Washington State Department of Transportation

Welcome to the

SR 20 Skagit River O'Brian Reach Floodplain Feasibility Study

COMMUNITY WORKSHOP #1

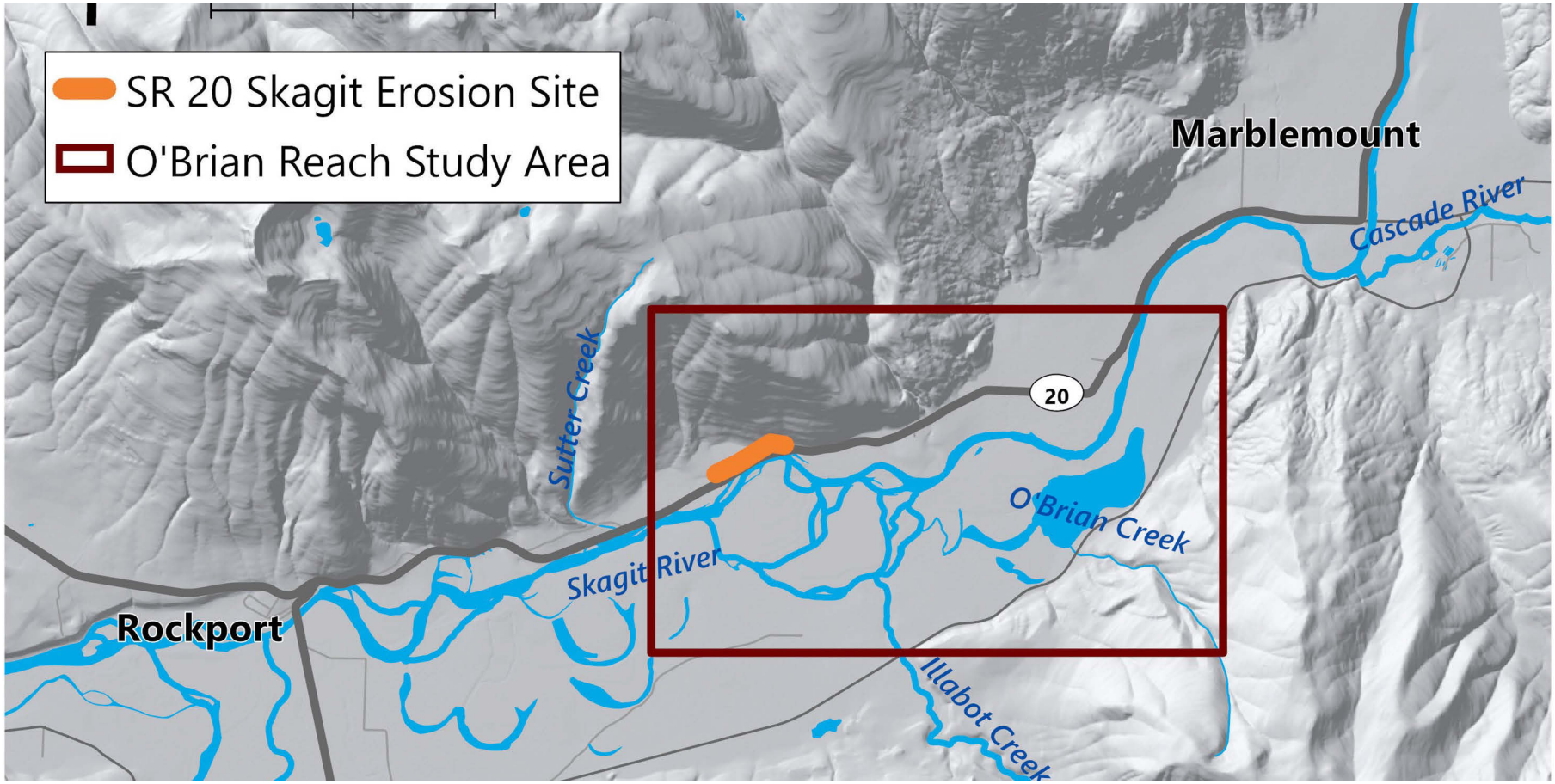
Washington State Department of Transportation

SR 20 Skagit River O'Brian Reach Floodplain Feasibility Study

COMMUNITY WORKSHOP #1

November 29, 2022

Jenni Dykstra, WSDOT Environmental Services Office
Jen O'Neal, Natural System's Design
Shawn Higgins, Natural System's Design
Hilary Wilkinson, Veda Environmental



SR 20 Skagit River O'Brian Reach Vicinity

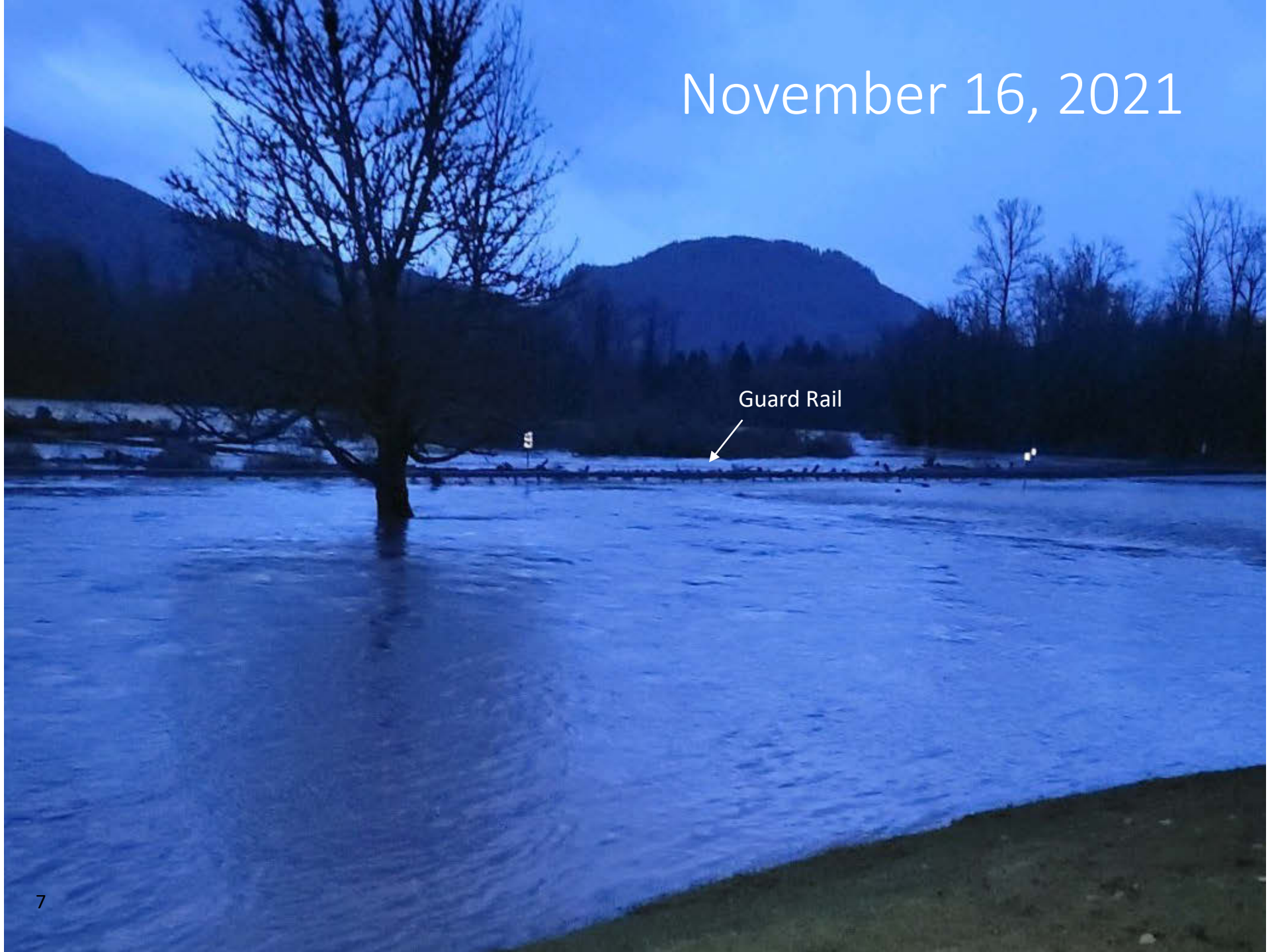
- Flood/Erosion Location: State Route 20, milepost 100.7 to 101
- O'Brian Reach Study Location: Skagit River, river-mile 72-74

Why is WSDOT sponsoring this study?

November 24, 2017

November 24, 2017

November 30, 2017


November 16, 2021
Guard Rail

November 16, 2021

November 22, 2021

SR 20 Eastbound shoulder

SR 20 Westbound shoulder

History of damage and repairs on SR 20

- 1970s – river eroded into 30-40’ buffer. Rip rap installed on the bank.
- 1995 – 500 feet of roadway damaged, more rip rap
- 2003 – flooding almost to top of jersey barrier
- 2004 – emergency rip rap installation along 40 feet of roadway
- 2004 – additional bank erosion
- 2005 – additional bank erosion
- 2006 – emergency rip rap installation along additional 150 feet of roadway.
- 2006 –immediately, river eroded additional 200 feet of the adjacent embankment and a portion of the 2006 repair was undermined by scour.
- 2007 – river migrated downstream and eroded the unprotected embankment and riparian area. Rip rap installed.
- 2014 – WSDOT constructed 4 dolotimber engineered log jams and a revetment along 1475 feet of the riverbank near milepost 100.7.
- 2017 – flooding overtopped SR 20 upstream of the dolotimber revetment and destroyed 1 lane of SR 20. EB lane closed for 4 weeks to repair the roadway and replace the rip rap. Detour 95 miles initial response.
- 2021 – flooding 6-ft deep over the roadway surface, scour undermined pavement on both sides, requiring repair. Closure during initial response to remove debris.



Frequent highway repairs can harm fish habitat

Chronic Environmental Deficiencies Program

- Long term repairs to address flooding and erosion
- Better for fish
- Creative approach using nature-based solutions

- MOA with Washington Department of Fish and Wildlife
- Goals of the CED program:
  - Protect WSDOT highways from environmental threats.
  - Reduce need for repairs that impact fish habitat.
  - Improve fish habitat with nature-based solutions that
  - Work with natural processes and minimize use of damaging materials.
  - Support WSDOT's mandate to maintain state highways.
  - Improve safety and resilience to climate change.

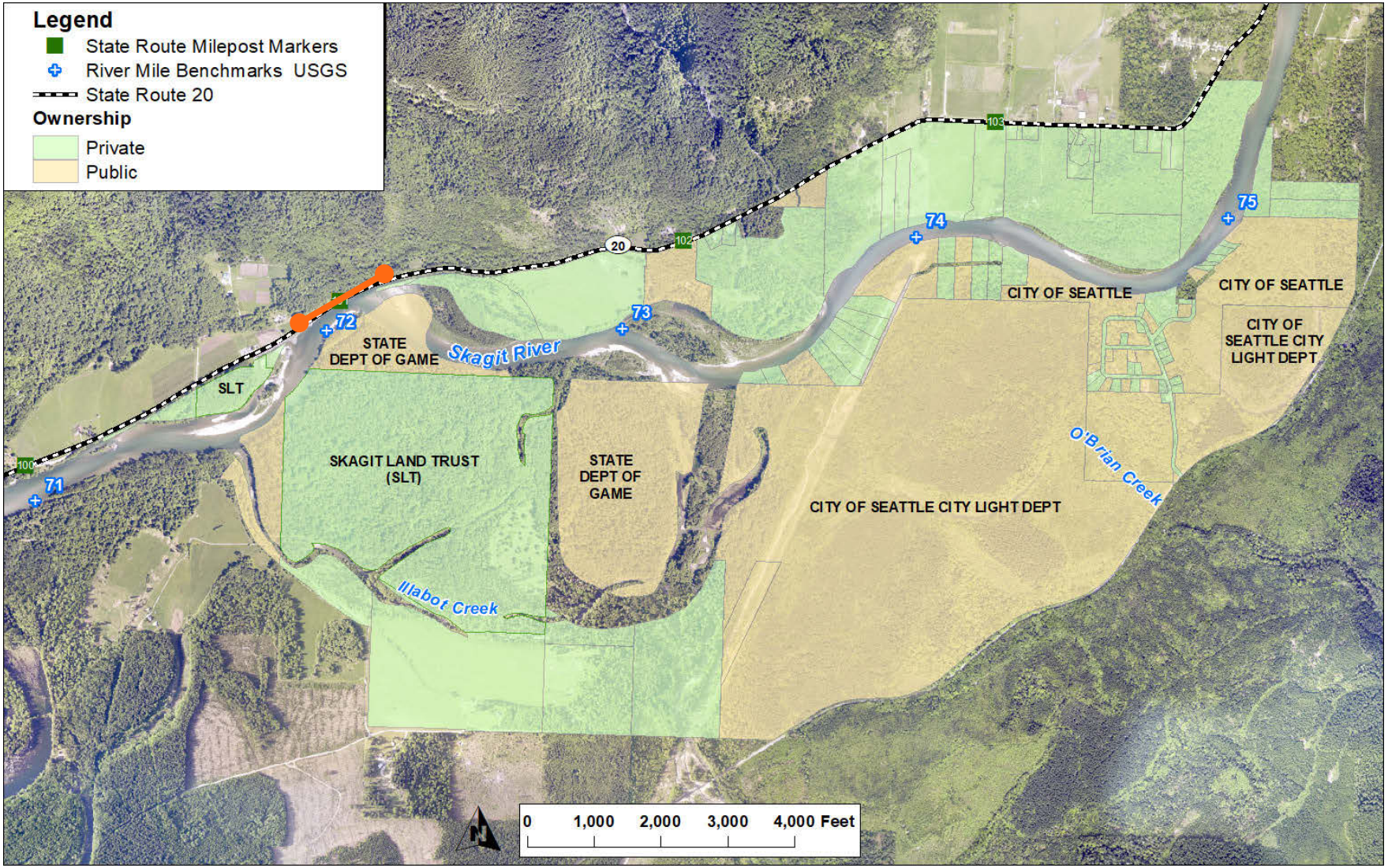
- Constructed 59 CED stream habitat and infrastructure improvement projects since 2002.

