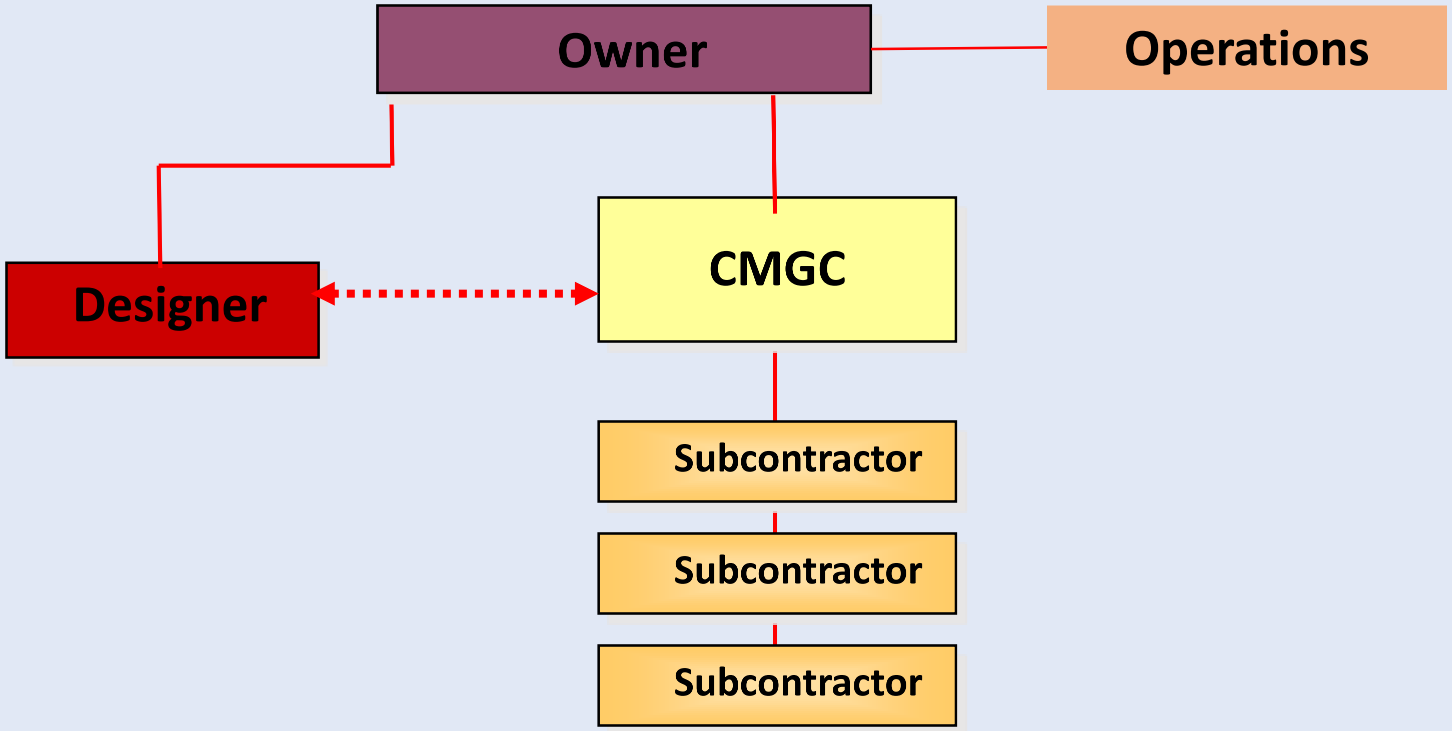
Design team and contractor form one team.

Project delivery technique for abbreviated project schedules



CMGC=Construction Manager – General Contractor

CMGC Brings Qualifications to Contractor Selection



In Closing:

Lower Costs

Contractors as equal team members

Communication

Selection


PAPÉ
MACHINERY
DEERE
PAPÉ
MACHINERY


THANK YOU

Attaining Stage 0 ecologic benefits with the complementary use of contour grading, simple roughness elements, wood jams, beaver dam analogues and time.

Rocco Fiori, Fiori GeoSciences, Sarah Beesley, Yurok Tribal Fisheries Program
Andrew Antonetti, Yurok Tribal Fisheries Program, Scott Silloway, Yurok Tribal Fisheries Program,
Jim Faukner, Yurok Tribal Fisheries Program

rocco@fiorigeosci.com

Presentation Topics

Restoration practices in two different geomorphic settings that have the same goals and objectives.

Goals: Improve survival & growth of Klamath River Salmonids, and increase ecosystem health and resiliency.

Objectives: Extend the hydoperiod, increase rearing & spawning habitat quantity & quality, and reduce floodplain turnover rates.

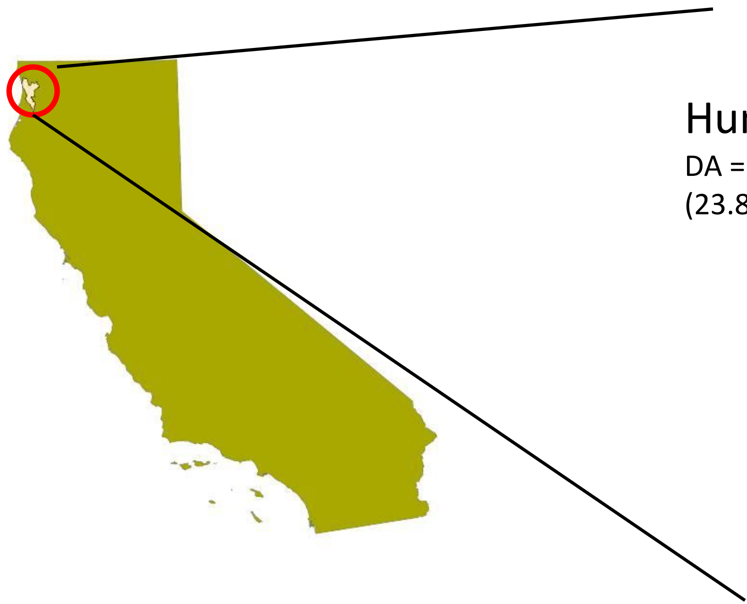
Terwer and Hunter Creek – Excessive sedimentation, wood depletion, rapid floodplain turnover rates, and intermittent stream flow.

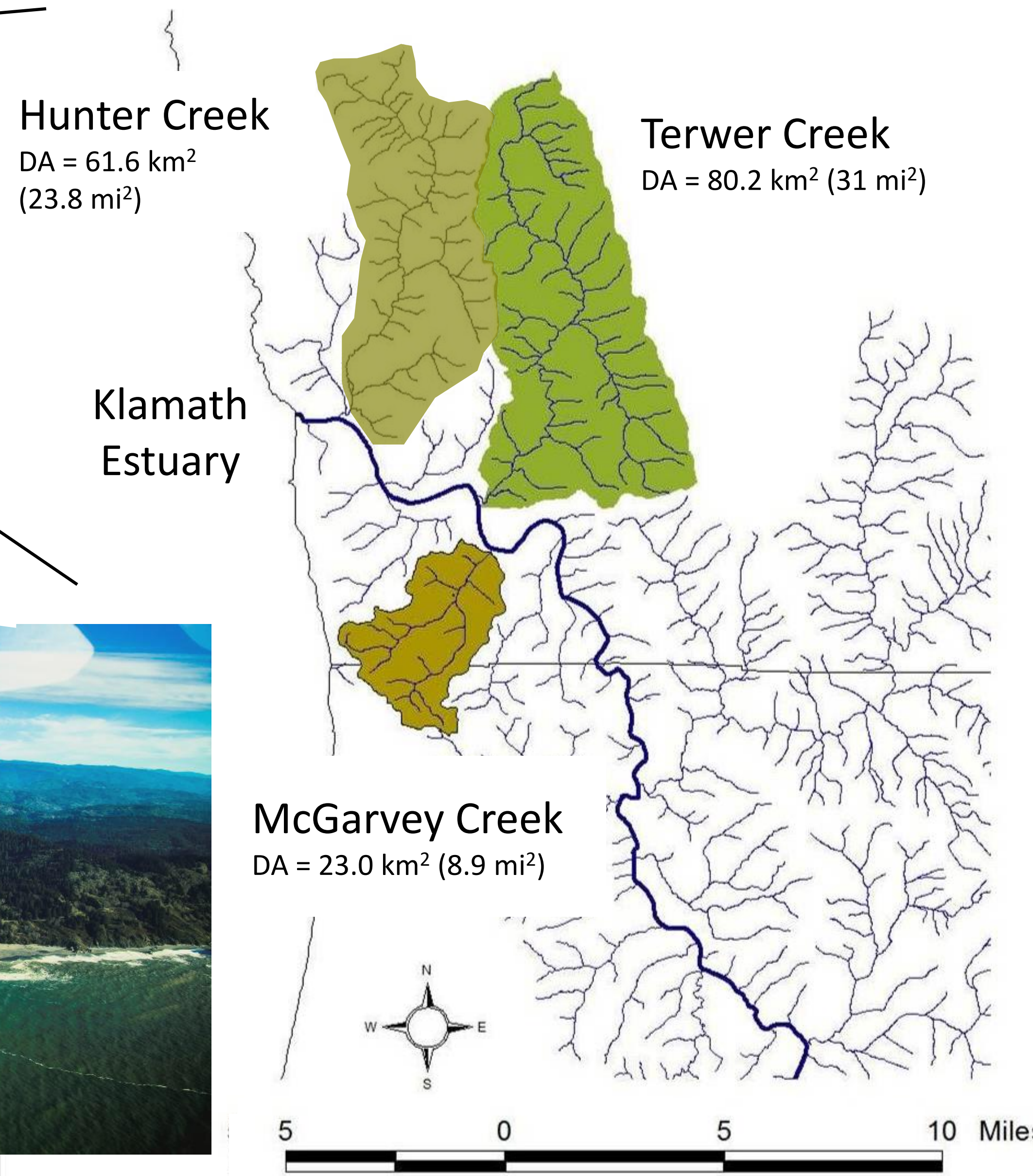
Design Elements and Geomorphic Response
Permit BOD Documents

McGarvey Creek – Incised stream channel, wood depletion and intermittent stream flow.

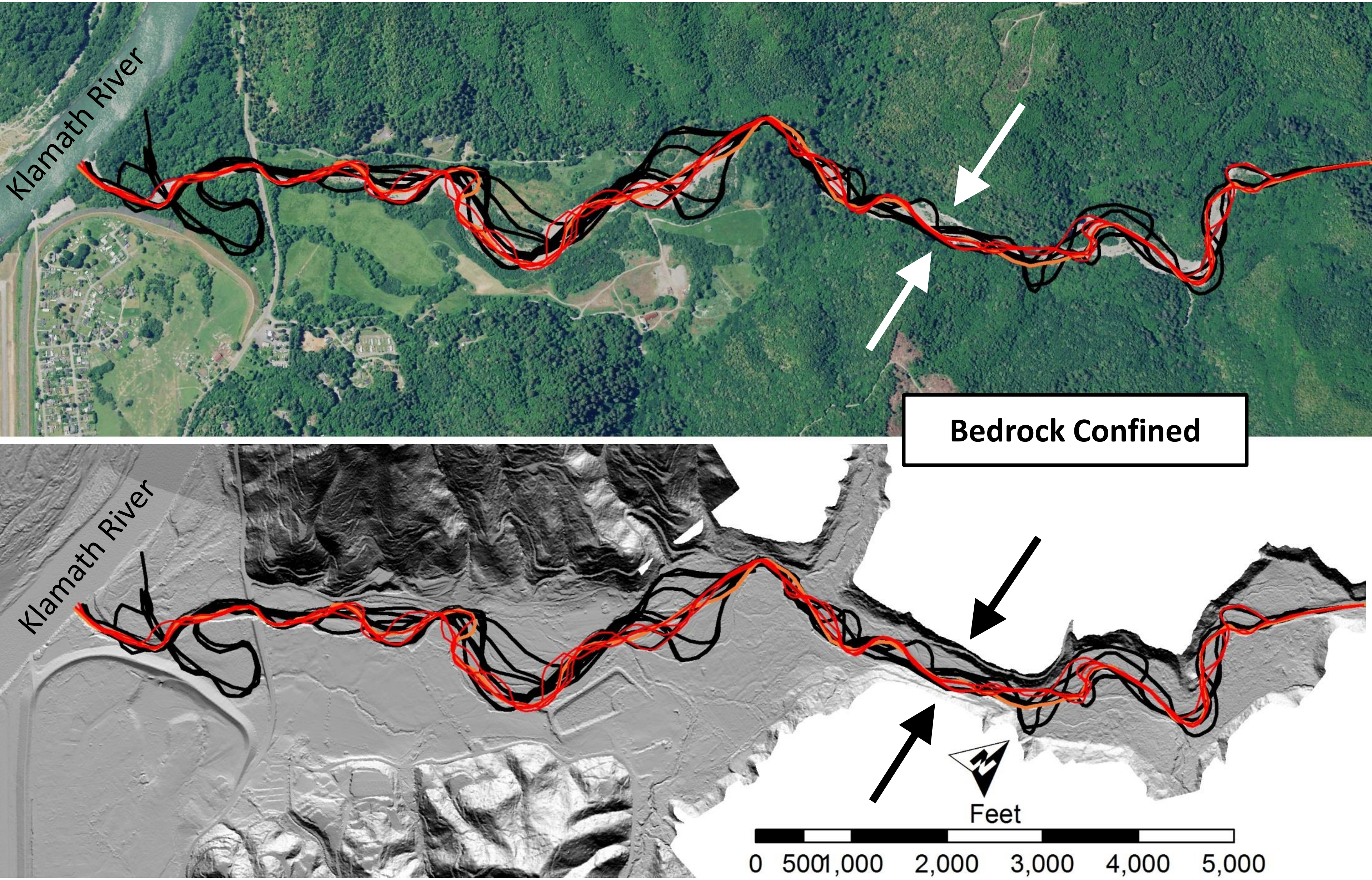
Mainstem and Alcove Habitats Enhanced with Beaver Dam Analogues