Adjacent 2014 CED project following November storm December 21, 2021

Opportunity

- Land in conservation use
- Re-distributing flows across the historic floodplain or into abandoned side channels can reduce pressure and flooding on the SR 20 road embankment.
- CED program has used approach in other projects
  - I-82 Yakima River
  - SR 207 Nason Creek
  - SR 970 Teanaway River
- Potential conservation partnership opportunities in the Skagit River Basin

Landowners in the O'Brian Reach



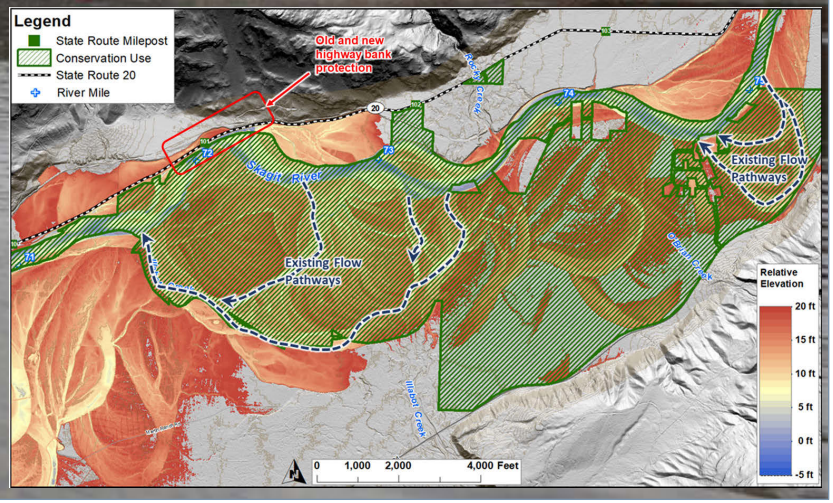
Opportunity: Enhance existing side channels in the Skagit River floodplain.

Salmon Recovery Funding Board (SRFB) Grant Request
June 2020

O'Brian Reach Floodplain Reconnection Project

Upper Skagit River Phase 1: Feasibility Study

- Proposal: Feasibility study to investigate fluvial processes and identify opportunities to reconnect side channels in a 3.7-mile study reach.
- Project Location: O'Brian Reach of the Skagit River Floodplain, RM 72-75
- Goal: Improve and restore native salmon habitat in the Skagit River floodplain by reconnecting side channels during small-medium floods.
- Objectives:
  - Engage the public early
  - Identify reconnection opportunities
  - Develop alternatives that enhance floodplain processes
  - Collaboratively identify a concept that maximizes floodplain habitats and diversity in this reach
- Species: Chinook, Coho, Steelhead, Chum, Pink, Bull Trout
- SWC Strategic Approach: Floodplain Target Area
- SRFB Request: $232,700



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SR 20 Skagit O'Brian Reach Floodplain Feasibility Study

- SRFB Grant awarded July 2021
- Grant funds: $232,700
  - WSDOT contribution: $16,100 in-kind project management
  - Seattle City Light contributed $25,000
- Natural Systems Design (NSD) implementing the study
- Veda Environmental supporting public outreach
- Study kickoff November 2021
- Study completed by December 2023

O’Brian Reach Feasibility Assessment

Natural Systems Design

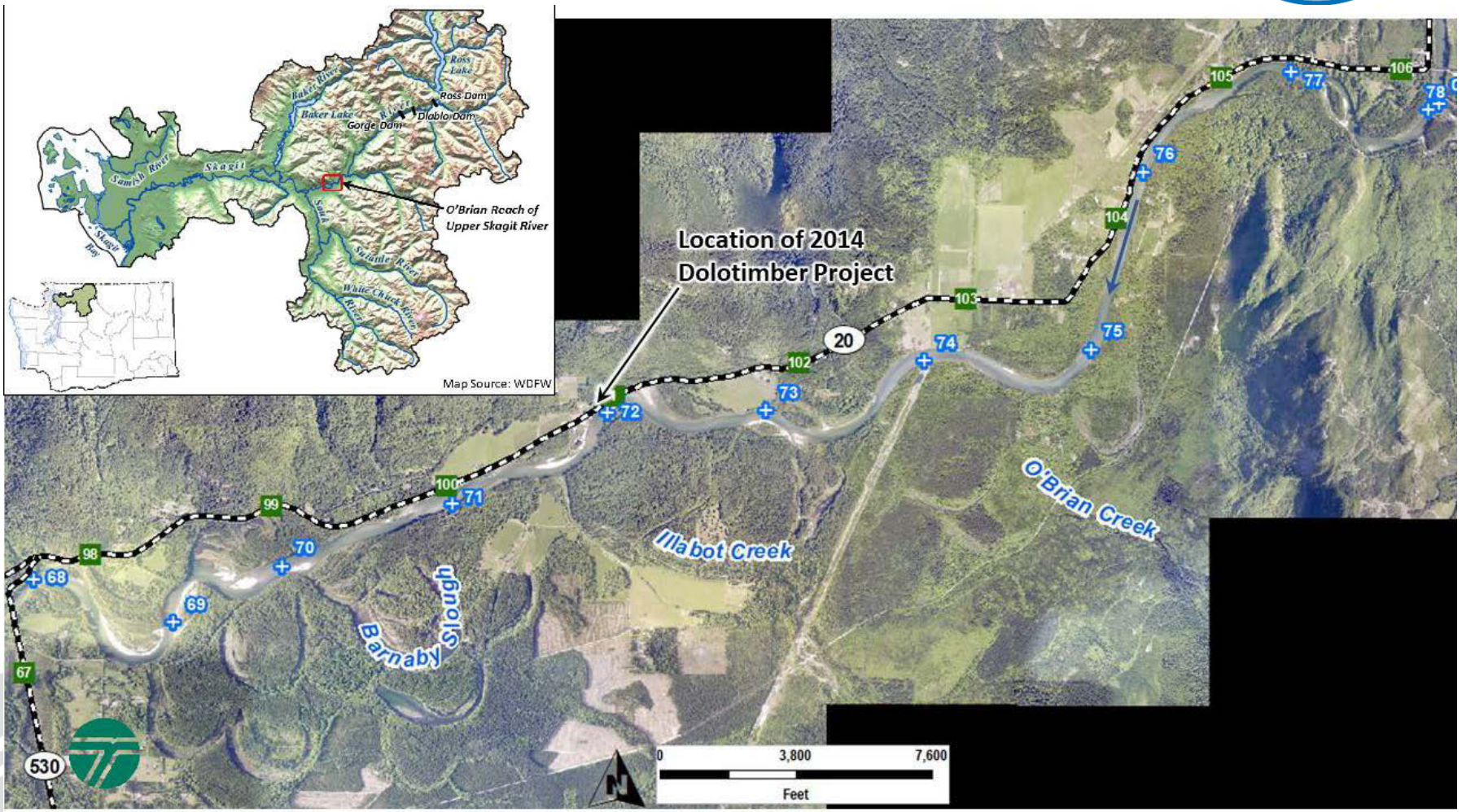
Study Overview and Status

- Study Goals
- Context
  - Geomorphic
  - Hydraulic
  - Habitat
- Evaluation Criteria – current draft
- Next Steps
- Questions and Discussion

Study Goals

- Assess floodplain connectivity and channel processes
- Determine **if** there are feasible actions to reduce issues with SR 20/flooding, benefit habitat, and at least remain neutral/acceptable to landowners and stakeholders

Study Location



Recovery Planning Context

ESA Recovery Plan
for the Puget Sound Steelhead
Distinct Population Segment
(Oncorhynchus mykiss)

West Coast Regional Office
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

Puget Sound Salmon Recovery Plan

SKAGIT CHINOOK RECOVERY PLAN

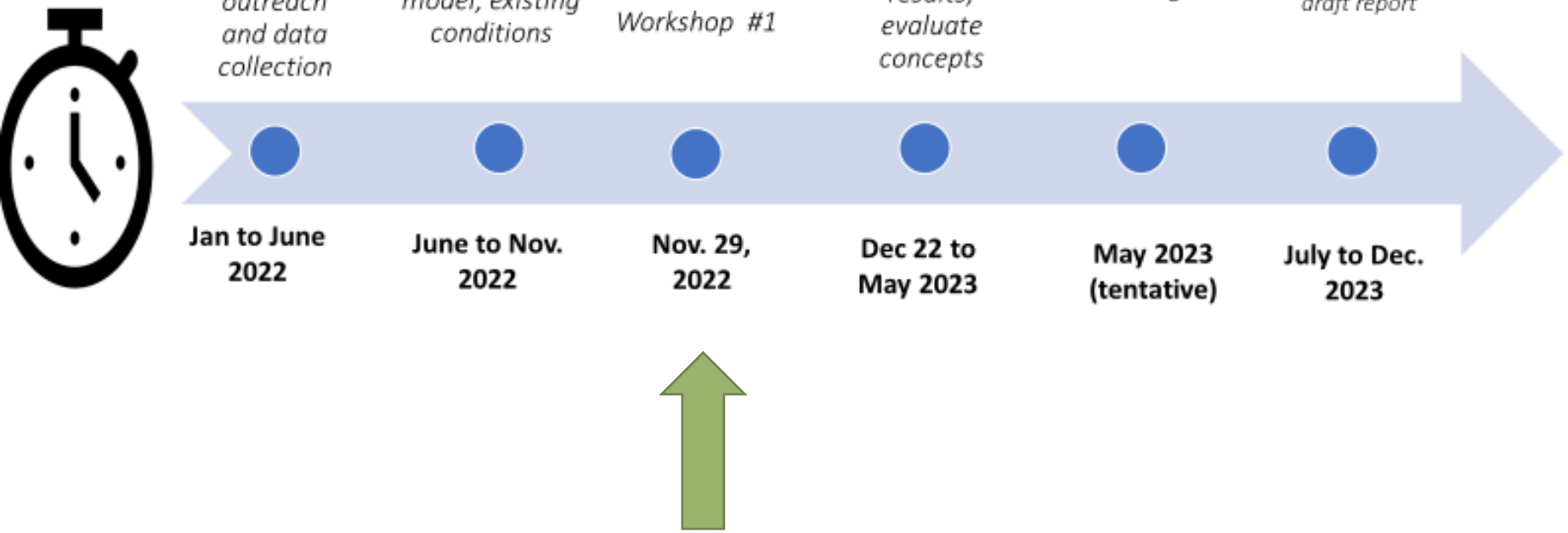
2005

Skagit River System Cooperative
11426 Moorage Way, LaConner, WA 98257

Washington Department of FISH and WILDLIFE

Study Status

TIMELINE



Overview and Results of Existing Conditions Analysis

Study Setting and Preliminary Results

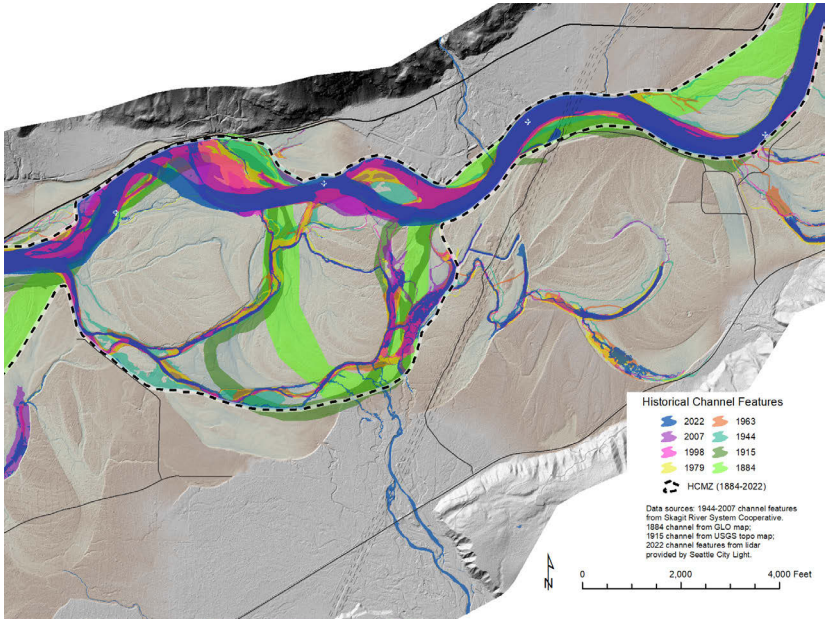
Technical Assessments:

- Geomorphic Characterization
- Hydraulic Model Development and Analysis
- Habitat Quantification

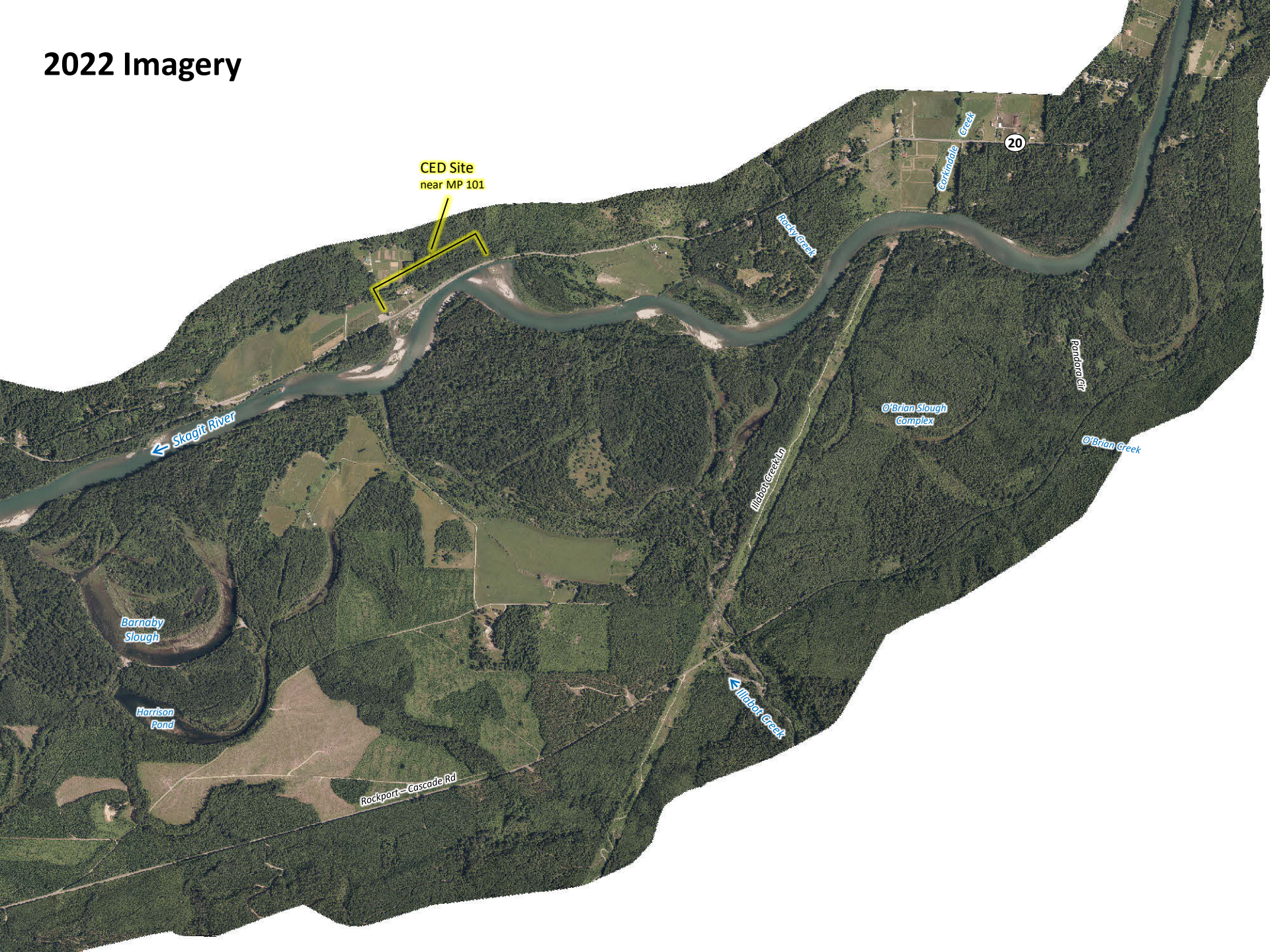
Geomorphic Assessment

Methods and Approach:

- Synthesis of Previous Studies and Compilation of Existing Information
- Targeted Field Reconnaissance
- Characterize Floodplain Topography and Landforms
- Mechanisms of Bank Erosion and Lateral Migration Rates
- Trajectories of Meander Bend Migration and Avulsion Risk Potential