Project Locations

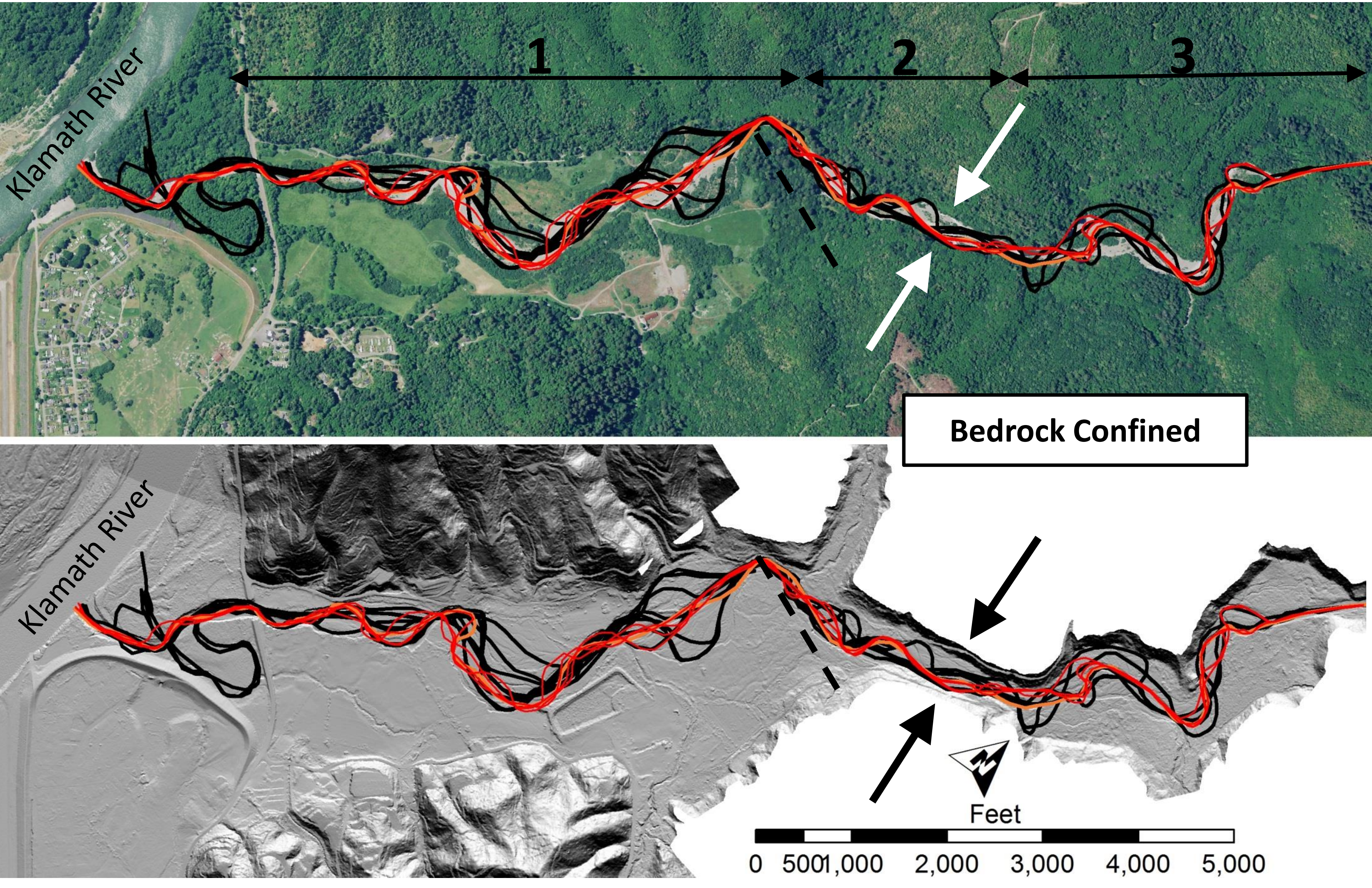




Terwer Creek Channel Migration Zones
1936 to 2016

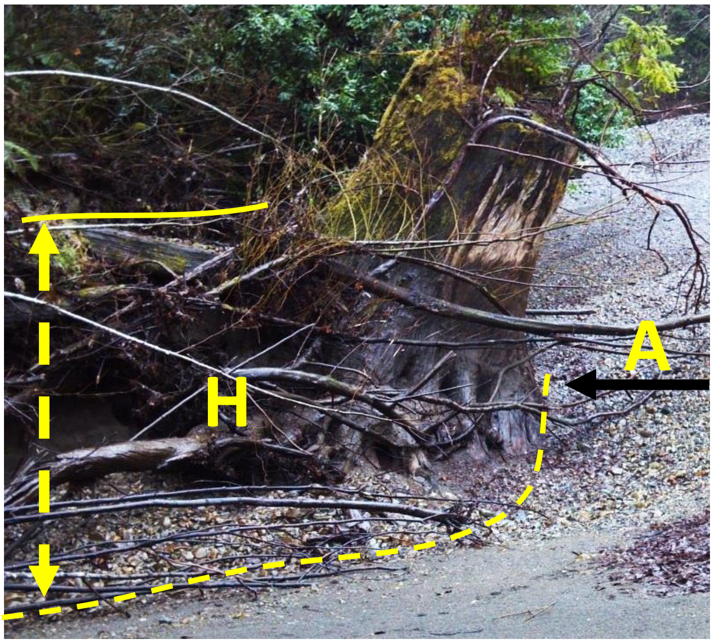


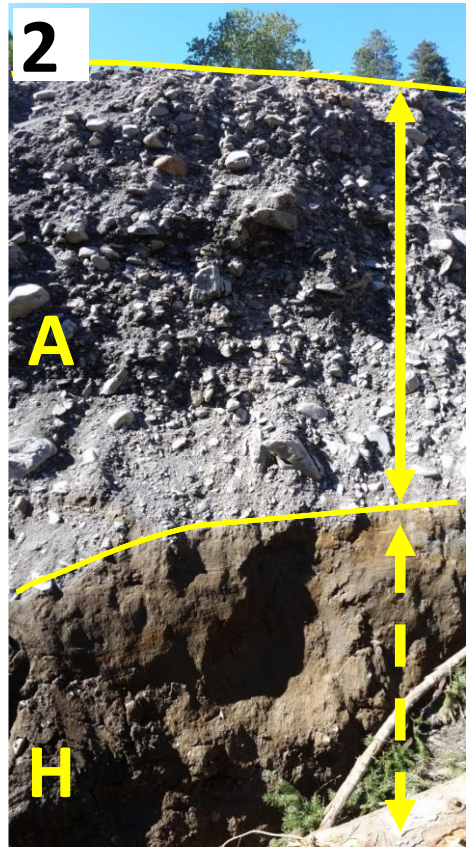
Terwer Creek Sediment Process Domains



Late Holocene-Anthropocene Stratigraphy

1



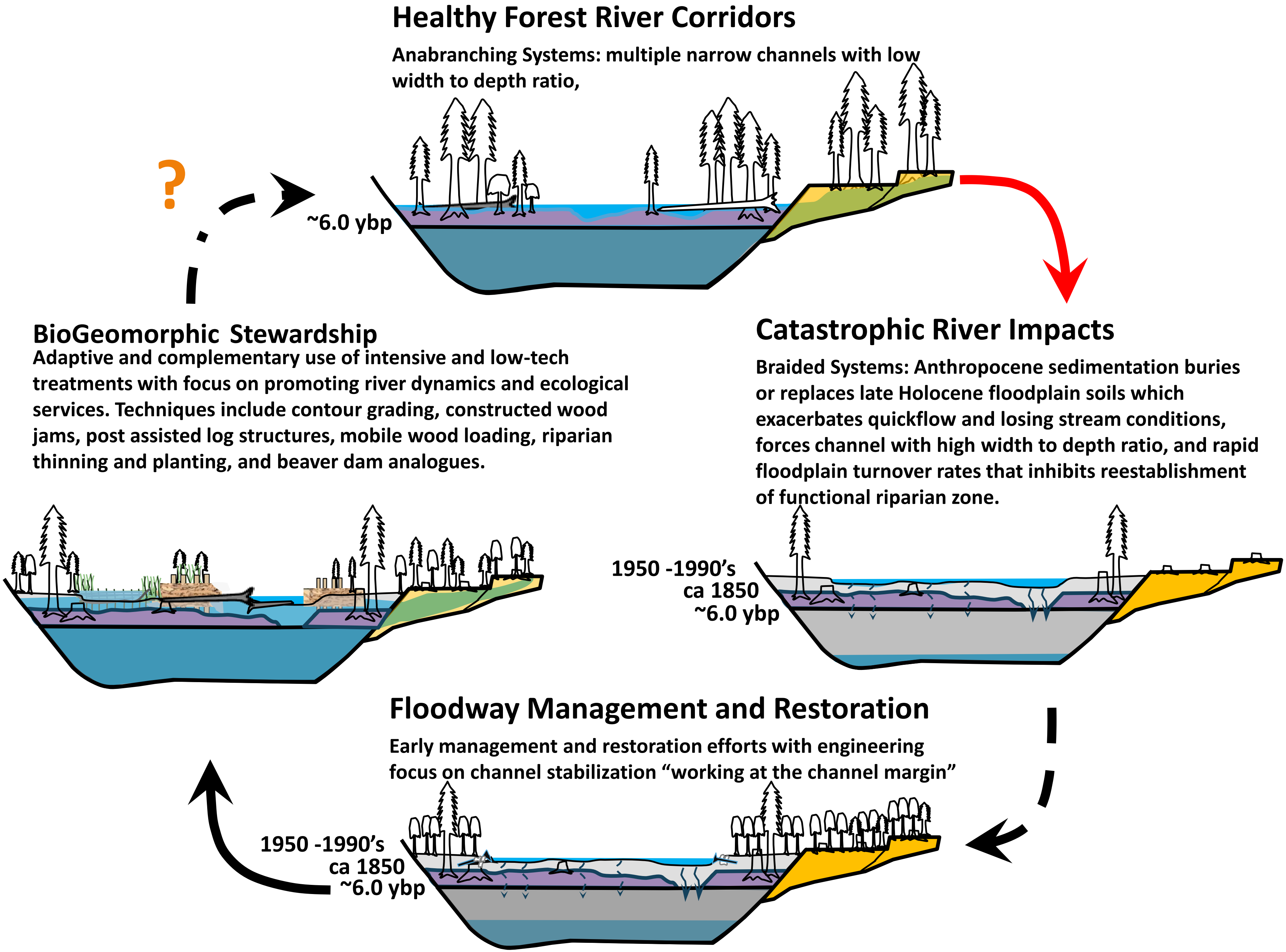


Hydraulic conductivities for common alluvial sediments

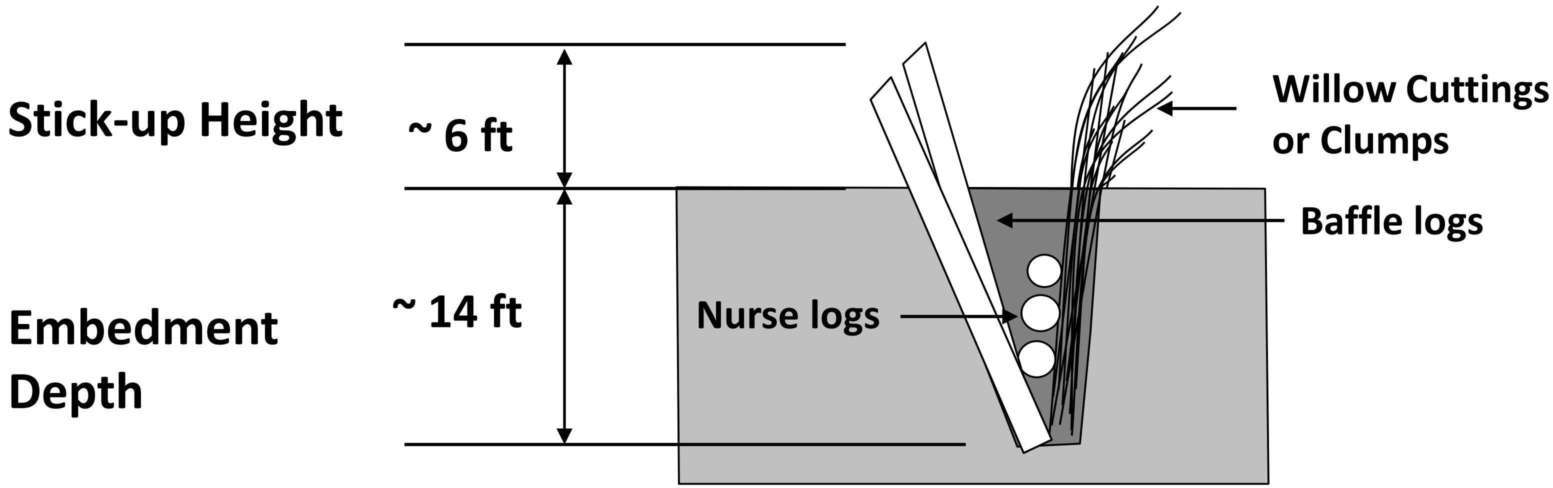
Material Type	Hydraulic Conductivity (K)				Relative K
	(ft/s)	(ft/s)	(gal/day/ft^2)	(gal/day/ft^2)	
Gravel	9.84E-04	9.84E-02	636	63600	High
Coarse Sand	2.95E-06	1.97E-02	1.9	12720	
Medium Sand	2.95E-06	1.64E-03	1.9	1060	
Fine Sand	6.56E-07	6.56E-04	0.4	424	
Silt, loess	3.28E-09	6.56E-05	0.002	42.4	Low
Clay	3.28E-11	1.54E-08	0.00002	0.01	

Terwer Creek and the Lower Klamath River

Terwer Creek and the Lower Klamath River


Healthy Forest River Corridors
Anabranching Systems: multiple narrow channels with low width to depth ratio,
?
~6.0 ybp
Catastrophic River Impacts
Braided Systems: Anthropocene sedimentation buries or replaces late Holocene floodplain soils which exacerbates quickflow and losing stream conditions, forces channel with high width to depth ratio, and rapid floodplain turnover rates that inhibits reestablishment of functional riparian zone.
1950 -1990's
ca 1850
~6.0 ybp
BioGeomorphic Stewardship
Adaptive and complementary use of intensive and low-tech treatments with focus on promoting river dynamics and ecological services. Techniques include contour grading, constructed wood jams, post assisted log structures, mobile wood loading, riparian thinning and planting, and beaver dam analogues.
Floodway Management and Restoration
Early management and restoration efforts with engineering focus on channel stabilization "working at the channel margin"
1950 -1990's
ca 1850
~6.0 ybp