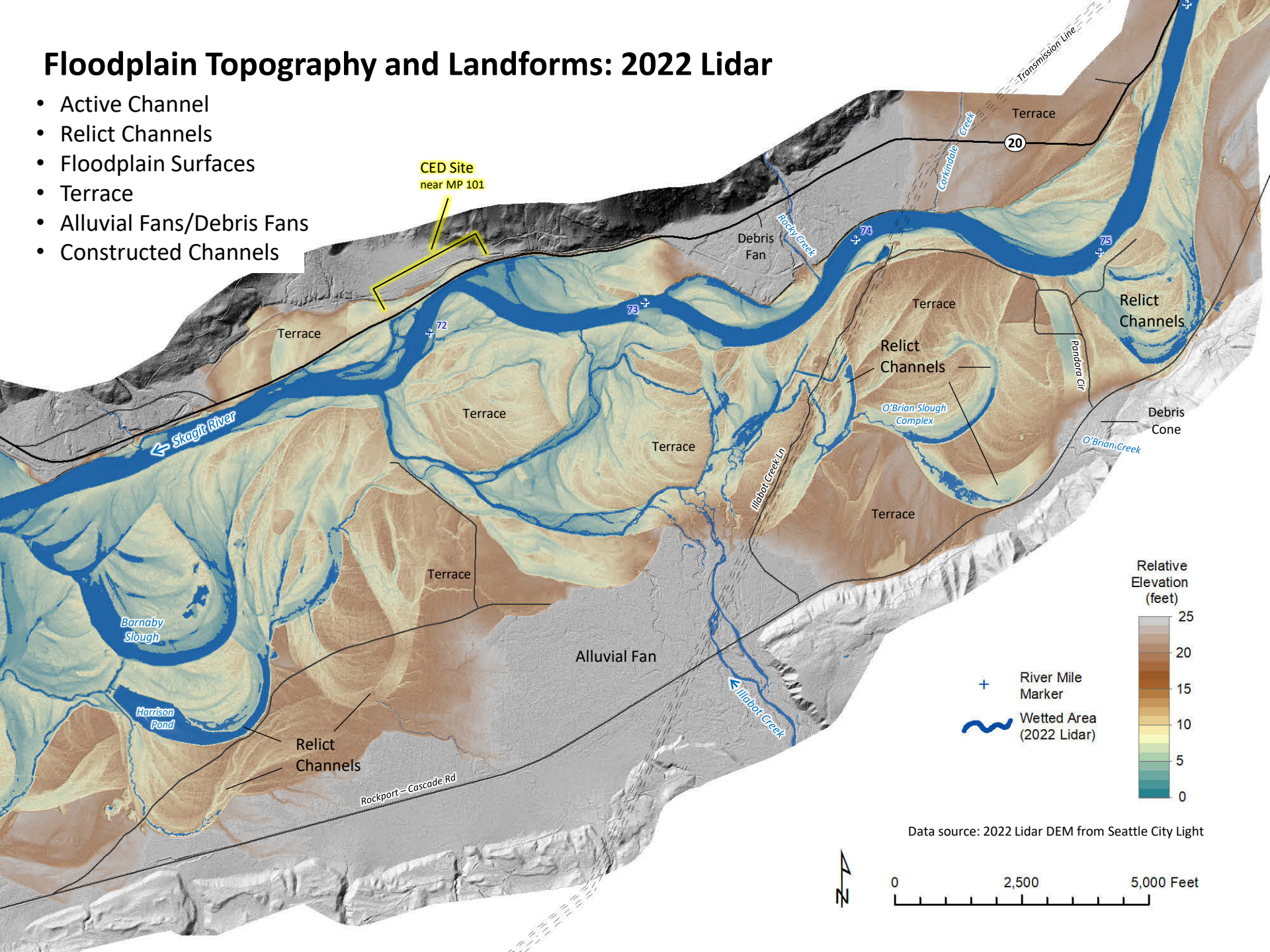


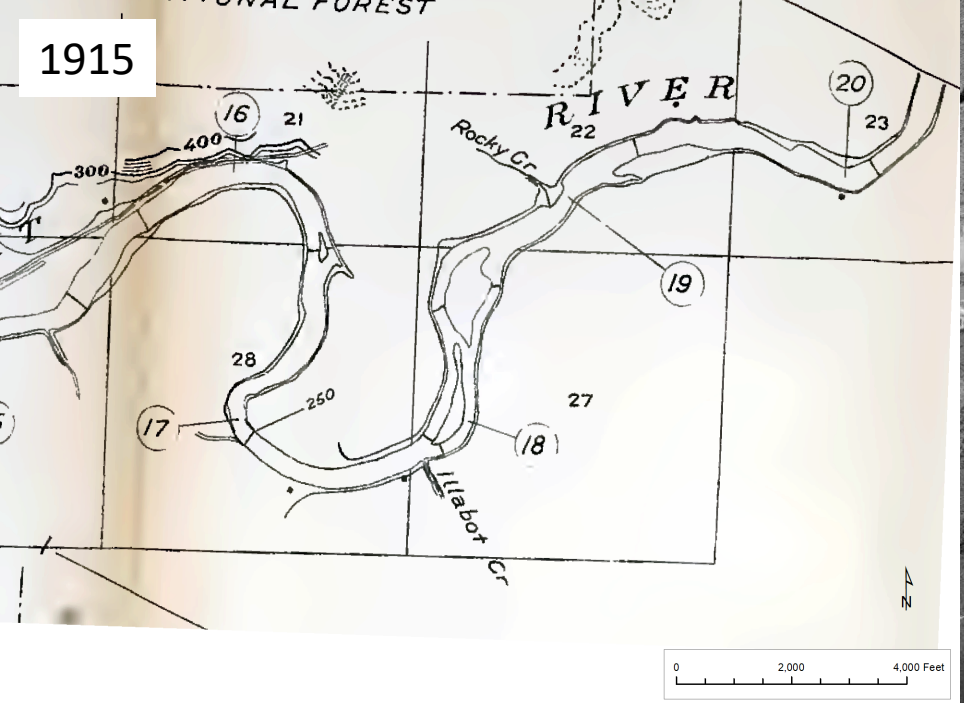
2022 Imagery

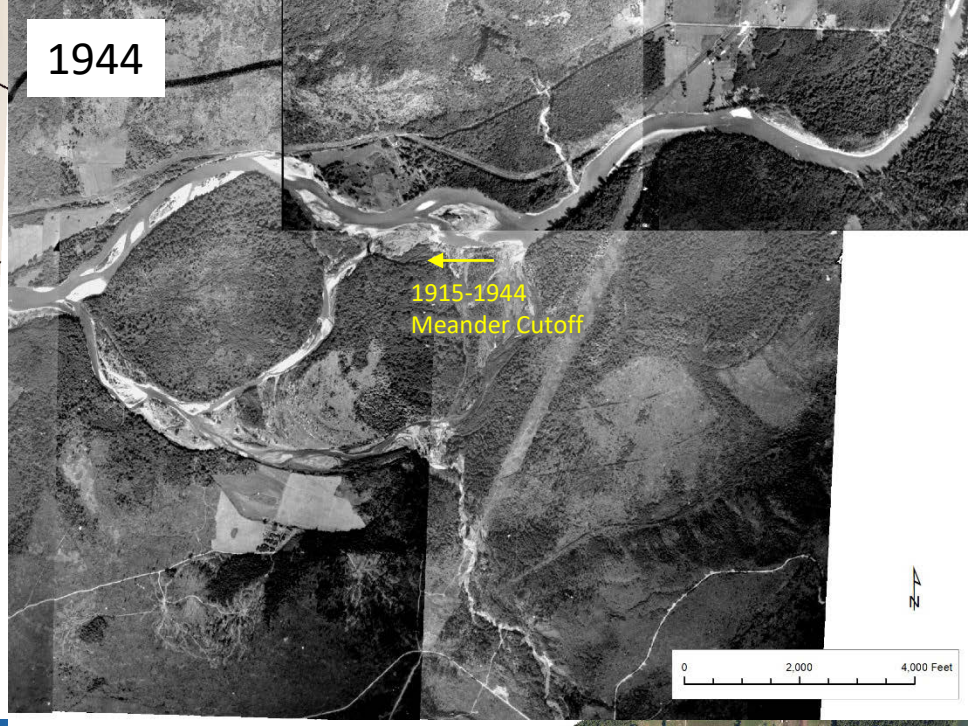


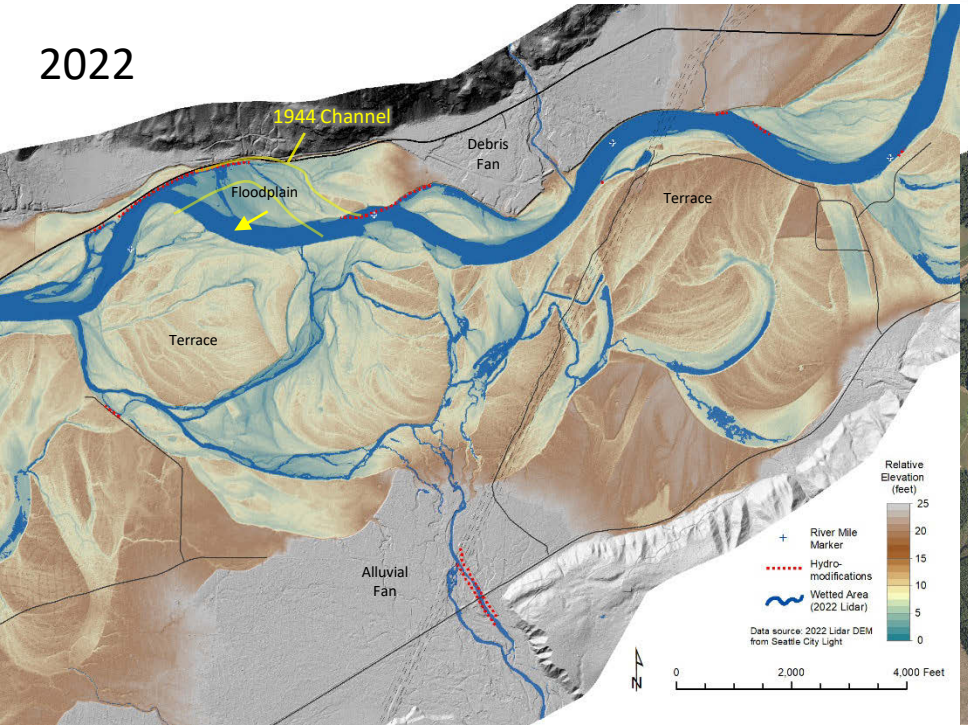
Floodplain Topography and Landforms: 2022 Lidar

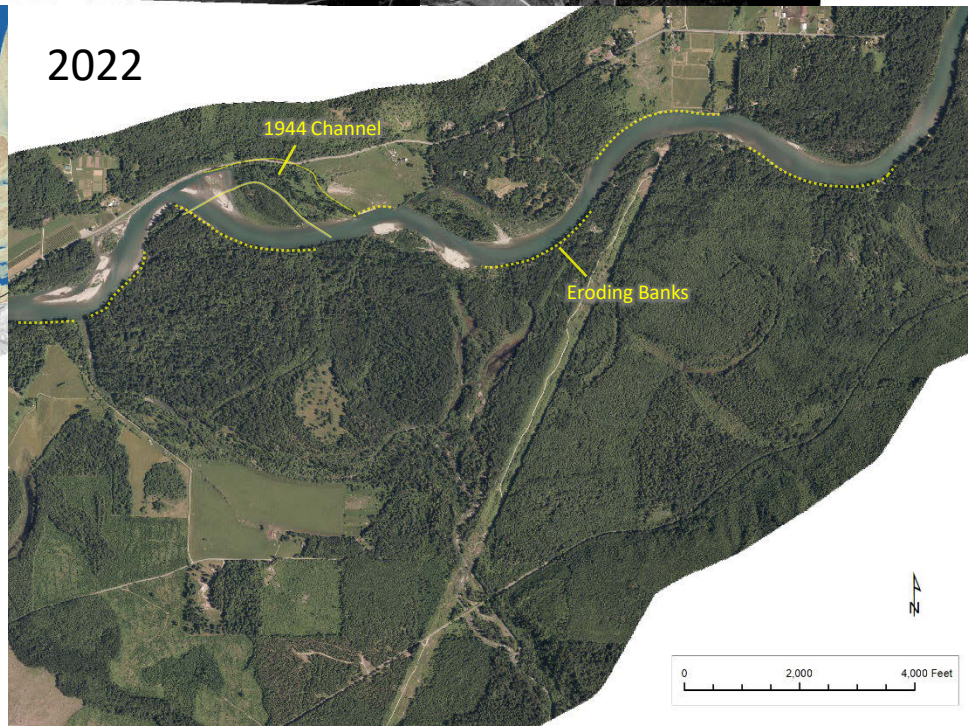
- Active Channel
- Relict Channels
- Floodplain Surfaces
- Terrace
- Alluvial Fans/Debris Fans
- Constructed Channels



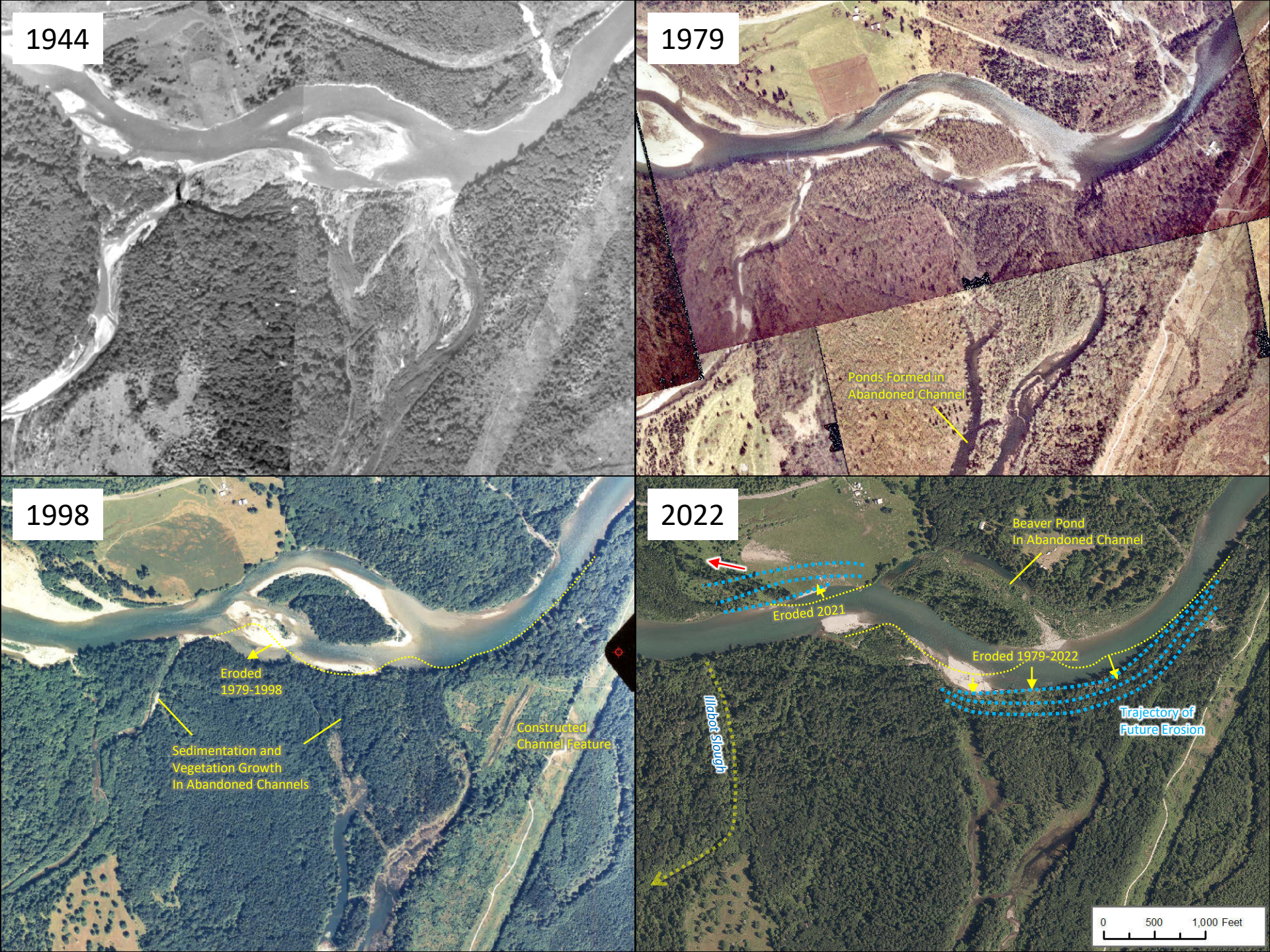

1915
RIVER
Rocky Cr
Illabot Cr
16
21
20
23
19
28
27
17
18
300
400
260
0
2,000
4,000 Feet


1944
1915-1944
Meander Cutoff
0
2,000
4,000 Feet


2022
1944 Channel
Floodplain
Debris
Fan
Terrace
Terrace
Alluvial
Fan
Relative
Elevation
(feet)
25
20
15
10
5
0
River Mile
Marker
Hydro-
modifications
Wetted Area
(2022 Lidar)
Data source: 2022 Lidar DEM
from Seattle City Light
0
2,000
4,000 Feet


2022
1944 Channel
Eroding Banks
0
2,000
4,000 Feet


1944
1979
1944 Banklines
1998
1944 Banklines
2022
1944 Banklines
Meander Bend
Migration 1944-2022
1,400 ft (18 ft/yr)
Trajectory of
Future Erosion
Potential
Avulsion
Pathway
0
500
1,000 Feet


1944
1979
Ponds Formed in
Abandoned Channel
1998
Eroded
1979-1998
Sedimentation and
Vegetation Growth
In Abandoned Channels
Constructed
Channel Feature
2022
Beaver Pond
In Abandoned Channel
Eroded 2021
Eroded 1979-2022
Trajectory of
Future Erosion
Ingbot Slough
0
500
1,000 Feet