Willow Baffle
Basic Architecture

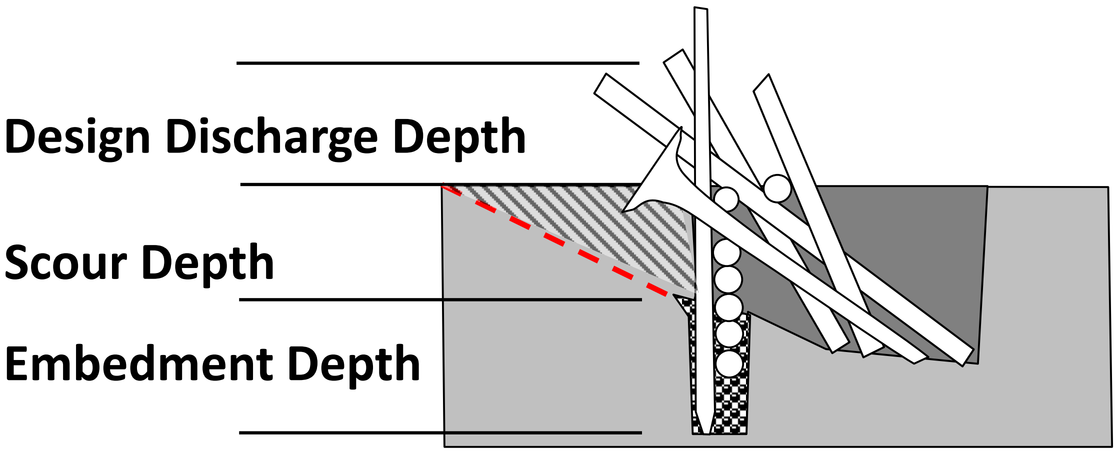


Section View

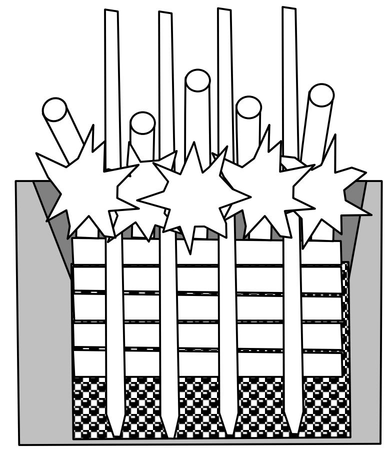
Rack Material
(not shown on drawing)

Photograph Example

Roughness Jams
Basic Architecture



Profile



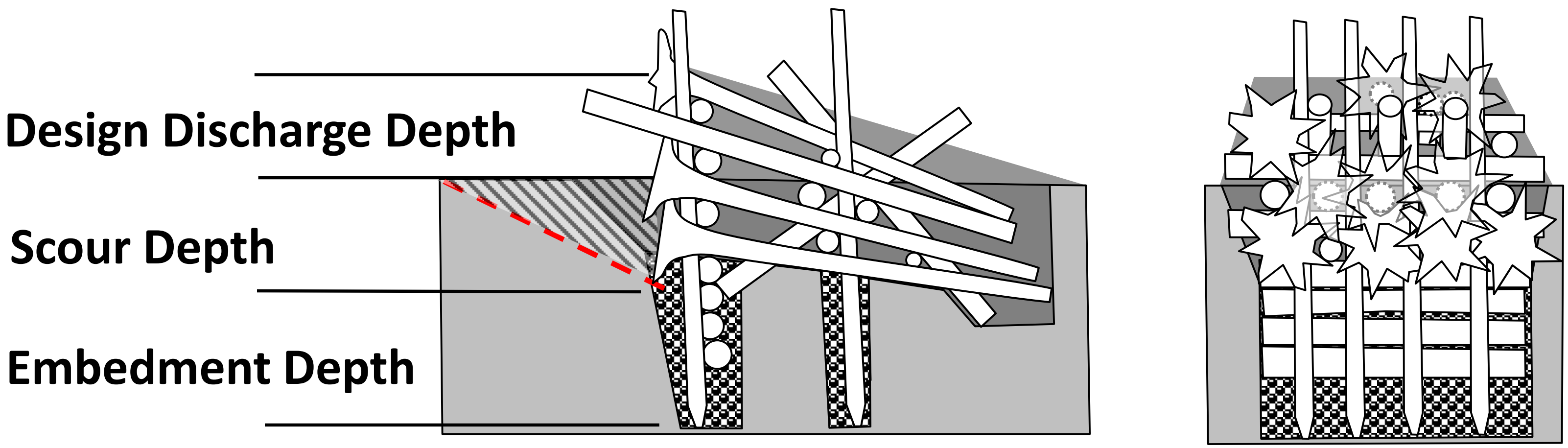
Section

Photograph Example

Variations on the theme:
Post Assisted Debris Rack
Channel Roughness Jam
Bar Roughness Jam

aka Post Assisted Log Structures Wheaton et al (2019)

Bar Apex Jam
Basic Architecture



Profile **Section**

Photograph Examples

Willow Baffles and Wood Jams
Side Channel Assembly

Side Channel Sediment Weirs

Terwer Creek Site 5

Bank Posts

Woven Members

Bar Apex Jam

Side Channel Sediment Weirs

Terwer Creek Site 5

As-Built
September 2017

Downstream View

Post ~2-yr RI Flow
January 2017

Side Channel Sediment Weirs

Terwer Creek Site 5

Post >10-yr RI Flow WY 2019

Planting Islands

Side Channel Sediment Weir

Side Channel Sediment Weir

Side Channel Sediment Weirs

Terwer Creek Site 5

Post ~2-yr RI
Flow
January 2017

Upstream View

Terwer Creek Site 5

Post >10-yr RI Flow WY 2019

Terwer Creek Sites 1 thru 3

Post ~10-yr RI Flow WY 2019

Post Assisted Log Structures

Channel Roughness Jam

Downstream View

Upstream View

Profile View

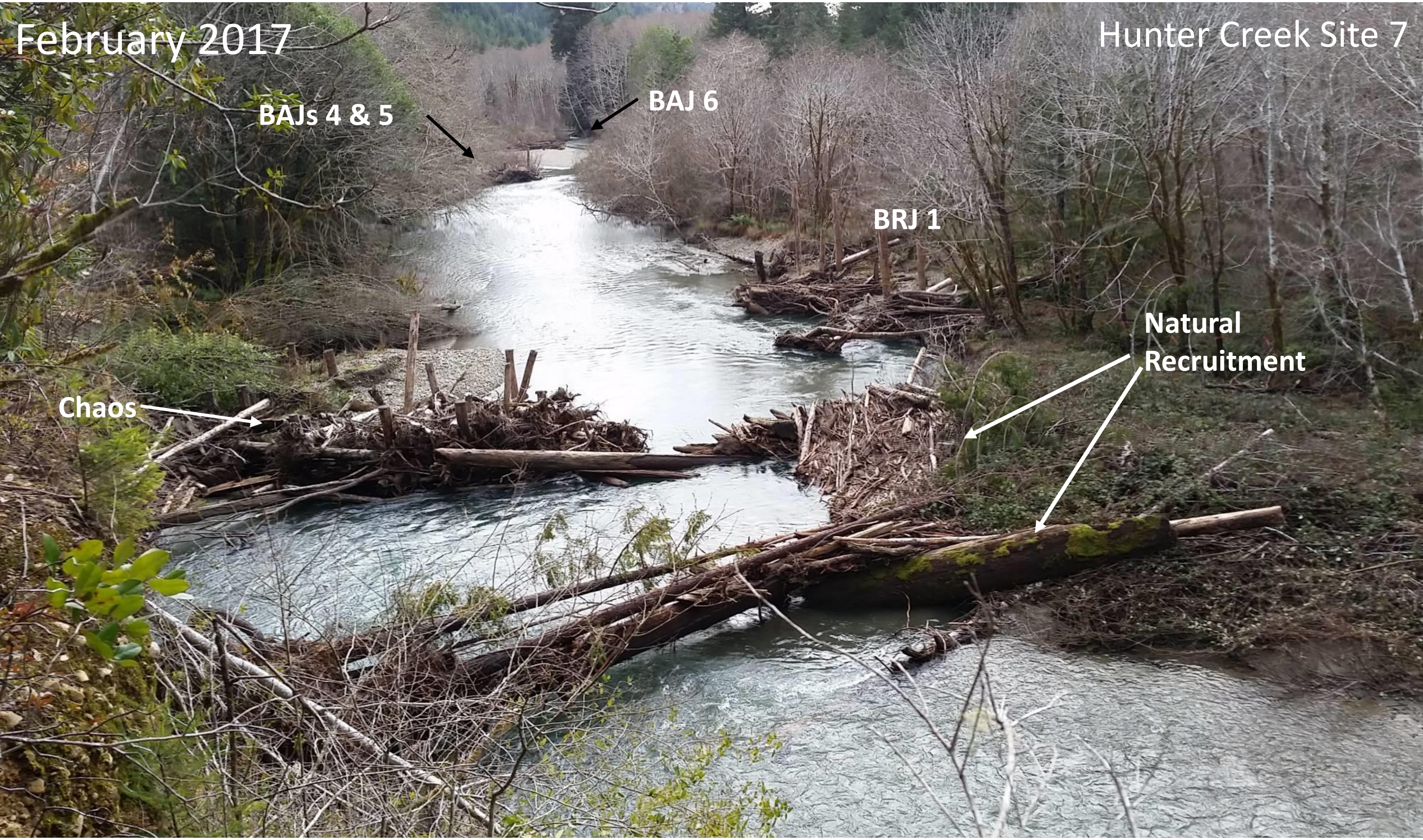
Post Assisted Log Structures

Post Assisted Log Structures

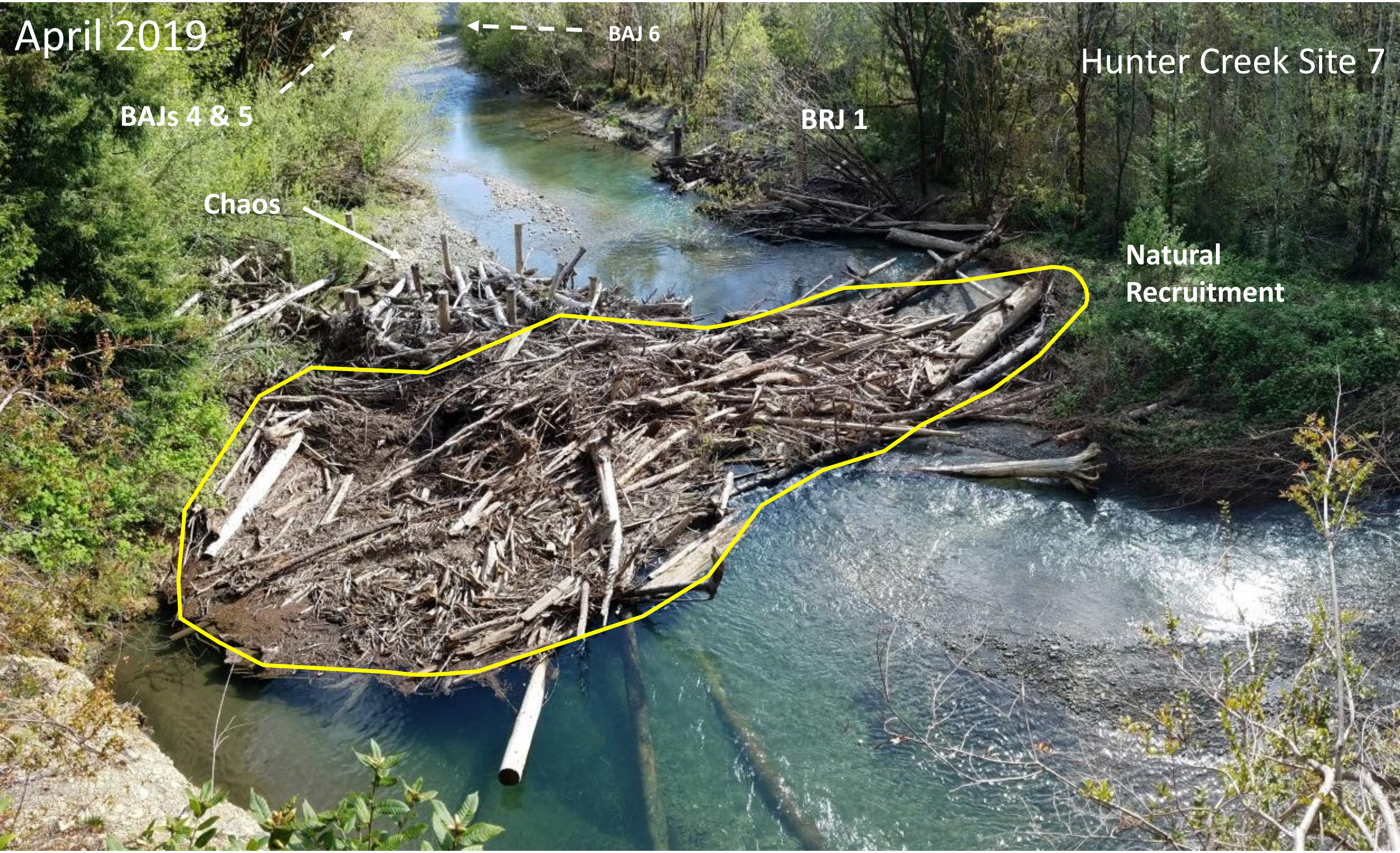
Ballast Zero Log Structures

Genesis of the Ballast-less ELJ

Genesis of the Ballast-less ELJ

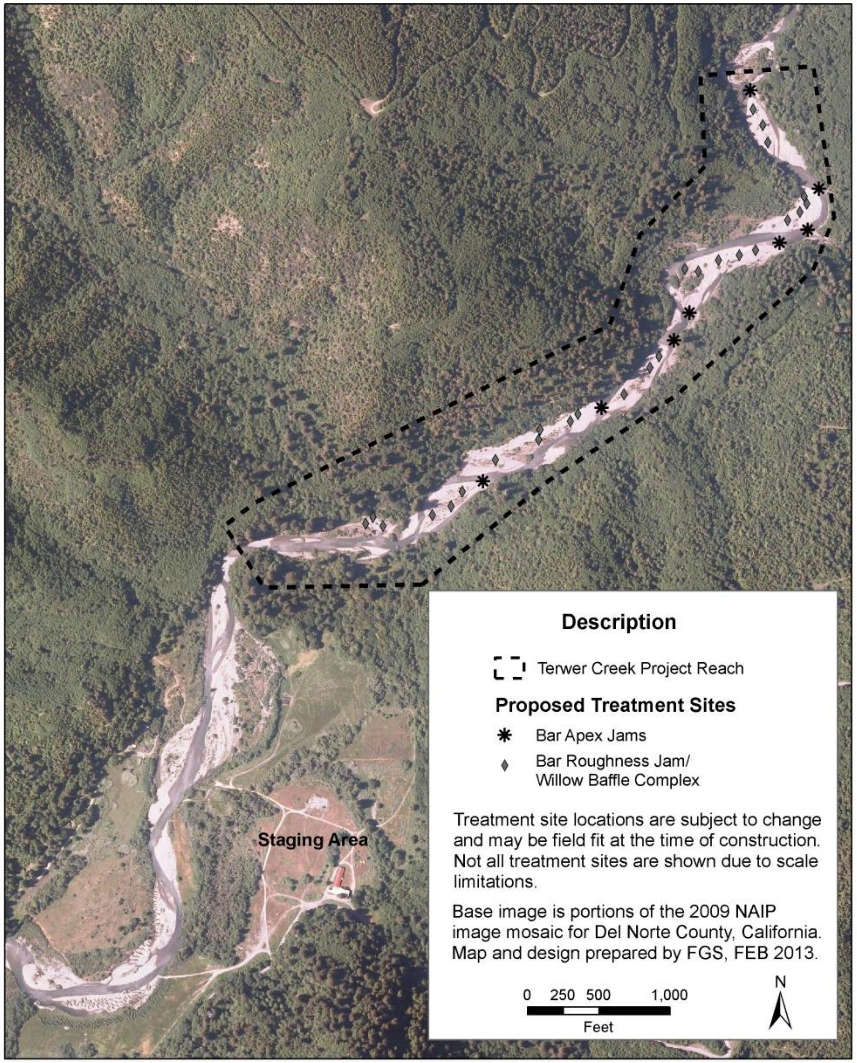


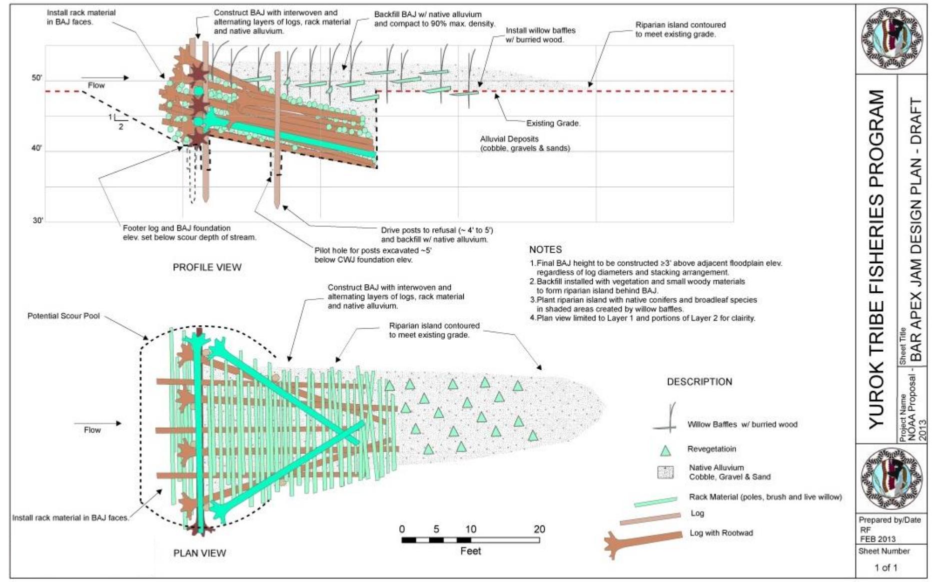
Genesis of the Ballast-less ELJ

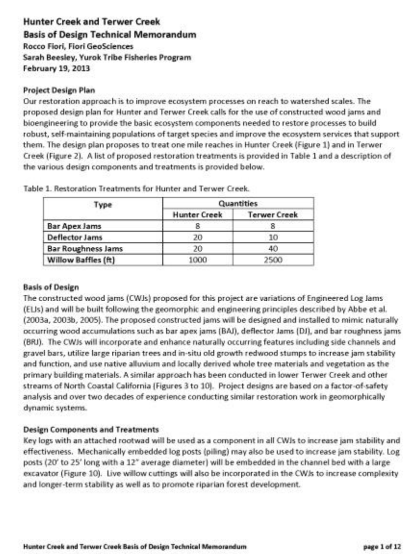


Chaos and Tranquility

Permit Basis of Design Documents







Hunter Creek and Terwer Creek
Basis of Design Technical Memorandum
Rocco Fiori, Fiori GeoSciences
Sarah Beesley, Yurok Tribe Fisheries Program
February 19, 2013

Project Design Plan
Our restoration approach is to improve ecosystem processes on reach to watershed scales. The proposed design plan for Hunter and Terwer Creek calls for the use of constructed wood jams and bioengineering to provide the basic ecosystem components needed to restore processes to build robust, self-maintaining populations of target species and improve the ecosystem services that support them. The design plan proposes to treat one mile reaches in Hunter Creek (Figure 1) and in Terwer Creek (Figure 2). A list of proposed restoration treatments is provided in Table 1 and a description of the various design components and treatments is provided below.

Table 1. Restoration Treatments for Hunter and Terwer Creek.

Type	Quantities	
	Hunter Creek	Terwer Creek
Bar Apex Jams	8	8
Deflector Jams	20	10
Bar Roughness Jams	20	40
Willow Baffles (ft)	1000	2500

Basis of Design
The constructed wood jams (CWJs) proposed for this project are variations of Engineered Log Jams (ELJs) and will be built following the geomorphic and engineering principles described by Abbe et al. (2003a, 2003b, 2005). The proposed constructed jams will be designed and installed to mimic naturally occurring wood accumulations such as bar apex jams (BAJ), deflector Jams (DJ), and bar roughness jams (BRJ). The CWJs will incorporate and enhance naturally occurring features including side channels and gravel bars, utilize large riparian trees and in-situ old growth redwood stumps to increase jam stability and function, and use native alluvium and locally derived whole tree materials and vegetation as the primary building materials. A similar approach has been conducted in lower Terwer Creek and other streams of North Coastal California (Figures 3 to 10). Project designs are based on a factor-of-safety analysis and over two decades of experience conducting similar restoration work in geomorphically dynamic systems.

Design Components and Treatments
Key logs with an attached rootwad will be used as a component in all CWJs to increase jam stability and effectiveness. Mechanically embedded log posts (piling) may also be used to increase jam stability. Log posts (20' to 25' long with a 12" average diameter) will be embedded in the channel bed with a large excavator (Figure 10). Live willow cuttings will also be incorporated in the CWJs to increase complexity and longer-term stability as well as to promote riparian forest development.

Hunter Creek and Terwer Creek Basis of Design Technical Memorandum **page 1 of 12**

American Fisheries Society Symposium xx:xxx-xxx, 2003

Wood in River Rehabilitation and Management

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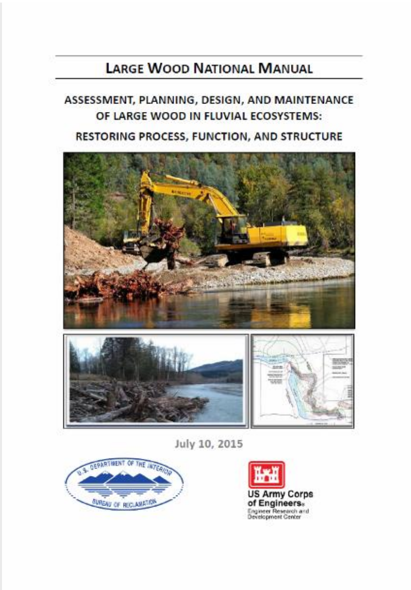
Abstract.—Wood induces hydraulic, morphologic, and textural complexity into fluvial systems in forested regions around the world. Snags and logjams can create complex networks of channels and wetlands across entire river valleys and historically posed a significant obstacle to navigation. The clearing of wood from rivers and riparian forest land along streams and rivers reduced or eliminated the supply of wood into rivers in many regions of the world. Ecological restoration of fluvial environments increasingly includes the placement of wood. But few guidelines exist on appropriate methods for emulating natural wood accumulations, where and how to place wood, its longevity, the hydraulic and geomorphic consequences of wood, and how to manage systems where wood is reintroduced. Important issues to understand when placing wood in rivers include the watershed and reach-scale context of a project, the hydraulic and geomorphic effects of wood placements, possible changes in wood structures over time, and how it may impact human infrastructure and safety. Engineered logjams constructed in Washington, USA and New South Wales, Australia offer examples of how wood reintroduction can be engineered without the use of artificial anchoring to form stable in-stream structures as part of efforts to rehabilitate fluvial ecosystems and provide ecologically sensitive means to treat traditional problems such as bank stabilization and grade control.

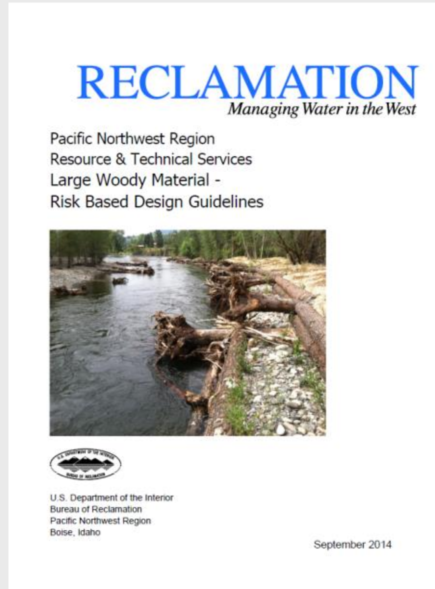
Introduction

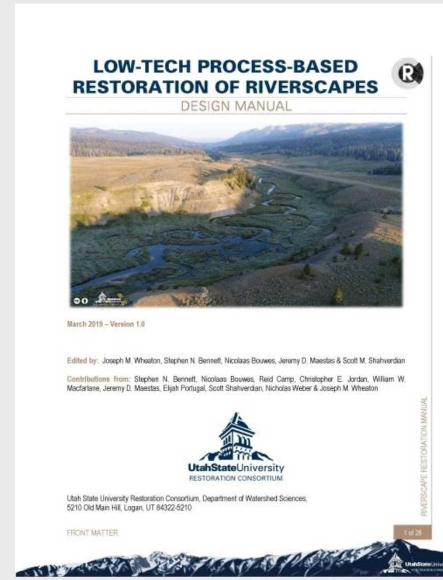
The geomorphic effects of wood on fluvial systems range in scale from controlling bed forms and influencing channel patterns to floodplain development (e.g., Wolff 1916; Davis 1901; Guardia 1933; Keller and Swanson 1979; Lienkaemper and Swanson 1987; Harwood and Brown 1993; Abbe and Montgomery 1996, 2003; Buffington and Montgomery 1999; Brooks 1999; Brooks and Brierley 2002). Snags and logjams can be the principal mechanism creating habitat complexity not only within an active channel, but also by inducing localized flooding and creating and sustaining secondary channels and wetlands (Triska 1984; Sedell and Froggatt 1984; Abbe 2000; Collins and Montgomery 2002). Examples of these complex fluvial systems with numerous side channels that extend across much of a river valley are increasingly rare (Figure 1). Habitat complexity directly or indirectly related to wood clearly benefits many aquatic ecosystems (e.g., Pearsons et al. 1992; Quinn and Peterson 1996; Lehtinen et al. 1997; Inoue and Nakano 1998), and reduced fish populations can reflect the extensive loss of physical complexity in fluvial systems resulting from wood removal, channelization, and floodplain development (e.g., Shields and Smith 1992; Beechie et al. 2001; Collins et al. 2003; Pess et al. 2003). Rehabilitation of fluvial ecosystems depends on re-es-

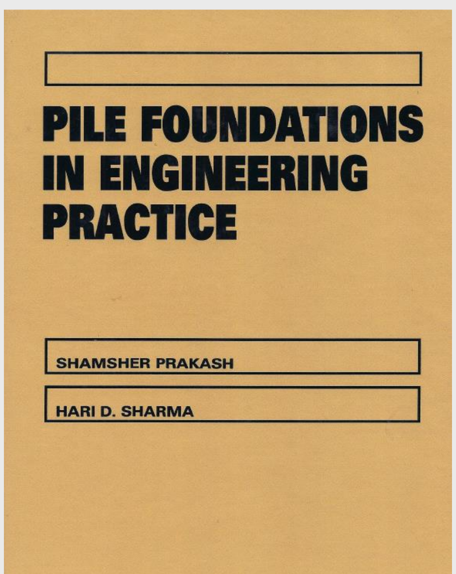
1

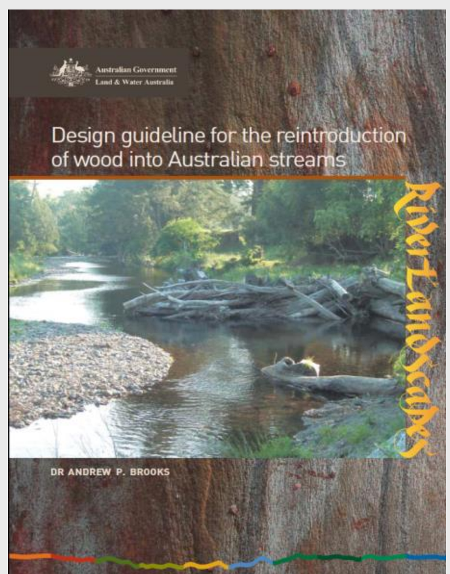
Design Resources For Post & Pile Supported Wood Structures