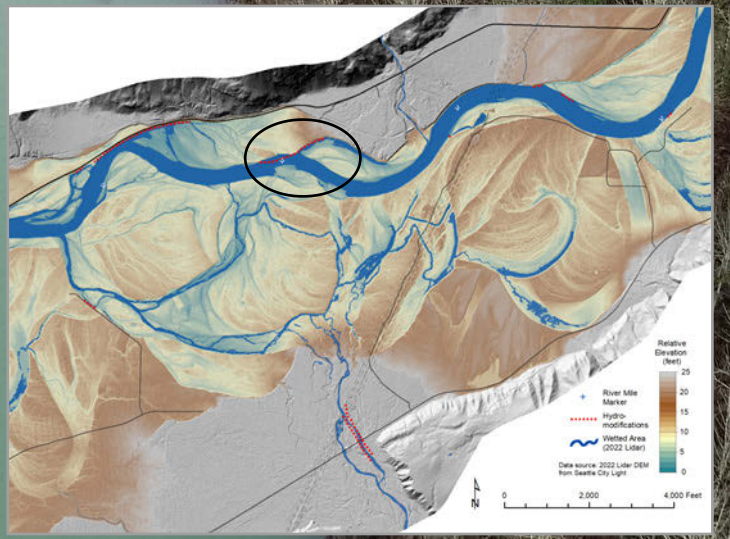

Chute Channel
on Inside of
Meander Bend
Photo: 12/14/2

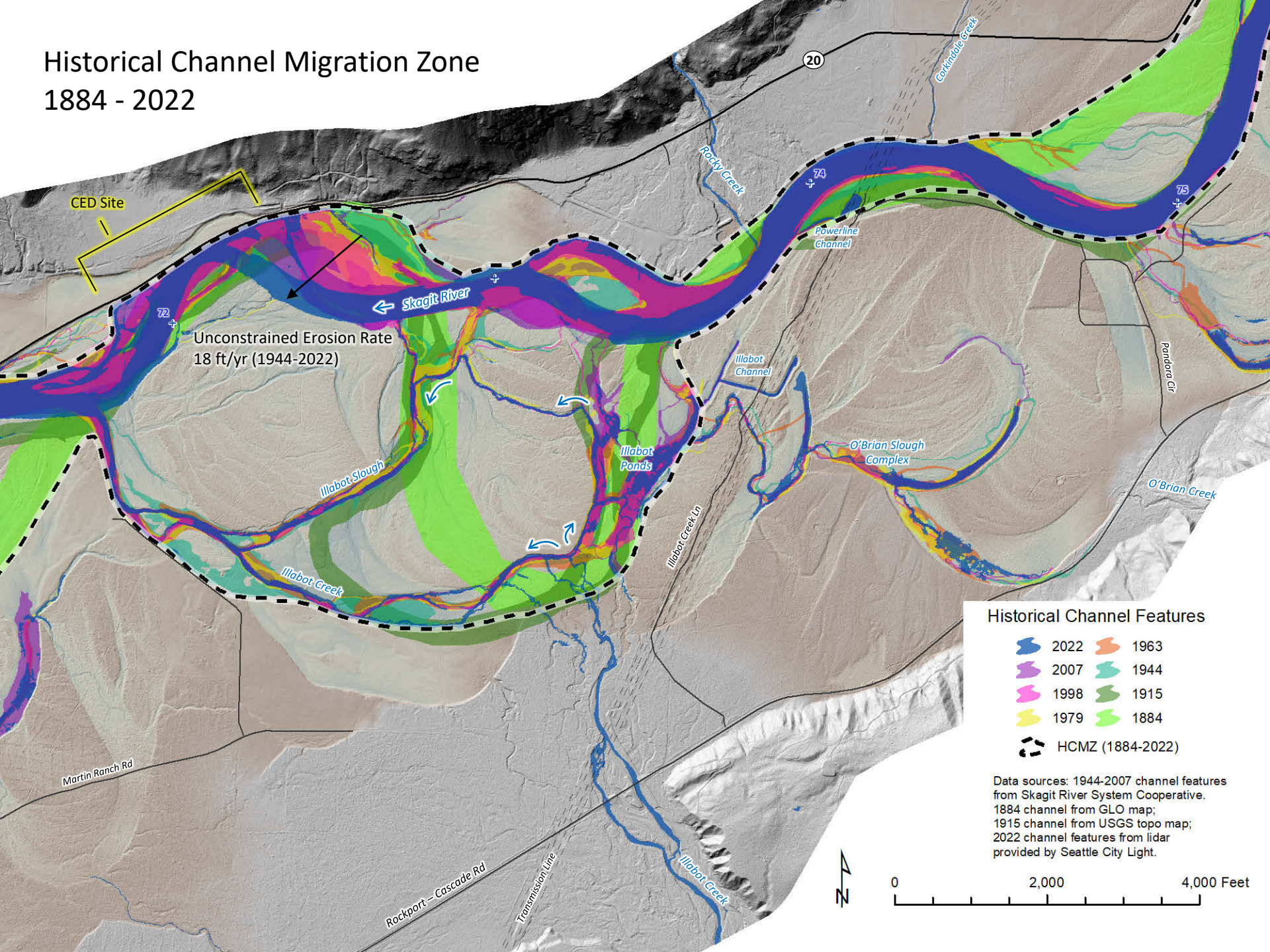
2021 Erosion at RM 73 Right Bank

Pond in Abandoned Channel

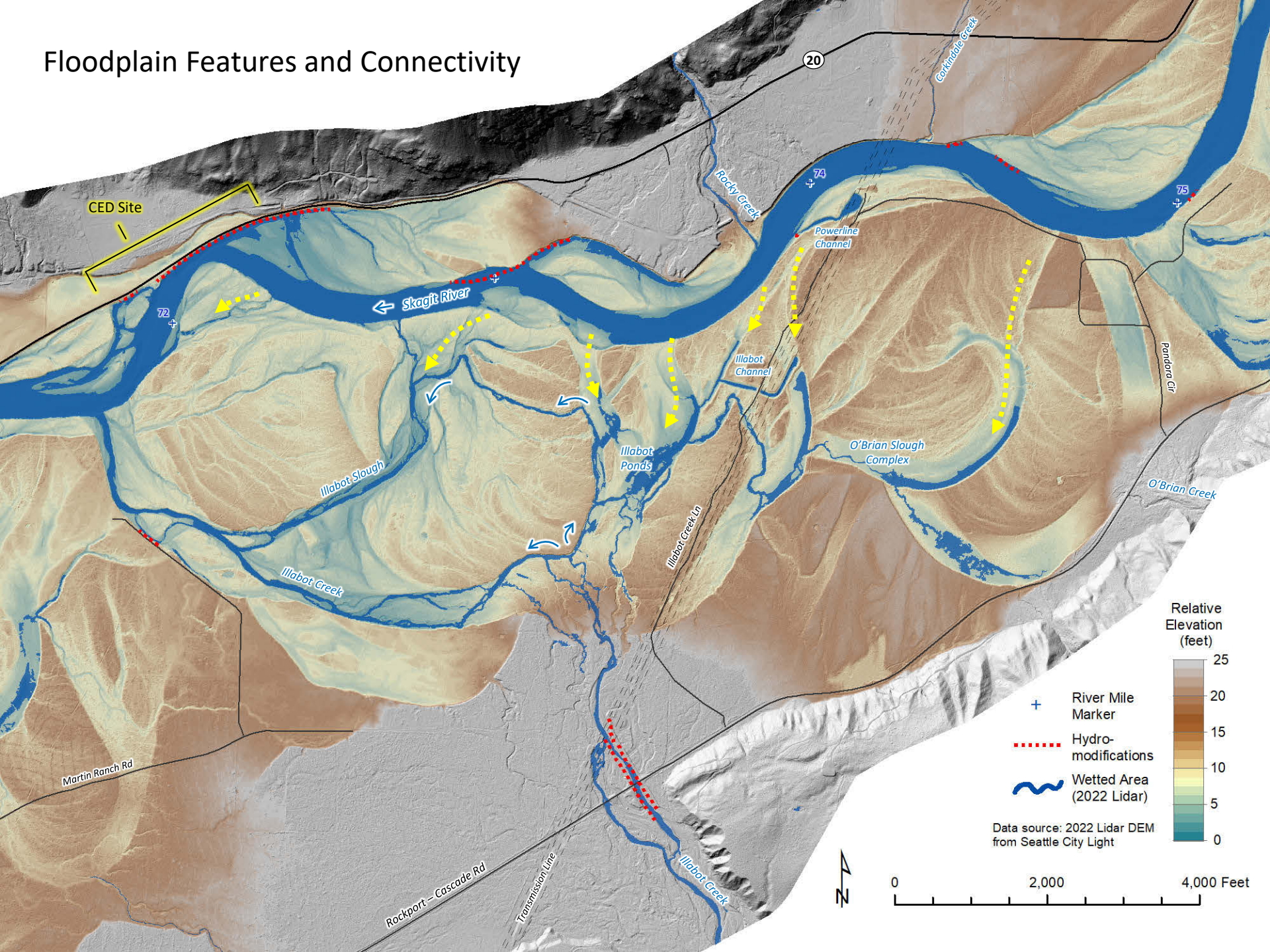
Flow

Rock Riprap
Washed Out 2021



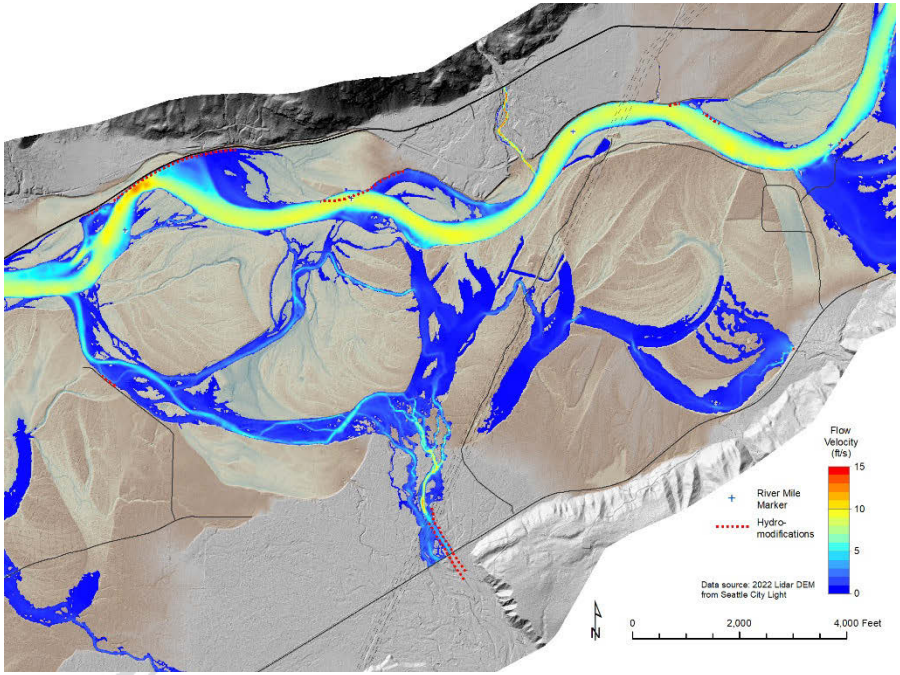

Historical Channel Migration Zone
1884 - 2022
CED Site
Unconstrained Erosion Rate
18 ft/yr (1944-2022)
Skagit River
Rocky Creek
Corkindale Creek
Powerline Channel
Illabot Channel
Illabot Ponds
Illabot Slough
Illabot Creek
Illabot Creek Ln
O'Brian Slough Complex
O'Brian Creek
Pandora Cir
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
20
72
74
75
Historical Channel Features
2022
2007
1998
1979
1963
1944
1915
1884
HCMZ (1884-2022)
Data sources: 1944-2007 channel features from Skagit River System Cooperative.
1884 channel from GLO map;
1915 channel from USGS topo map;
2022 channel features from lidar provided by Seattle City Light.
N
0
2,000
4,000 Feet