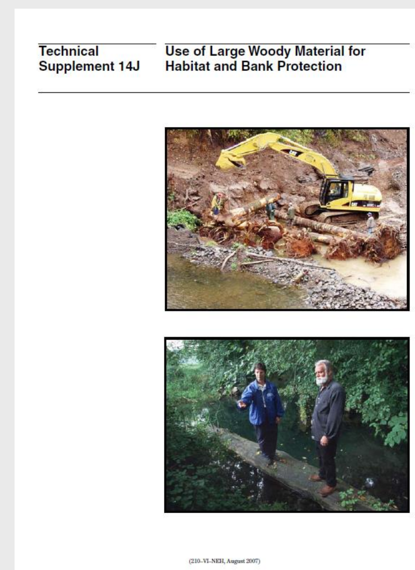




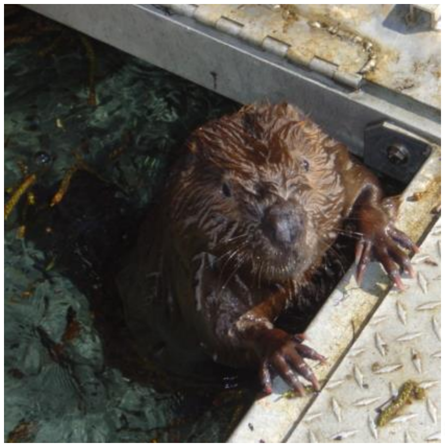


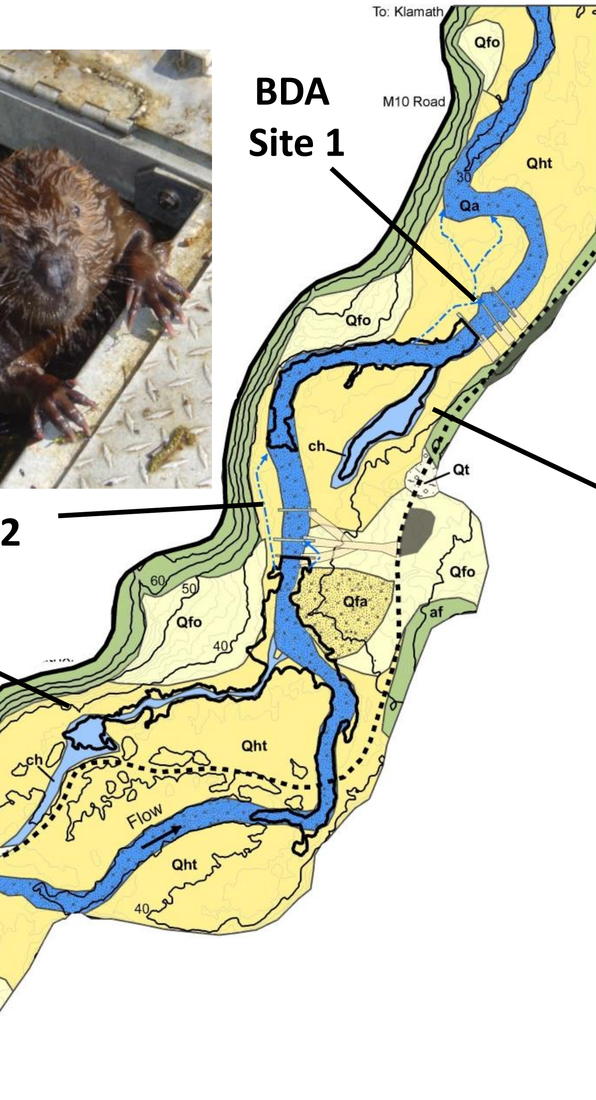






McGarvey Creek
Beaver Dam Analogue Beta Test

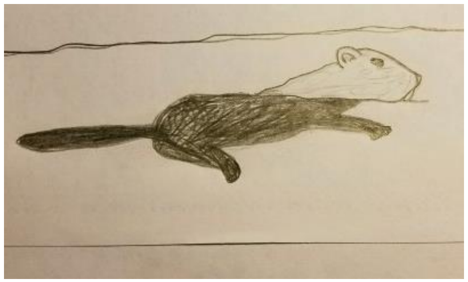




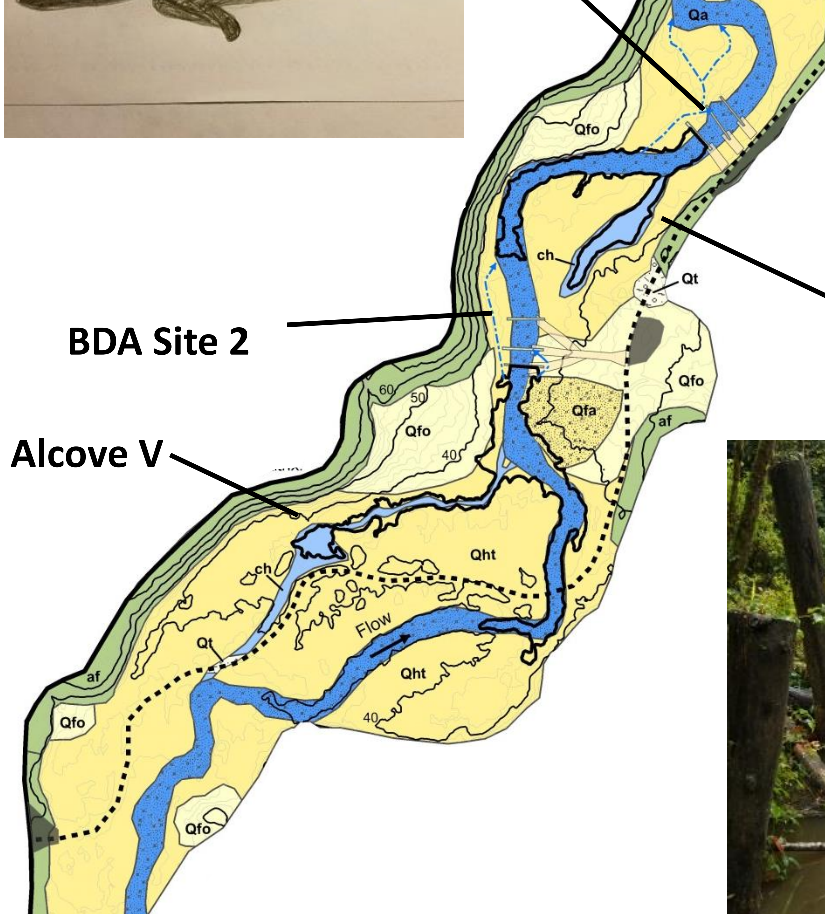
BDA Site 1 10/27/18

Alcove III 02/19/14

McGarvey Creek
Beaver Dam Analogue Beta Test



BDA Site 1



BDA Site 2

Alcove V

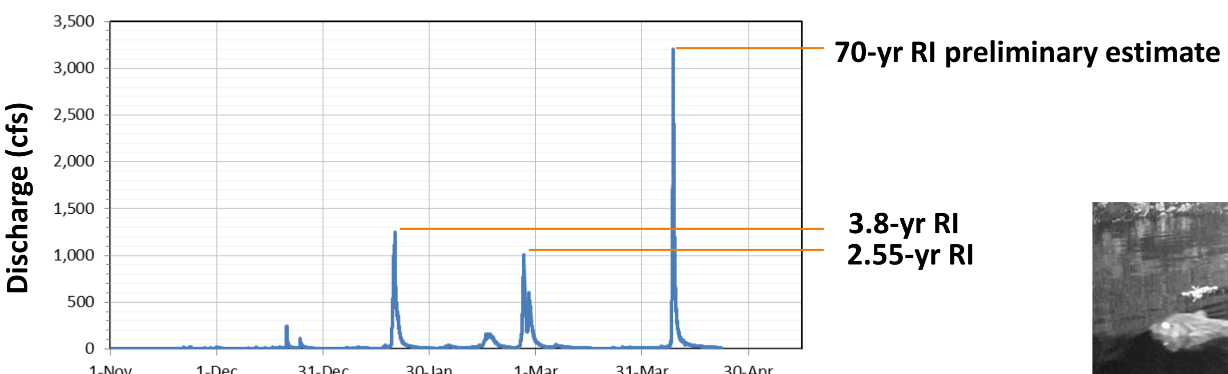
BDA Site 1 11/23/18

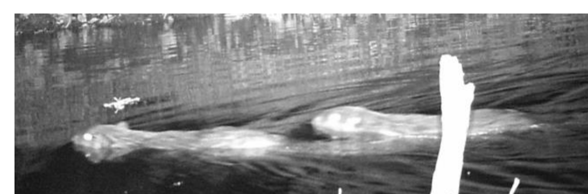
Alcove III 11/23/18

McGarvey Creek
Beaver Dam Analogue Beta Test

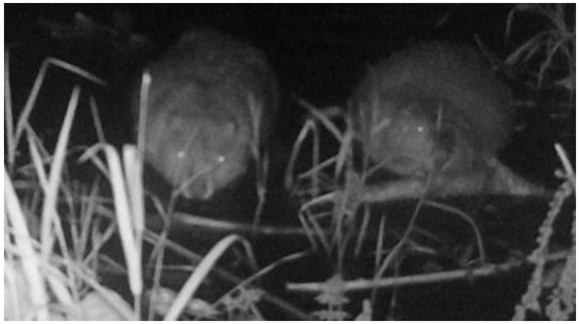
BDA Site 1

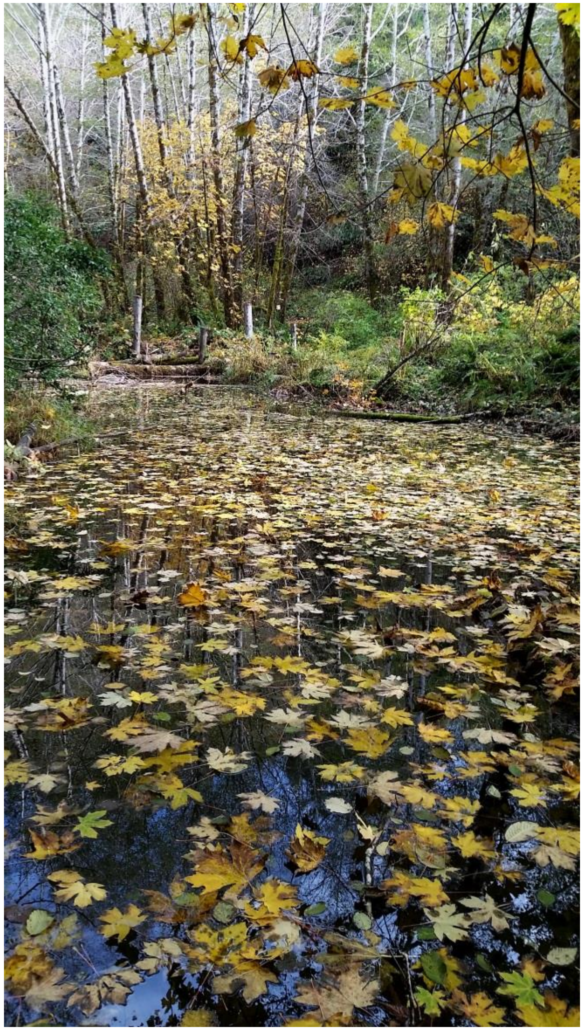
McGarvey Creek Stream Gage





Biomimicry

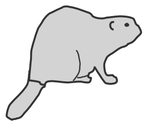




Beaver Dam Analogue Design Tool

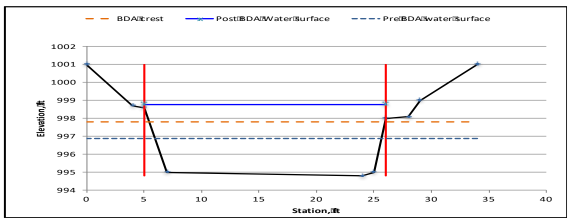
1. Design Summary

$$\omega = (\rho g Q S)/w$$

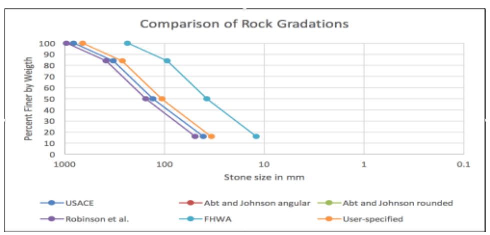


	A	B	C	D	E	F	G	H	I
1	Design summary	Beaver Dam Analog Design						Version 1.0	
2	PROJECT	Test							DATE
3	Structure type	Post line with wicker weave					ANALYST	I. M. Beaver	10/13/17
4	River and reach	Any Creek					REVIEWER	C. Canadensis	10/13/17
5	BDA location	Station 10+00							
6	Spreadsheet developer	Fiori Geosciences							
7	Public safety risk	Low							
8	Property damage risk	Low							
9	Design discharge	90	cfs	2.55	m^3/s				
10	Design discharge return interval	1.7	years			from Hydrology worksheet			
11	Channel bed sediment	Medium sand							
12	Species of wood used for posts	Douglas Fir	Pseudotsuga menziesii			see Wood Properties Table for information about several species			
13	Primary BDA purpose	Pond creation							

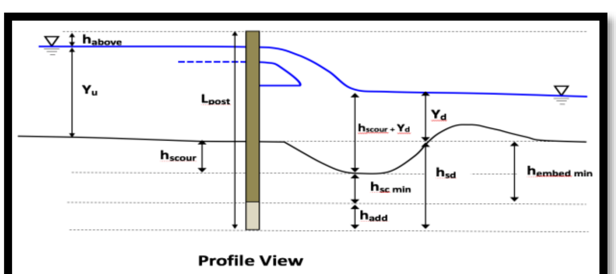
2 – 5. Hydrology and Hydraulics



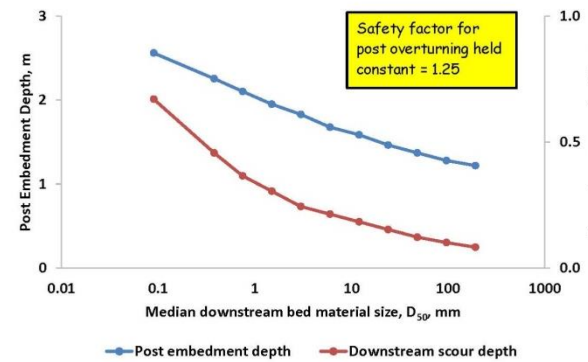
6 – 8. Scour and Impact Force Analysis



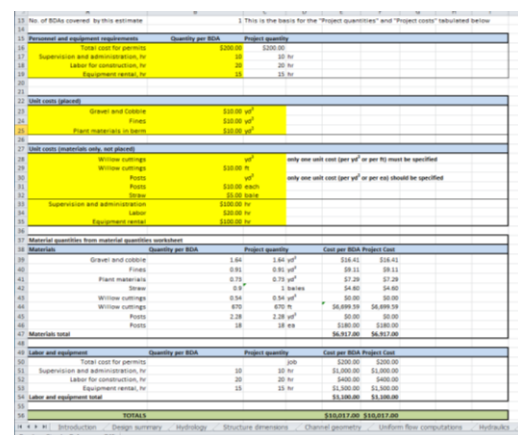
9 – 10. Post Overturning, Breakage and Uplift Analysis



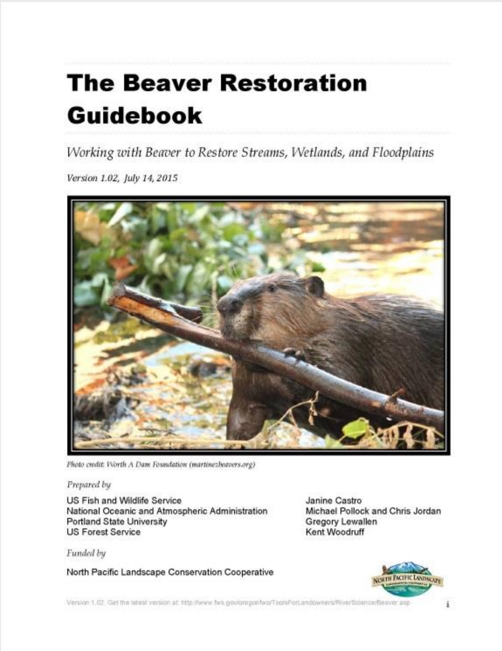
9b. Design Factor of Safety

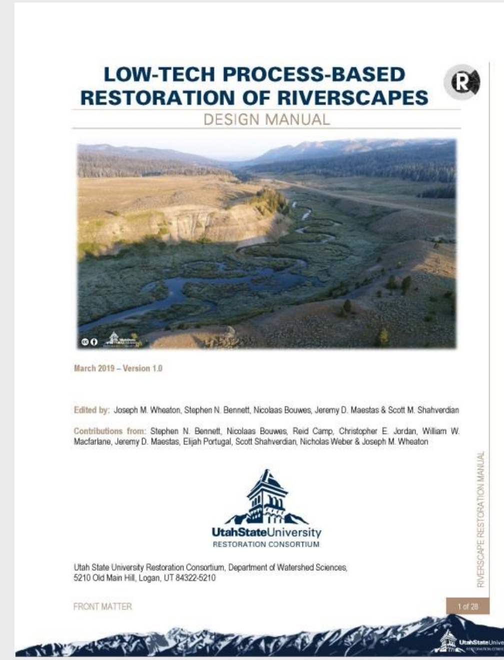


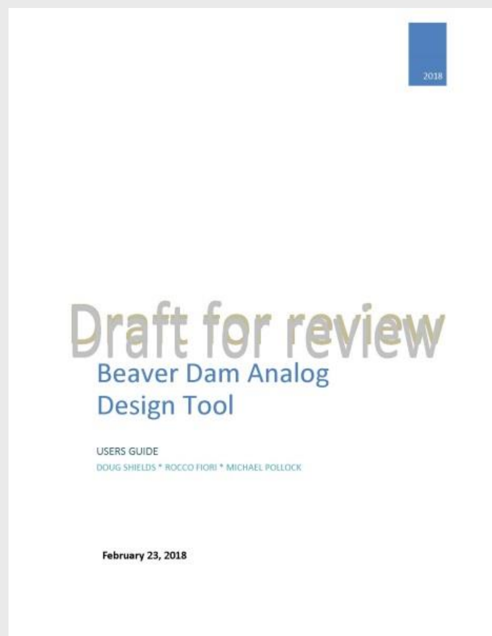
11 – 12. Materials and Cost Estimate



Design Resources for Beaver Dam Analogues and Low-Tech Process-Based Restoration







Contributors

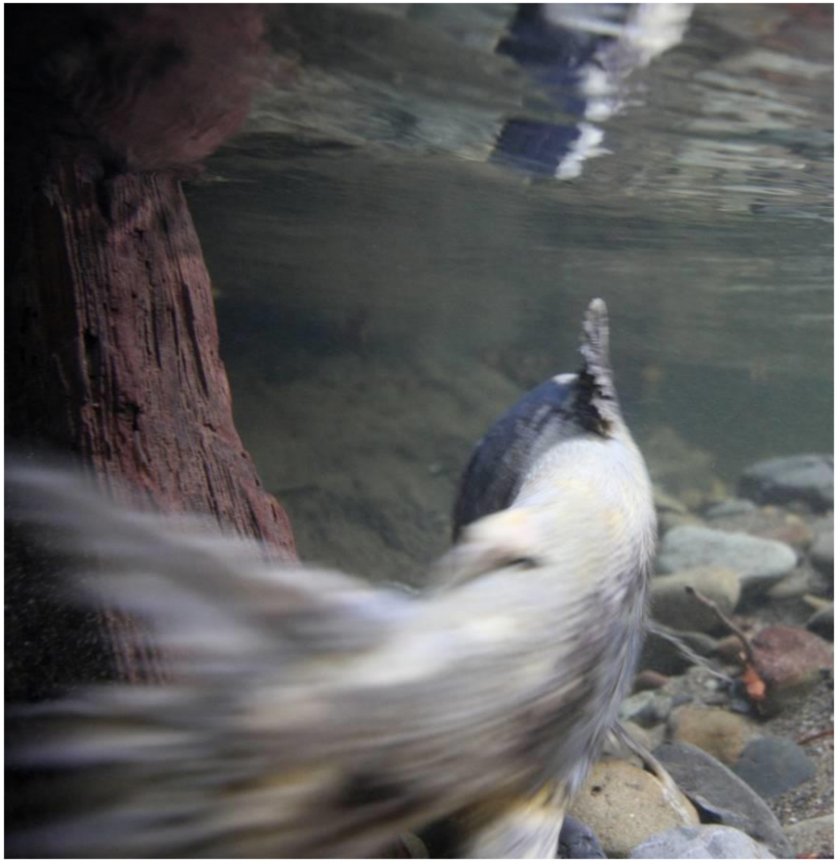
- Chase Stockwell – Fisheries Biologist, Yurok Tribal Fisheries Program
- Richard Bates – Fisheries Technician, Yurok Tribal Fisheries Program
- DJ Bandrowski – Restoration Engineer, Yurok Tribal Fisheries Program
- Yurok Tribal Fisheries Program Heavy Equipment Operators:
  - Aldaron McCovey
  - Steven Nova
  - Josh Jimenez
  - Marty Barbour
  - Richard Bates
- Doug Shields, cbec ecoengineering
- Michael Pollock, NOAA Fisheries Northwest

Project of Partners

- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- National Oceanic and Atmospheric Administration
- CA Dept of Fish and Wildlife
- Green Diamond Resources Company
- Yurok Tribe Watershed Restoration Dept.
- Yurok Tribe Environmental Program

Thank You

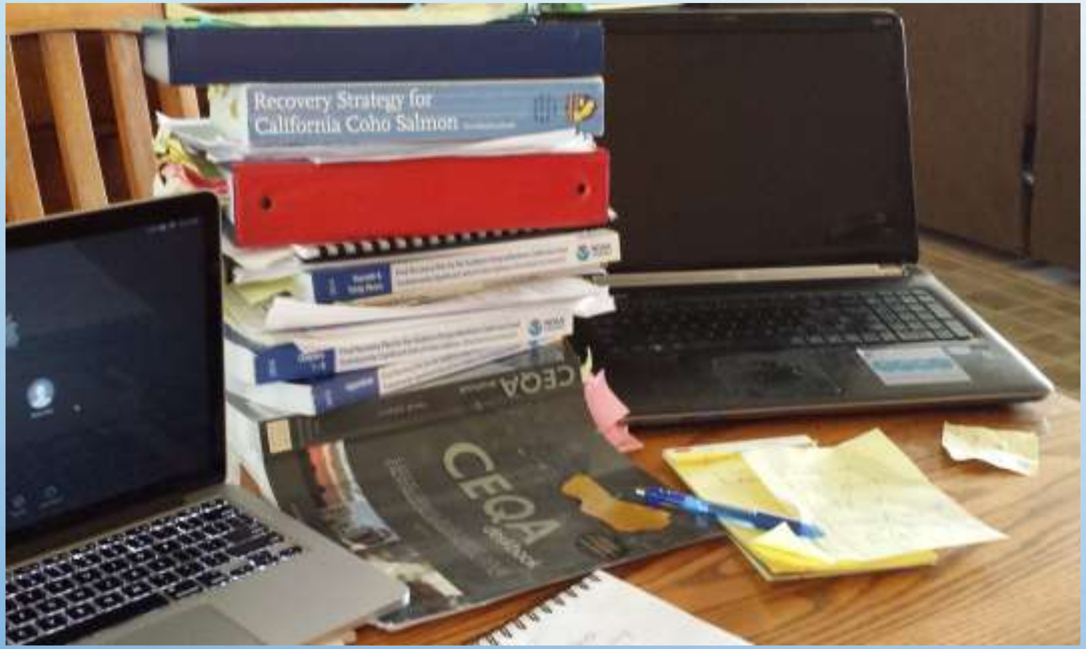
Less is more…..Wood and Sediment. Just add water!

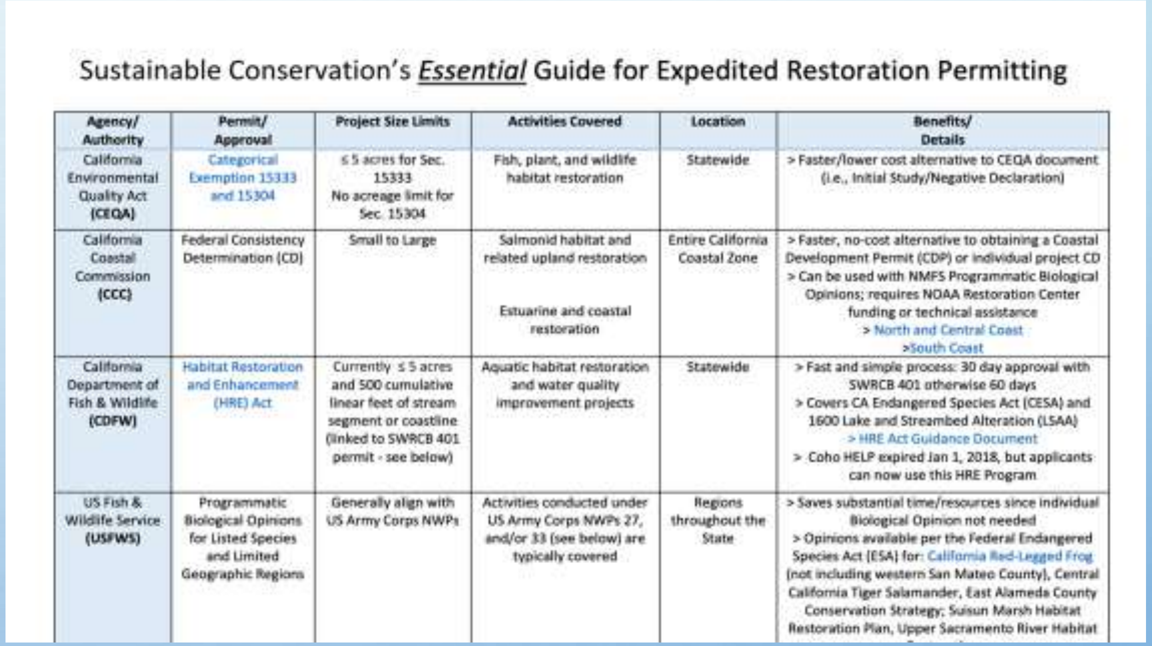


MOVING FLOODPLAIN RECONNECTION/STAGE 0 PROJECTS INTO ACTION

STAGE 0 PROJECTS FROM A REGULATORY PERSPECTIVE

LOOKING AT FLOODPLAIN RECONNECTION (STAGE 0) FROM A REGULATORY PERSPECTIVE





Sustainable Conservation's ***Essential*** Guide for Expedited Restoration Permitting

Agency/ Authority	Permit/ Approval	Project Size Limits	Activities Covered	Location	Benefits/ Details
California Environmental Quality Act **(CEQA)**	Categorical Exemption 15333 and 15304	≤ 5 acres for Sec. 15333 No acreage limit for Sec. 15304	Fish, plant, and wildlife habitat restoration	Statewide	> Faster/lower cost alternative to CEQA document (i.e., Initial Study/Negative Declaration)
California Coastal Commission **(CCC)**	Federal Consistency Determination (CD)	Small to Large	Salmonid habitat and related upland restoration Estuarine and coastal restoration	Entire California Coastal Zone	> Faster, no-cost alternative to obtaining a Coastal Development Permit (CDP) or individual project CD > Can be used with NMFS Programmatic Biological Opinions; requires NOAA Restoration Center funding or technical assistance > North and Central Coast >South Coast
California Department of Fish & Wildlife **(CDFW)**	Habitat Restoration and Enhancement (HRE) Act	Currently ≤ 5 acres and 500 cumulative linear feet of stream segment or coastline (linked to SWRCB 401 permit - see below)	Aquatic habitat restoration and water quality improvement projects	Statewide	> Fast and simple process: 30 day approval with SWRCB 401 otherwise 60 days > Covers CA Endangered Species Act (CESA) and 1600 Lake and Streambed Alteration (LSAA) > HRE Act Guidance Document > Coho HELP expired Jan 1, 2018, but applicants can now use this HRE Program
US Fish & Wildlife Service **(USFWS)**	Programmatic Biological Opinions for Listed Species and Limited Geographic Regions	Generally align with US Army Corps NWPs	Activities conducted under US Army Corps NWPs 27, and/or 33 (see below) are typically covered	Regions throughout the State	> Saves substantial time/resources since individual Biological Opinion not needed > Opinions available per the Federal Endangered Species Act (ESA) for: California Red-Legged Frog (not including western San Mateo County), Central California Tiger Salamander, East Alameda County Conservation Strategy; Suisun Marsh Habitat Restoration Plan, Upper Sacramento River Habitat

REGULATORY APPROACHES CONTRIBUTORS

- BOB PAGLIUCO, NATIONAL MARINE FISHERIES SERVICE
- DAMION CIOTTI, U.S. FISH AND WILDLIFE SERVICE
- GIL FALCONE, NORTH COAST REGIONAL WATER QUALITY CONTROL BOARD
- BETSY STAPLETON, SCOTT RIVER WATERSHED COUNCIL
- SARAH BEESLEY, YUROK TRIBE

PERMITTING EVOLUTION MODEL (PEM)**

**Coined by Bob Pagliuco

PERMITS AND AUTHORIZATIONS NEEDED FOR RESTORATION PROJECTS IN CALIFORNIA

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

US Army Corps of Engineers.