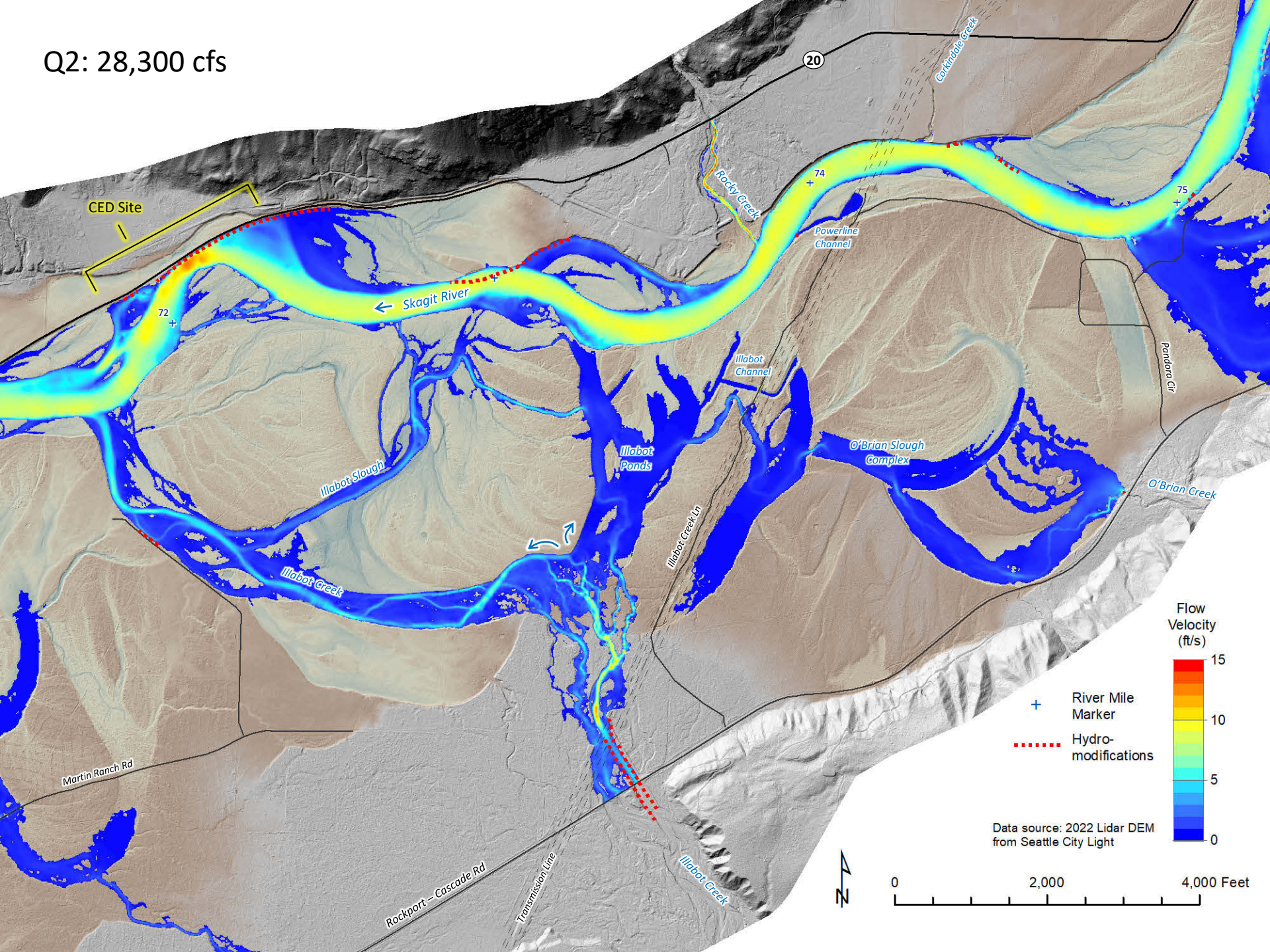
Floodplain Features and Connectivity

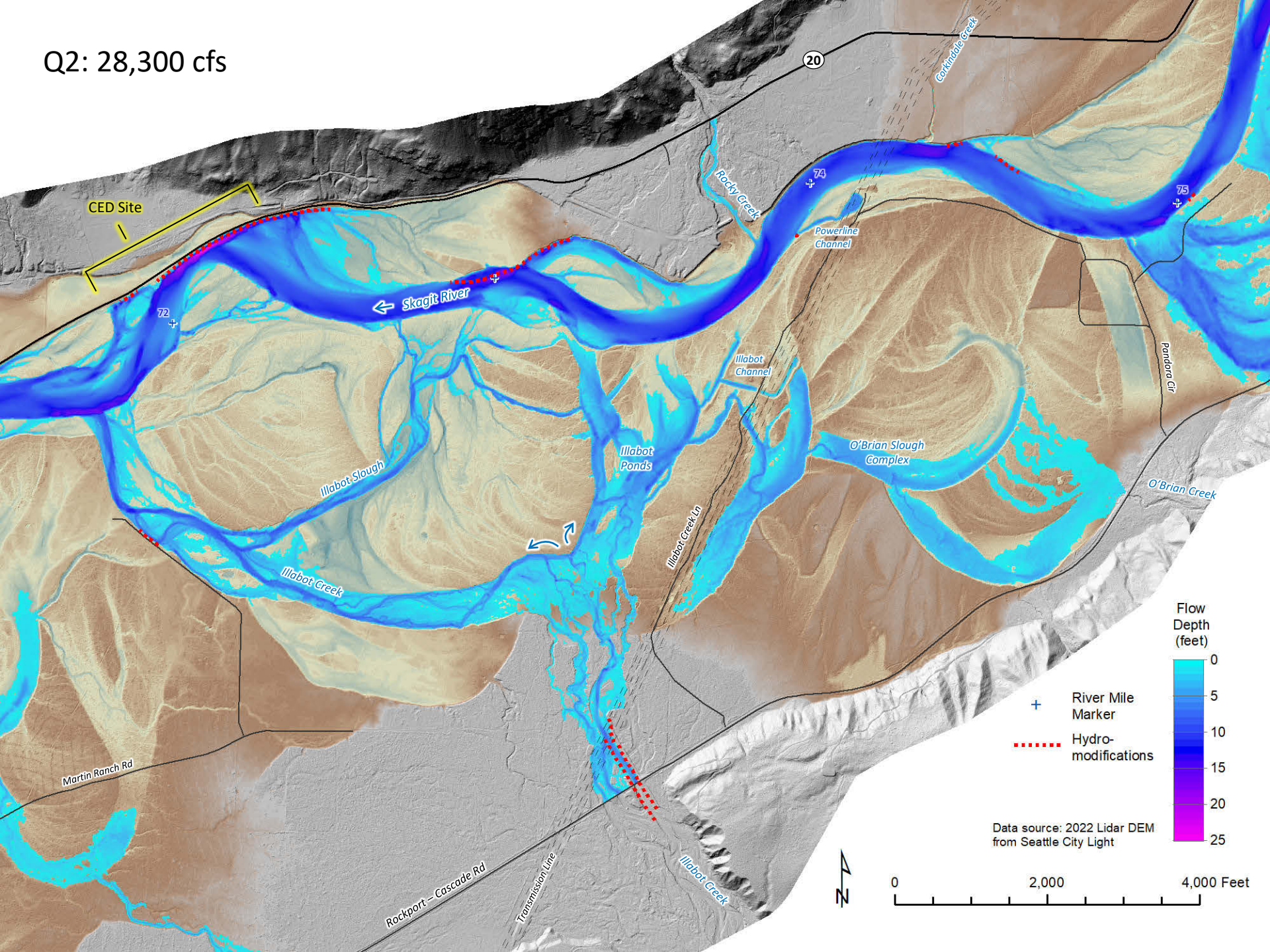


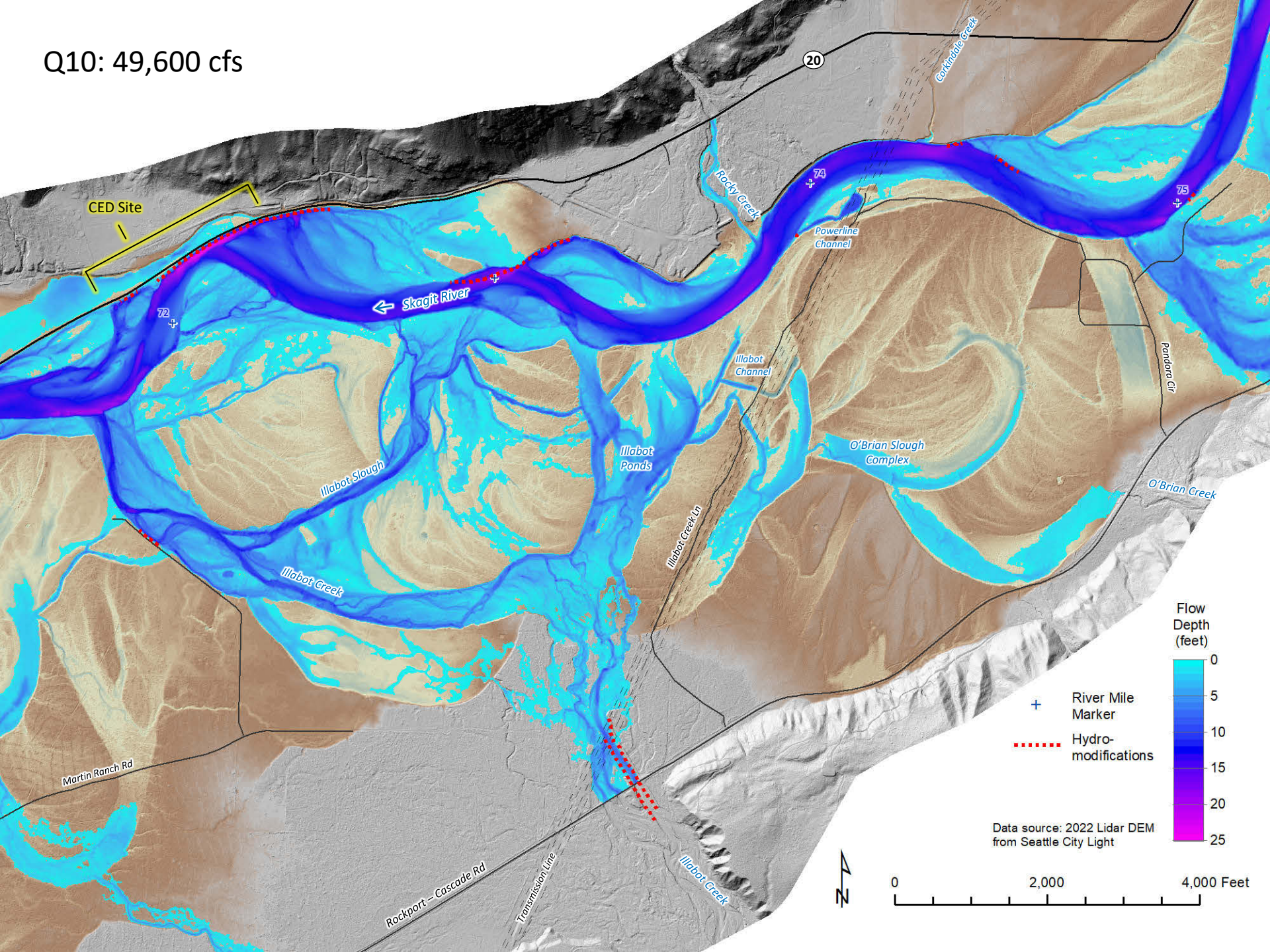
Hydraulic Model Development

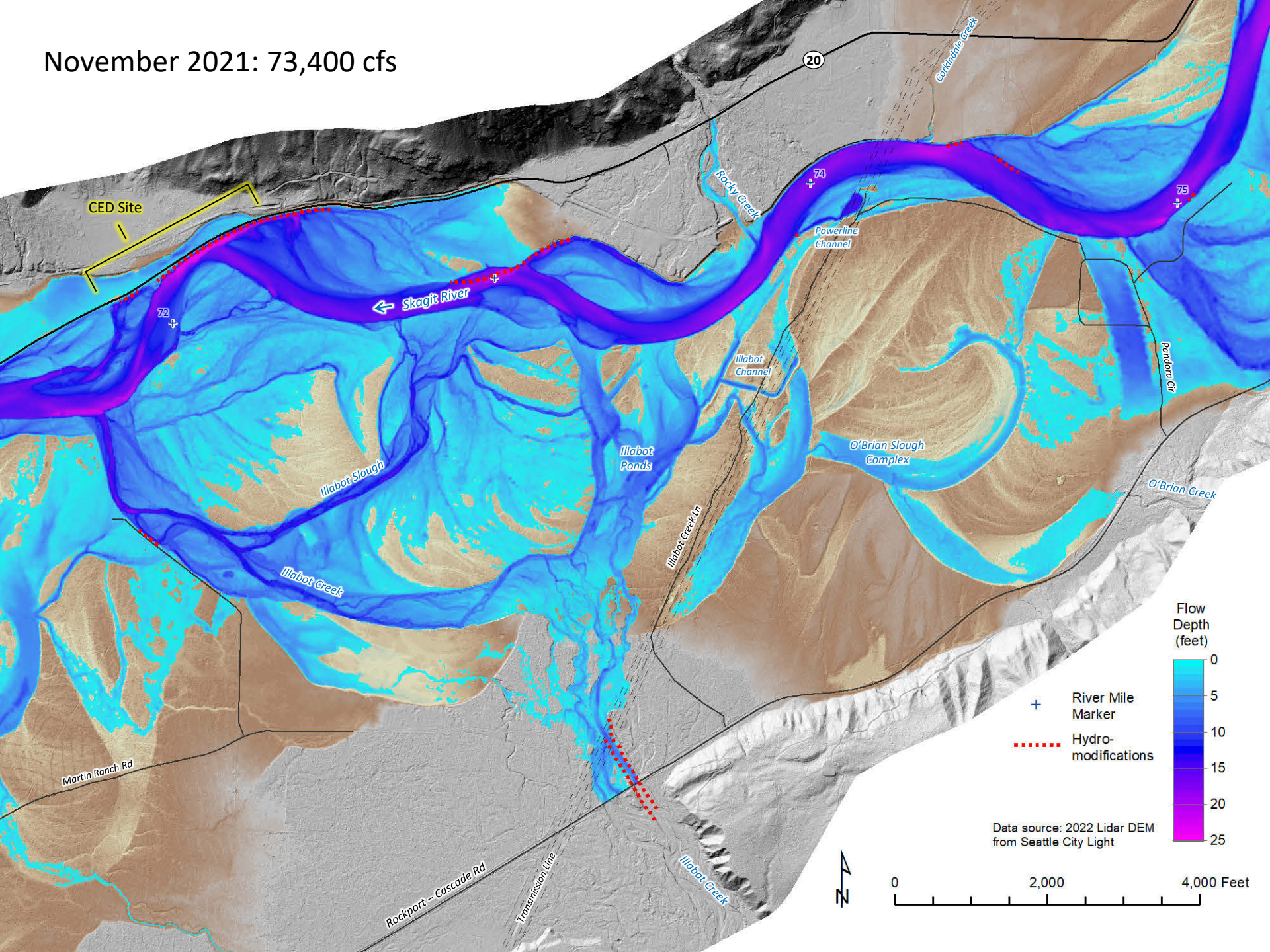
- 2-Dimensional flow simulations to calculate inundation depth, velocity, and shear
- Hydrology for Skagit River Illabot Creek, Rocky Creek, O'Brian Creek
- Calibrated to stage elevations at USGS gages; Validated with observations from Nov. 2021
- Output to inform evaluations of side channel connectivity, flood and erosion risk, and habitat quantification
- Framework for evaluating conceptual design opportunities