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Local County

NEPA

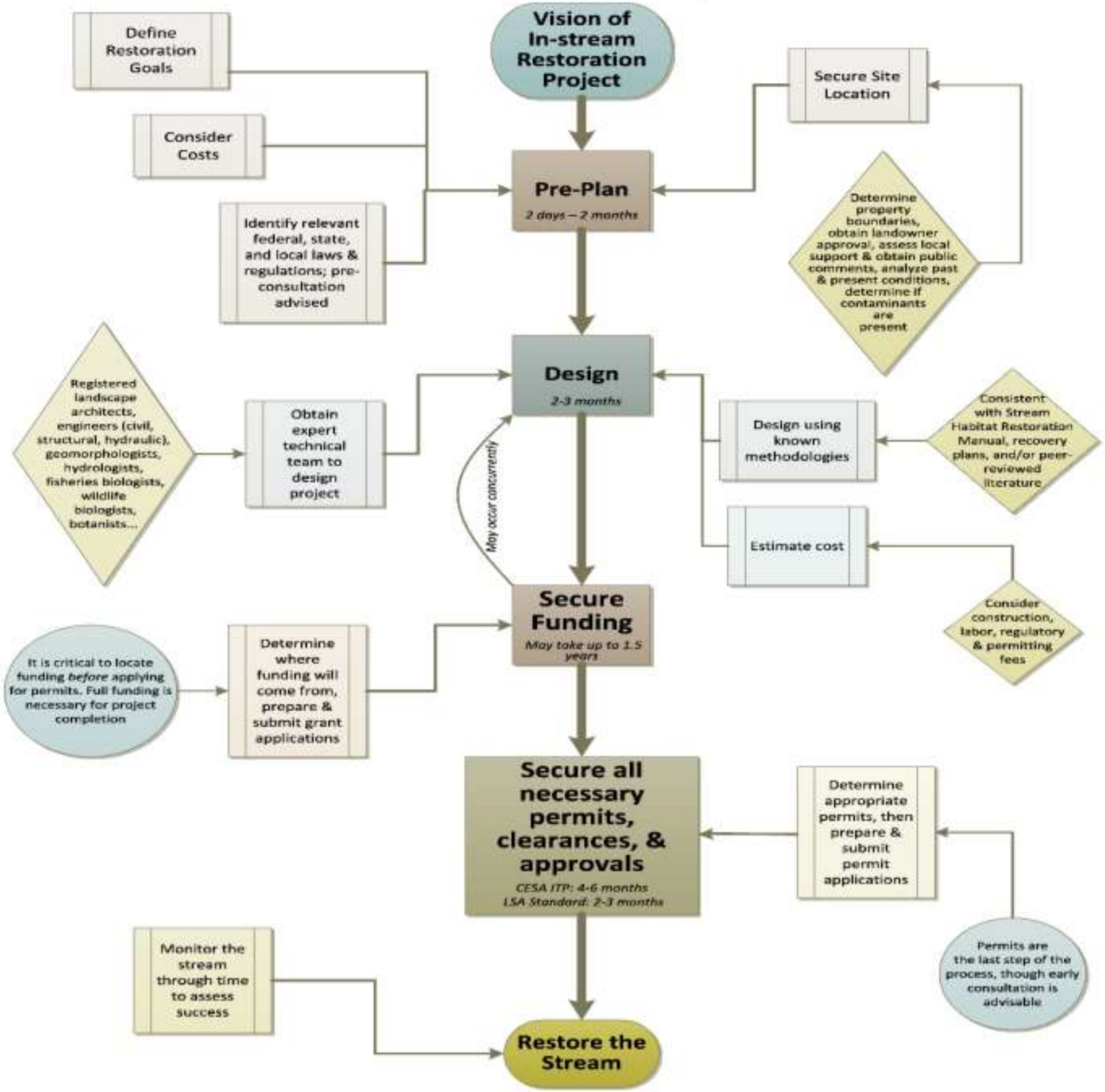
CALIFORNIA Water Boards

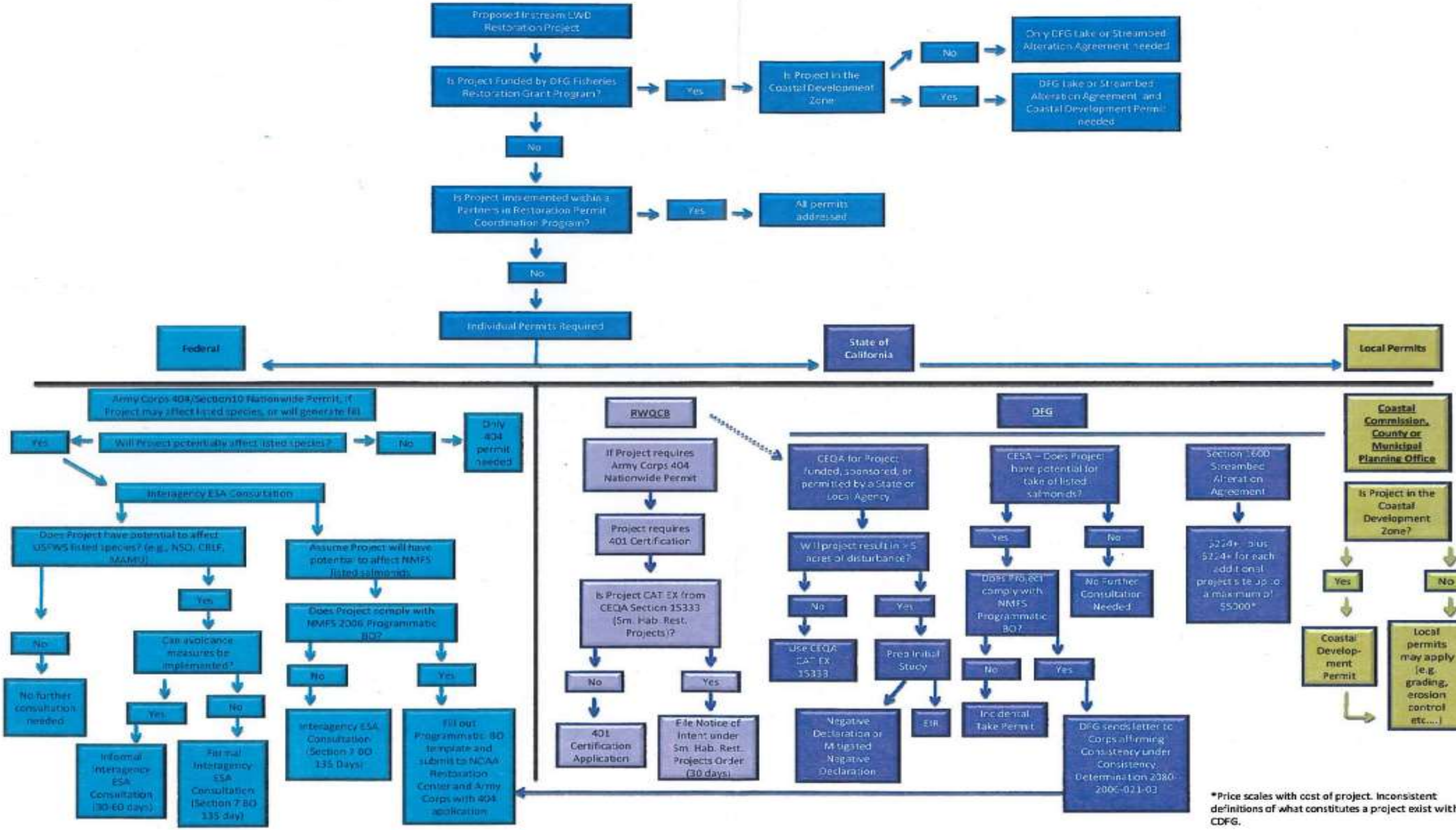
CALIFORNIA COASTAL COMMISSION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE
NOAA FISHERIES

CEQA

Small In-stream Restoration Project Process





*Price scales with cost of project. Inconsistent definitions of what constitutes a project exist within CDFG.

WHAT REGULATORY PATHWAYS ARE AVAILABLE

PACIFIC NORTHWEST

CALIFORNIA

PERMITTING STAGE 0 PROJECTS IN THE PACIFIC NORTHWEST

- **PROGRAMMATICS, PROGRAMMATICS, PROGRAMMATICS!**
- NOAA/NMFS AQUATIC RESTORATION BIOLOGICAL OPINION FOR AQUATIC RESTORATION
  - OREGON, WASHINGTON, IDAHO
  - USED BY FOREST SERVICE, BUREAU OF LAND MANAGEMENT, BUREAU OF INDIAN AFFAIRS, ARMY CORPS, BUREAU OF RECLAMATION, NRCS
  - USED FOR STAGE 0 PROJECTS AND COVERS ESA-LISTED SPECIES: MAMMALS, FISH, BIRDS, AMPHIBIANS, AND PLANTS
- USFWS PROGRAMMATIC BIOLOGICAL OPINIONS FOR AQUATIC RESTORATION
  - INCLUDE IMPLEMENTATION HANDBOOK FOR GENERAL AND SPECIFIC CONSERVATION MEASURES AND BO REQUIREMENTS

CATEGORIES OF COVERED ACTIVITIES IN PROGRAMMATIC BIOLOGICAL OPINIONS

- FISH SCREENS AND FISH PASSAGE
- INSTREAM FLOW IMPROVEMENTS
- INSTREAM STRUCTURE REMOVAL
- SIDE CHANNELS AND FLOODPLAIN FUNCTION CHANNEL RECONSTRUCTION (*REQUIRES ADDITIONAL DOCUMENTATION AND PROJECT DESCRIPTION)
- RIPARIAN HABITAT IMPROVEMENT
- RIPARIAN VEGETATION MANAGEMENT, INCLUDING PRESCRIBED FIRE AND PLANTING
- REDUCTION OR RELOCATION OF RECREATION IMPACTS
- ROAD AND TRAIL EROSION

PACIFIC NORTHWEST PROGRAMMATIC APPROACH FOR CHANNEL RECONSTRUCTION/RELOCATION

- **DESIGN CRITERIA** – REROUTING OF FLOW OR NEWLY CONSTRUCTED CHANNELS THAT ARE TYPICALLY MORE SINUOUS AND COMPLEX
- **APPLICATION** – APPLIES TO STREAM SYSTEMS THAT HAVE BEEN STRAIGHTENED, CHANNELIZE, OR OTHERWISE MODIFIED
- **DESIGN GUIDANCE –** GEOMORPHICALLY APPROPRIATE, DESIGN ACTIONS TO RESTORE FLOODPLAIN IN A MANNER THAT MIMICS NATURE
- **DESIGN CRITERIA DOCUMENTATION** – BACKGROUND, PROJECT DESCRIPTION, DESIGN ANALYSIS, MAPS & DRAWINGS
- **RESTORATION REVIEW TEAM**
- **MONITORING AND ADAPTIVE MANAGEMENT PLAN**
- **NO SURPRISES**

PERMITTING PATHWAYS IN CALIFORNIA

NOAA RESTORATION CENTER BIOLOGICAL OPINIONS

- PROVIDE FEDERAL ESA COVERAGE
- PROGRAMMATIC BO AREAS
  - SANTA ROSA: 2016 TO INDEFINITE (10 ACRES, <1000 FEET DEWATERING)
  - NORTHERN CA/ARCATA: 2012 TO 2022 (< 1000 FEET DEWATERING, .25 ACRE STAGING)
  - SOUTHERN CA/LONG BEACH: 2015 TO 2025 (<500 FEET DEWATERING, INCLUDES DAM REMOVAL)
  - CENTRAL VALLEY/SACRAMENTO: 2018 TO 2028 (<1000 FEET DEWATERING, .5 ACRE STAGING)
- FEDERAL NEXUS
  - NOAA RESTORATION CENTER FUNDING
  - US ARMY CORPS ISSUANCE OF A SECTION 404 CWA OR SECTION 10 (RHA)
- COVERED ACTIVITIES DIFFER BY AREA
- PROGRAMMATIC BO LIMITATIONS VARY AREA
- NEW PROGRAMMATIC BIOLOGICAL OPINIONS ARE UNDER DEVELOPMENT (USFWS)

NOAA/CALIFORNIA COASTAL COMMISSION CONSISTENCY DETERMINATION

- RESTORATION PROJECTS WITHIN THE COASTAL ZONE
- NEXUS FOR USE NOAA RESTORATION CENTER FUNDING OR TECHNICAL ASSISTANCE
- PROVIDES AN ALTERNATE PATHWAY FOR A COASTAL DEVELOPMENT PERMIT
- AVAILABLE FOR USE IN THE NORTH, CENTRAL, AND SOUTH COASTS
- SHORT APPLICATION PROCESS
- REDUCE COSTS AND TIMEFRAMES FOR PROJECT APPLICANTS AND COASTAL COMMISSION STAFF

U.S. FISH AND WILDLIFE SERVICE OPPORTUNITIES

- SOME EXISTING PROGRAMMATIC BIOLOGICAL OPINIONS FOR FEDERAL ESA SPECIES
  - FROGS, SALAMANDERS, OTHERS
  - USED WITH ARMY CORPS SECTION 404 PERMITTING
- USFWS CAN SERVE AS NEPA LEAD IF PROJECT PROPONENTS ENGAGE EARLY
- LOOKING TO DEVELOP NEPA CATEGORICAL EXCLUSIONS FOR BEAVER DAM ANALOGS
- USFWS PROJECT FUNDING CAN MEAN AGENCY TAKES CARE OF NEPA AND PERMITTING

ARMY CORPS OF ENGINEERS NATIONWIDE PERMITS

- NWP 27 INCLUDES RESTORATION, ENHANCEMENT, AND ESTABLISHMENT OF WETLANDS AND RIPARIAN AREAS, THE RESTORATION AND ENHANCEMENT OF NON-TIDAL STREAMS
- UP TO 10 ACRES OF IMPACTS, SIZING CORRESPONDS WITH NOAA RC BIOLOGICAL OPINIONS
- COMPENSATORY MITIGATION IS NOT REQUIRED FOR ACTIVITIES AUTHORIZED BY THIS NWP SINCE THESE ACTIVITIES MUST RESULT IN NET INCREASES IN AQUATIC RESOURCE FUNCTIONS AND SERVICES.