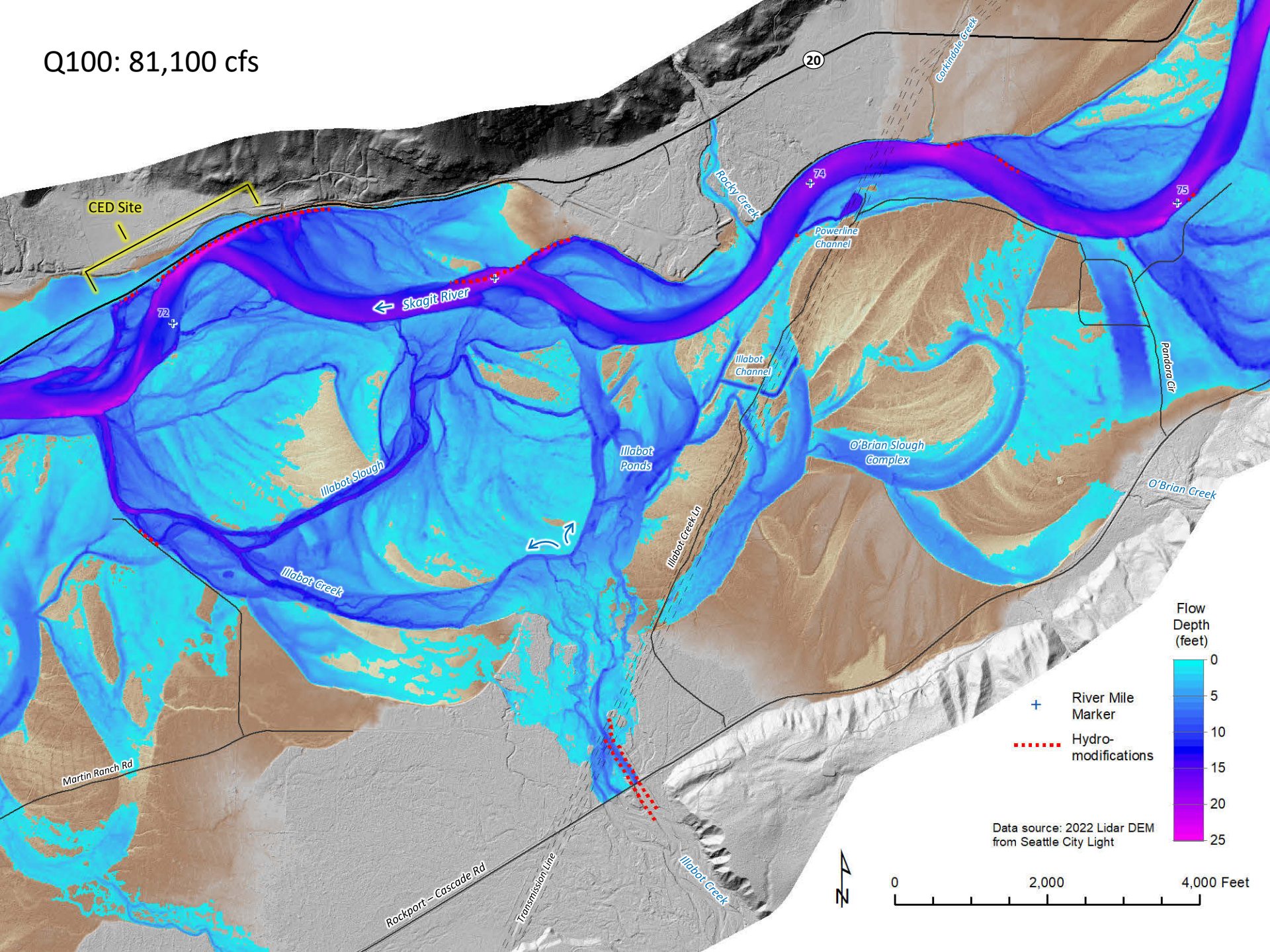



Q2: 28,300 cfs
CED Site
20
Corkindale Creek
Rocky Creek
74
75
Powerline Channel
Skagit River
72
Illabot Channel
Pandora Cir
Illabot Slough
Illabot Ponds
O'Brian Slough Complex
O'Brian Creek
Illabot Creek Ln
Illabot Creek
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
Illabot Creek
Flow Velocity (ft/s)
15
10
5
0
River Mile Marker
Hydro-modifications
Data source: 2022 Lidar DEM from Seattle City Light
N
0
2,000
4,000 Feet


Q2: 28,300 cfs
CED Site
20
Corkindale Creek
Rocky Creek
74
75
Powerline Channel
Skagit River
72
Illabot Channel
Pandora Cir
O'Brian Slough Complex
O'Brian Creek
Illabot Ponds
Illabot Slough
Illabot Creek Ln
Illabot Creek
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
Illabot Creek
Flow Depth (feet)
0
5
10
15
20
25
River Mile Marker
Hydro-modifications
Data source: 2022 Lidar DEM from Seattle City Light
N
0
2,000
4,000 Feet


Q10: 49,600 cfs
CED Site
20
Corkindale Creek
Rocky Creek
74
75
Powerline Channel
Skagit River
72
Illabot Channel
Pandora Cir
O'Brian Slough Complex
O'Brian Creek
Illabot Ponds
Illabot Slough
Illabot Creek Ln
Illabot Creek
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
Illabot Creek
Flow Depth (feet)
0
5
10
15
20
25
River Mile Marker
Hydro-modifications
Data source: 2022 Lidar DEM from Seattle City Light
N
0
2,000
4,000 Feet


November 2021: 73,400 cfs
CED Site
Skagit River
72
74
75
20
Corkindale Creek
Rocky Creek
Powerline Channel
Illabot Channel
Pandora Cir
O'Brian Slough Complex
O'Brian Creek
Illabot Ponds
Illabot Slough
Illabot Creek Ln
Illabot Creek
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
Illabot Creek
Flow Depth (feet)
0
5
10
15
20
25
River Mile Marker
Hydro-modifications
Data source: 2022 Lidar DEM from Seattle City Light
N
0
2,000
4,000 Feet


Q100: 81,100 cfs
CED Site
20
Corkindale Creek
Rocky Creek
74
75
Powerline Channel
Skagit River
72
Illabot Channel
Pandora Cir
Illabot Ponds
O'Brian Slough Complex
O'Brian Creek
Illabot Slough
Illabot Creek Ln
Illabot Creek
Martin Ranch Rd
Rockport – Cascade Rd
Transmission Line
Illabot Creek
Flow Depth (feet)
0
5
10
15
20
25
River Mile Marker
Hydro-modifications
Data source: 2022 Lidar DEM from Seattle City Light
N
0
2,000
4,000 Feet

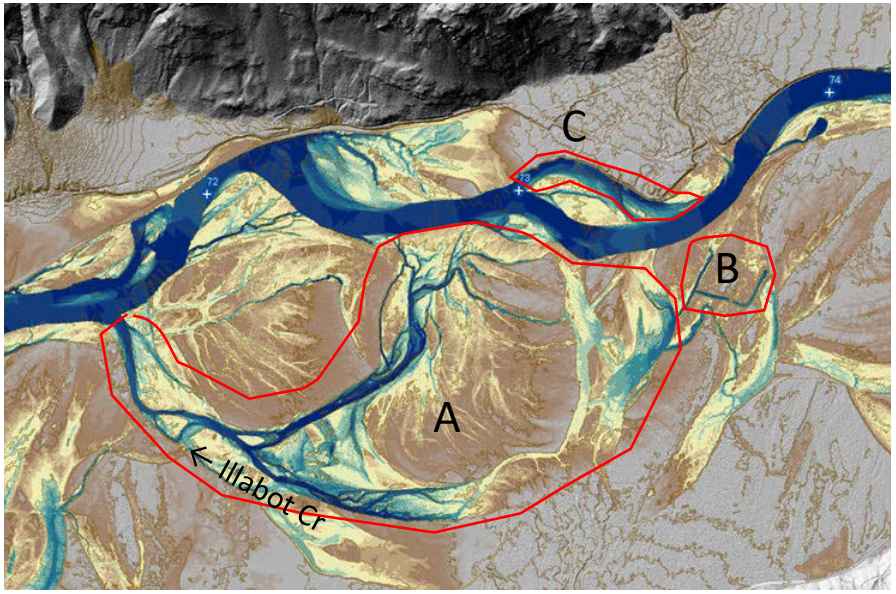
Fish Habitat

Existing side channel and off channel habitat

A. Illabot side channels
- Relict Skagit River channels
- Illabot Creek flows through western portion into Skagit River
- Complex side channels and off channel wetlands
- Provides high quality spawning and rearing habitat

B. Illabot constructed channel
- Blind channel originally constructed for spawning
- Some filling with fine sediment and currently functions as off channel rearing habitat

C. Slough at RM 73
- Relict mainstem channel
- Series of beaver dams - ponded off channel habitat
- Spawning gravels and backwater habitat in downstream portion



Fish Habitat

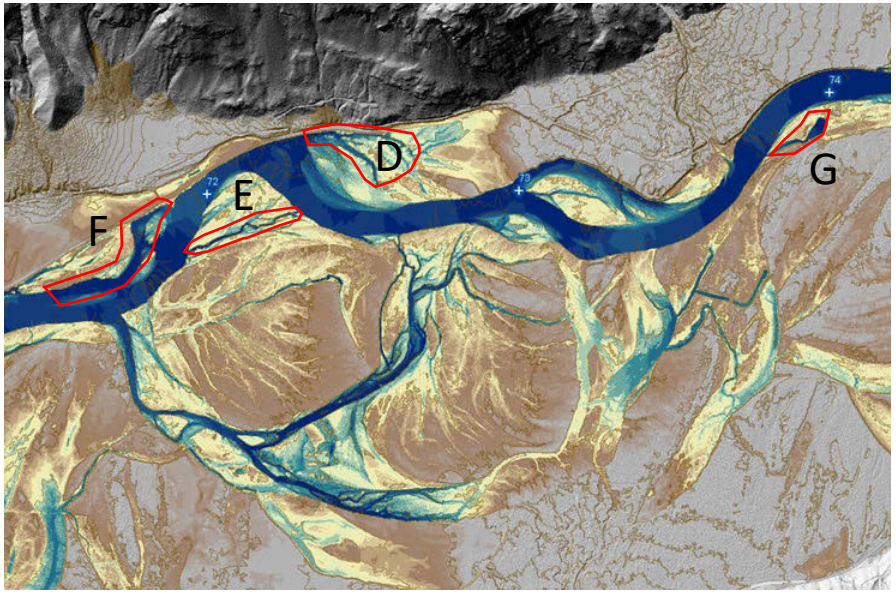
Existing side channel and off channel habitat

D. Hoopers Slough
- Backwater formed by bar on mainstem and off channel wetlands

E. Unnamed chute side channel
- High quality habitat with log jams and pools at inlet and outlet
- Middle section goes seasonally dry

F. Timber Dolo Side Channel
- Upper section contains complex habitat formed by timber dolos, ELJs, and recruited wood
- Upstream section is most heavily used

G. Powerline Pond
- Constructed channel, originally designed for spawning
- Filled in during flood shortly after construction with fines
- Currently functions as off channel rearing habitat



Fish Habitat

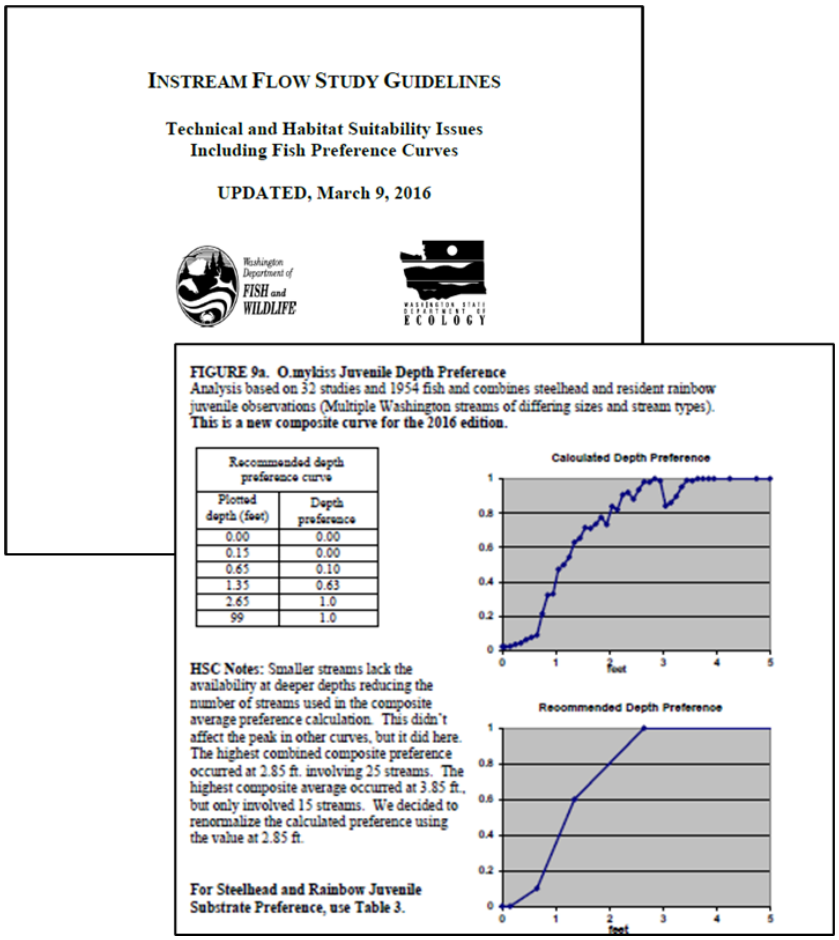
Mainstem Habitat

- Dominated by fast water habitat types: glides and riffles
- Few mainstem pools present:
  - Along right bank at Bullers Side Channel outlet
  - Along Highway 20 revetment and ELJs near entrance of timber dolo side channel

Habitat Suitability Modeling

Existing side channel and off channel habitat

- Spawning and rearing evaluated using WA DOE/WDFW suitability criteria
- Input variables included:
  - Depth
  - Velocity
  - Substrate Size
  - Instream cover
- Three flows used for model:
  - 50% exceedance (Typical Spring June Flow)
  - 90% exceedance (Typical Low September Flow)
  - 1-year flow



INSTREAM FLOW STUDY GUIDELINES

Technical and Habitat Suitability Issues
Including Fish Preference Curves

UPDATED, March 9, 2016

Washington Department of FISH and WILDLIFE

ECOLOGY

FIGURE 9a. O.mykiss Juvenile Depth Preference
Analysis based on 32 studies and 1954 fish and combines steelhead and resident rainbow juvenile observations (Multiple Washington streams of differing sizes and stream types).
This is a new composite curve for the 2016 edition.

Recommended depth preference curve	
Plotted depth (feet)	Depth preference
0.00	0.00
0.15	0.00
0.65	0.10
1.35	0.63
2.65	1.0
99	1.0

Calculated Depth Preference

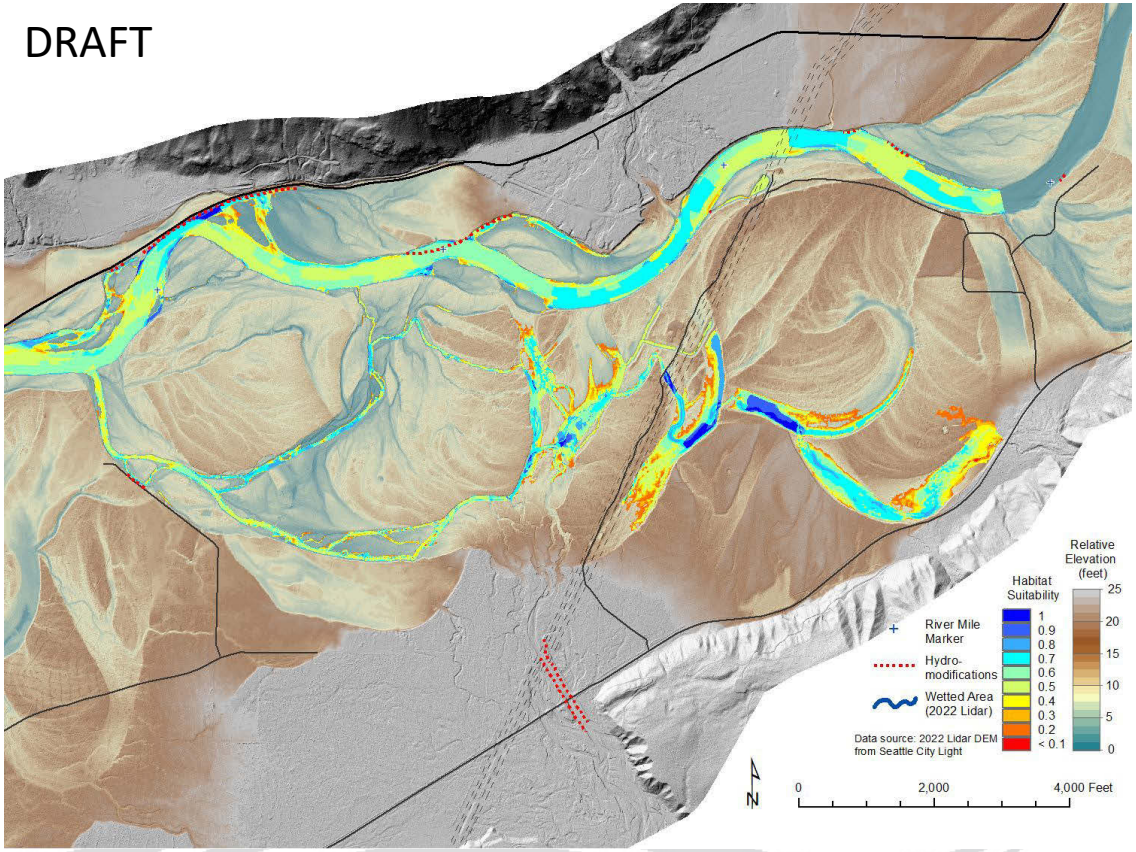
HSC Notes: Smaller streams lack the availability at deeper depths reducing the number of streams used in the composite average preference calculation. This didn't affect the peak in other curves, but it did here. The highest combined composite preference occurred at 2.85 ft. involving 25 streams. The highest composite average occurred at 3.85 ft., but only involved 15 streams. We decided to renormalize the calculated preference using the value at 2.85 ft.

Recommended Depth Preference

For Steelhead and Rainbow Juvenile Substrate Preference, use Table 3.

Preliminary Habitat Suitability Model

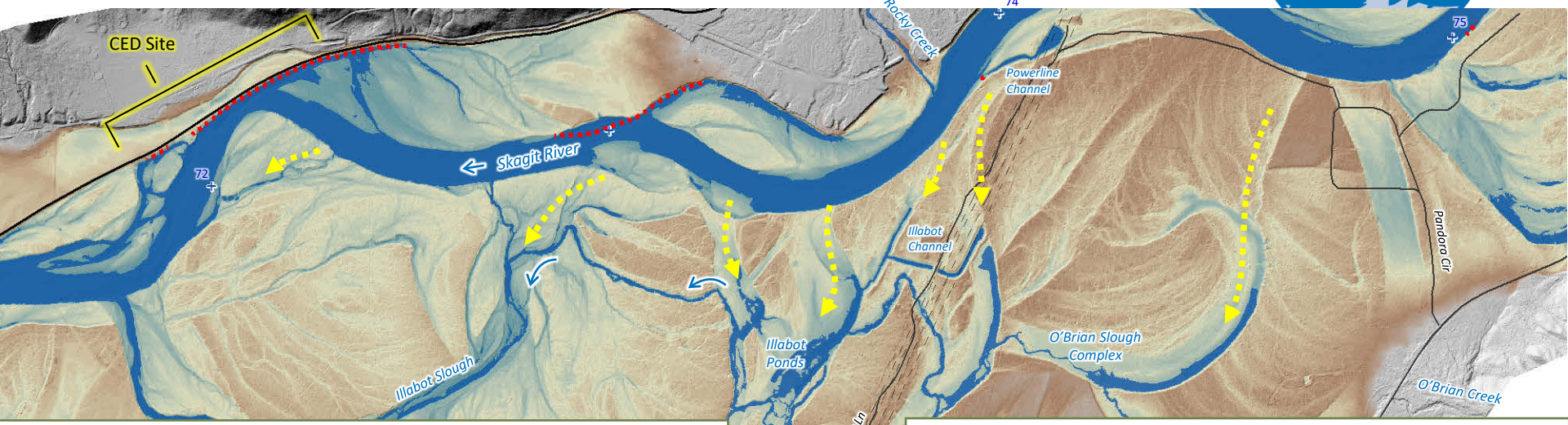
DRAFT



Model Results for Existing Conditions will be cross validated with observations of juvenile Chinook and steelhead use in the area.

Developing and Evaluating Design Alternatives

Developing Alternatives



Goals

- Assess floodplain connectivity and channel processes
- Determine if there are feasible actions to reduce issues with SR 20/flooding, benefit habitat, and at least remain neutral/acceptable to landowners and stakeholders

Alternatives

- Two Action Alternatives
- One No Action Alternative
- Stakeholder and Key Partner Input
- Evaluate Using Specific Criteria

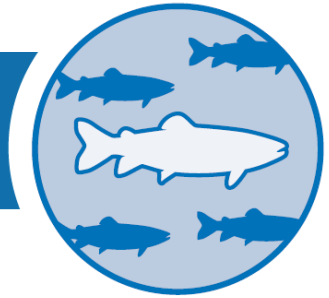
Potential Action Types

- Channel Excavation
- Engineered Log Jams
- LWD Placement
- Planting

Draft Evaluation Criteria - All

Category		STUDY Objective (CRITERIA)
Infrastructure	1	Reduce Flood Risk to SR 20
	2	Reduce Erosion Risk to SR 20
	3	Adjacent Property and Infrastructure (No significant increased flood or erosion risk)
	4	Minimize Effects on Private Property
	5	Barnaby Project (Does not reduce the potential effectiveness of the Barnaby Project downstream)
Biological	6	Benefit Multiple Species
	7	Increase Summer Rearing Habitat
	8	Increase Winter Refuge Habitat
	9	Habitat Type
	10	Wildlife Effects
Other	11	Ease of Construction
	12	Aesthetics
	13	Minimize Effects on Recreation
	14	Time Frame for Benefits

INFRASTRUCTURE Criteria



Category		STUDY Objective (CRITERIA)
Infra-structure	1	Reduce Flood Risk to SR 20
	2	Reduce Erosion Risk to SR 20
	3	**Adjacent Property and Infrastructure -** No significant increased flood or erosion risk to adjacent (upstream or downstream) infrastructure and private land (that is not designated for conservation use or has unwilling landowners)
	4	Minimize Effects on Private Property- Minimize the amount of private property that would be affected by the project
	5	Barnaby Project - Does not reduce the potential effectiveness of the Barnaby Project downstream at meeting its project objectives, by increasing or decreasing flows entering the Barnaby Project area above a threshold (probably need help with what that threshold is)

BIOLOGICAL Criteria

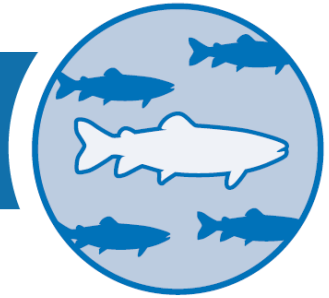
Category		STUDY Objective (CRITERIA)
Biological	6	Benefit Multiple Species – focus on target salmon populations
	7	Increase Summer Rearing Habitat
	8	Increase Winter Refuge Habitat
	9	Habitat Type- holistically evaluate value of existing habitat compared to potential restoration areas
	10	Wildlife Effects- Evaluate effects of alternatives on wildlife

OTHER Criteria

Category		STUDY Objective (CRITERIA)
Other	11	Ease of Construction – Ease of construction and restoration, including cost and long-term maintenance (vegetation management) requirements
	12	Aesthetics – Evaluate the aesthetic impacts of the project on the public and on private landowners
	13	Recreation – Minimize the effects of the project on navigability of the river for recreation purposes
	14	Time Frame for Benefits – Evaluate the timeframe for habitat benefits, any lag time, as well as duration/sustainability of alternatives

Next steps and stakeholder engagement opportunities

Next Steps



- Provide Input on the Evaluation Criteria - Today
- Develop alternatives, assess feasibility
- Workshop #2 – Alternatives review/discussion
- Report and develop a concept for any preferred and feasible alternative

Questions/Discussion?