STATE WATER BOARD/REGIONAL WATER QUALITY CONTROL BOARDS

- SMALL HABITAT GENERAL CERTIFICATION (SB12006GN)
  - LIMITED PROJECT SIZE ≤5 ACRES / 500 LINEAR FEET
  - PRIMARY PURPOSE = HABITAT RESTORATION
  - MONITORING AND REPORTING TO MEET PERFORMANCE STANDARDS AND PROJECT GOALS
  - NO UNAUTHORIZED TAKE
  - MEETS CEQA EXEMPTION 15333, SMALL HABITAT RESTORATION
  - RESTORATION FEE

STATE WATER BOARD/REGIONAL WATER QUALITY CONTROL BOARDS

- CWA SECTION 401 WATER QUALITY CERTIFICATION
  - NO SIZE LIMIT
  - NO UNAUTHORIZED TAKE / NO NET LOSS OF WETLANDS OR WATERS
  - MONITORING AND REPORTING
  - WILL REQUIRE CEQA ANALYSIS OR EXEMPTION
  - RESTORATION FEE
- CRITICAL ELEMENTS
  - AVOID / MINIMIZE FINE SEDIMENT DISCHARGE
  - GRADE CONTROL, SITE SELECTION, SPECIES PROTECTION, INFRASTRUCTURE RISK
  - MONITOR AND REPORT FUNCTIONAL IMPROVEMENTS

PERMITTING BREAKTHROUGH: HABITAT RESTORATION AND ENHANCEMENT ACT

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PERMITTING BREAKTHROUGH: HABITAT RESTORATION AND ENHANCEMENT ACT

- CDFG CODE 1652 OR 1653
- WATERBOARD SMALL HABITAT 401 WATER QUALITY CERTIFICATION THEN CDFW CONSISTENCY DETERMINATION OR CDFW PERMIT
- CDFW WILL APPROVE COMPLETE APPLICATIONS WITHIN 30-DAYS OR 60-DAYS DEPENDING ON THE TYPE OF REQUEST SUBMITTED
- PROVIDES CA ENDANGERED SPECIES COVERAGE (THIS IS A HUGE DEAL)
- ALLOWS USE OF A VARIETY OF REFERENCE MANUALS (BEAVER RESTORATION MANUAL)
- SIZE LIMITED
  - <5 ACRE IMPACT AREA
  - <500 LINEAR FEET OF STREAMBANK IMPACTS OR DEWATERING LENGTH
- PERMIT 5 YEARS OF ACTIVITY WITH ANNUAL WORK PLANS (E.G., 5 BDA'S/YEAR, UP TO 15 MORE OVER 5 YEARS)
- ADAPTIVE MANAGEMENT ACTIVITIES

UPCOMING AND ON-GOING PROGRAMMATIC APPROACHES

- SUSTAINABLE CONSERVATION IS WORKING TO DEVELOP SIMPLIFIED APPROACHES FOR PERMITTING VOLUNTARY RESTORATION PROJECTS
  - AGENCIES INVOLVED
    - NOAA RC
    - ARMY CORPS OF ENGINEERS (COORDINATED PERMITTING)
    - U.S. FISH & WILDLIFE SERVICE (STATEWIDE BO)
    - STATE WATER RESOURCES CONTROL BOARD (STATEWIDE 401)
  - USING NOAA RC AND NMFS PROGRAMMATIC BIOLOGICAL OPINIONS AS MODELS
  - FLOODPLAIN RESTORATION AND STREAM AND RIPARIAN HABITAT IMPROVEMENT
  - SIZING WILL BE MEDIUM TO LARGE PROJECT (PARAMETERS TBD)
  - BOARD RANGE OF SPECIES
  - WILL ULTIMATELY RESULT IN A SWRCB GENERAL ORDER FOR RESTORATION

STAGE 0 WORKSHOP BRAINSTORMING SESSION IDEAS, ISSUES, GAPS

- FIGURE OUT HOW TO AVOID SPECIFIC ACRE LIMITATIONS, USE SITE SPECIFIC RELATIVE UPPER LIMITS
- GET AWAY FROM CHANNEL FILL QUANTITIES AND FOCUS ON LONG-TERM RESTORATION OUTCOMES
- DEVELOP CEQA AND NEPA EXEMPTION PATHWAYS
- DEVELOP A WAIVER PROCESSES
- INCORPORATE ADAPTIVE MANAGEMENT INTO PERMITTING
- PROVIDING LEARNING OPPORTUNITIES FOR SCIENTIST TO INFORM AGENCY STAFF
- INCORPORATE EARLY COLLABORATION
- DEVELOP A MEANS TO ADDRESS POPULATIONS VS INDIVIDUALS
- HOW DO WE ADDRESS CONFLICTING ENDANGERED SPECIES HABITAT NEEDS

QUESTIONS?

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FEASIBILITY OF FLOODPLAIN RECONNECTION USING MULTIPLE ENTRY, ADAPTIVE MANAGEMENT APPROACH UNDER CURRENT REGULATIONS

CHALLENGES AND BARRIERS

- ADAPTIVE MANAGEMENT PERMITS AND FUNDING
- NATURAL DESIGN, LACK OF COMPLETED DESIGN PLAN TO REVIEW
- MULTIPLE YEARS OF SMALL INTERVENTIONS, DISTURBANCE, AND ASSOCIATED IMPACTS
- INCREMENTS OF ECOSYSTEM UPLIFT
- END RESULT IS RESILIENT BUT EACH INTERVENTION MAY NOT BE
- DOES THIS APPROACH MEET THE OVERALL NEEDS?
- DOES A COMMITTED STEWARD PROGRAM MAKE UP FOR LACK OF RESILIENCE?
- HOW DO THE AGENCIES ADDRESS PLANNED MULTIPLE EPISODES OF BANK EROSION AND CHANNEL DEPOSITION

QUESTIONS TO CONSIDER

- WHAT PERMITTING AVENUES ARE AVAILABLE?
- WILL PERMITTING ALLOW THIS APPROACH TO ACHIEVE SUFFICIENT SCALE TO ACHIEVE STAGE 0?
- IF SO, WHAT PERMITTING APPROACHES HAVE PEOPLE USED?
- WHAT PERMITTING BARRIERS PREVENT THE ABILITY TO DO SO?
- WHAT PERMITTING ISSUES NEED TO CHANGE?
- WHAT RECOMMENDATIONS DO YOU HAVE FOR CHANGE?

FEASIBILITY OF FLOODPLAIN RECONNECTION USING MULTIPLE ENTRY, ADAPTIVE MANAGEMENT APPROACH UNDER CURRENT REGULATIONS

OPPORTUNITIES AND POTENTIAL SOLUTIONS

FEASIBILITY OF FLOODPLAIN RECONNECTION USING SINGLE-YEAR ‘VALLEY RESET’ OR ‘CHANNEL FILL’ APPROACHES UNDER CURRENT REGULATIONS

CHALLENGES AND BARRIERS

- ONE SEASON OF DISTURBANCE, CAN BE LARGE
- FULL ‘DESIGN’ PERFORMANCE IN 1 YEAR, FOLLOWED BY VEGETATION IMPROVEMENTS OVER TIME
- WHAT IS POTENTIAL NEED FOR FUTURE MANAGEMENT?
- ARE THERE EXISTING PERMITTING AVENUES AVAILABLE?
- HOW DO REGULATORY AGENCIES ADDRESS LARGE-SCALE FILL AND SUBSEQUENT PLANNED EROSION AND ONE YEAR DISTURBANCE?
- WHAT ARE THE OPPORTUNITIES AVAILABLE AND THE GAPS TO USE THEM?
- INSTITUTIONAL THOUGHTS ON SEDIMENT

QUESTIONS TO CONSIDER

- HAS THIS BEEN DONE IN CALIFORNIA?
- IF SO, WHAT PERMITTING APPROACHES HAVE PEOPLE USED?
- WHAT PERMITTING BARRIERS PREVENT THE ABILITY TO DO SO?
- HOW, SPECIFICALLY, WOULD YOU ADDRESS REGULATORY CONCERN OVER 1) STREAM CHANNEL FILL, 2) PRESENCE AND DISTURBANCE OF NON-TARGET LISTED SPECIES 3) LARGE FOOTPRINT DISTURBANCE OF RIPARIAN VEGETATION 4) OTHER REGULATORY CONCERNS?
- WHAT PERMITTING ISSUES NEEDS TO CHANGE?
- WHAT RECOMMENDATIONS DO YOU HAVE FOR CHANGE?

FEASIBILITY OF FLOODPLAIN RECONNECTION USING SINGLE-YEAR ‘VALLEY RESET’ OR ‘CHANNEL FILL’ APPROACHES UNDER CURRENT REGULATIONS

OPPORTUNITIES AND POTENTIAL SOLUTIONS

MONITORING AND ADAPTIVE MANAGEMENT STRATEGIES FOR USE IN PERMITTING

CHALLENGES AND BARRIERS

- HOW CAN WE ADDRESS FILL AND EROSION FOR REGULATORY APPROVAL?
- WHAT DO WE NEED TO ILLUSTRATE TO SHOW COMPLIANCE WITH THE CLEAN WATER ACT, ESA, OTHER REGULATIONS?
- HOW DO YOU MONITOR AND ADAPT DESIGN STRATEGIES?
- HOW DO WE RAISE COMFORT LEVELS OF THE REGULATORY COMMUNITY?

QUESTIONS TO CONSIDER

- IS IT SCIENTIFIC MONITORING, PROJECT EFFECTIVENESS MONITORING, MONITORING TO IMPLEMENT ADAPTIVE MANAGEMENT THAT IS NEEDED?
- HOW MUCH MONITORING NEEDS TO OCCUR? AT EACH PROJECT, ACROSS THE STATE AS A WHOLE?
- IF AT THE STATE LEVEL, HOW SHOULD PROJECT DATA FROM MULTIPLE SITES BE AGGREGATED TO PROVIDE LARGER SCALE ANSWERS TO QUESTIONS REGARDING THE PROJECT TYPE?
- HOW SHOULD ADAPTIVE MANAGEMENT BE PERMITTED?

MONITORING AND ADAPTIVE MANAGEMENT STRATEGIES FOR USE IN PERMITTING

OPPORTUNITIES AND POTENTIAL SOLUTIONS

CRITICAL DESIGN GUIDANCE AND IDENTIFICATION OF DESIGN CRITERIA TO ILLUSTRATE FOR PERMITTING

CHALLENGES AND BARRIERS

- WHAT IS THE FEASIBILITY OF STAGE O IN RELATION TO FISH PASSAGE & OTHER DESIGN CRITERIA?
- WHAT ARE THE OPPORTUNITIES & LIMITING FACTORS? HOW DOES CHANNEL FILL AND EROSION FIT IN?
- IS THERE ROOM TO MOVE FORWARDS WITH NO 'PLAN SET' AND DEFER DESIGN TO PROCESSES, IS THIS POSSIBLE?
- HOW DO WE GET AWAY FROM SINGLE SPECIES FOCUS AND MEASURE ECOLOGICAL SERVICES BENEFIT?
- HOW DO WE COST EFFECTIVELY DETERMINE POPULATION LEVEL BENEFITS?

QUESTIONS TO CONSIDER

- WHO IS RESPONSIBLE FOR DETERMINING PROJECT BENEFITS?
- WHAT KIND OF PROJECTS REQUIRE ENGINEERED PLANS?
- HOW CAN INFRASTRUCTURE PROTECTION BE ASSURED IF THERE ARE NOT ENGINEERED PLANS?
- HOW CAN PROJECT PROPONENTS AND PERMITTERS BE ASSURED THE PROJECTS ARE APPROPRIATELY PLACED, AND ARE NOT CAUSING HARM, IF THERE ARE NOT ENGINEERS AND/OR A TAC?
- WHAT DO REFERENCE MANUALS AND OTHER SUPPORTIVE DOCUMENTS NEED TO CONTAIN FOR PERMITTERS TO BE COMFORTABLE ACCEPTING THEM AS DESIGN AND IMPLEMENTATION MANUALS?

CRITICAL DESIGN GUIDANCE AND IDENTIFICATION OF DESIGN CRITERIA TO ILLUSTRATE FOR PERMITTING

OPPORTUNITIES AND POTENTIAL SOLUTIONS

CAN A PROGRAMMATIC APPROACH TO CEQA AND PERMITTING BE DEVELOPED? WHAT SHOULD A PROGRAMMATIC PROGRAM INCLUDE?

CHALLENGES AND BARRIERS

- STATE-WIDE PERMITTING CHALLENGES WITH DIVERSE STREAMS.
- PRESCRIPTIVE REGULATORY APPROACH VS. ADAPTIVE MANAGEMENT APPROACH
- IMPACTS OFTEN FOCUS ON AREAS OF DISTURBANCE AND IMPACTS ONLY
- ADDRESSING DIFFERENCES IN CA ESA AND FEDERAL ESA

QUESTIONS TO CONSIDER

- HOW DO WE GET AWAY FROM SINGLE SPECIES FOCUS AND MEASURE ECOLOGICAL SERVICES BENEFIT IN PERMITTING AND CEQA?
- CAN WE PRESCRIBE MORE ECOSYSTEM UPLIFT THAN DISTURBANCE AND NOT SET LIMITS TO PROJECT SIZE?
- WHAT PRACTICES SHOULD BE INCLUDED IN A PROGRAMMATIC CEQA EVALUATION? WHAT SPECIES SHOULD BE INCLUDED?
- DO WE LIMIT DISTURBANCE, LIMIT TAKE, OR REDUCE DURATION OF DISTURBANCE? CAN STAGE 0 OBJECTIVES BE ACHIEVED WITH THESE LIMITATIONS?

CAN A PROGRAMMATIC APPROACH TO CEQA AND PERMITTING BE DEVELOPED? WHAT SHOULD A PROGRAMMATIC PROGRAM INCLUDE?

OPPORTUNITIES AND POTENTIAL SOLUTIONS