A GLIMPSE THROUGH TIME: FROM A RIVER TO ROCKS TO RECOVERY

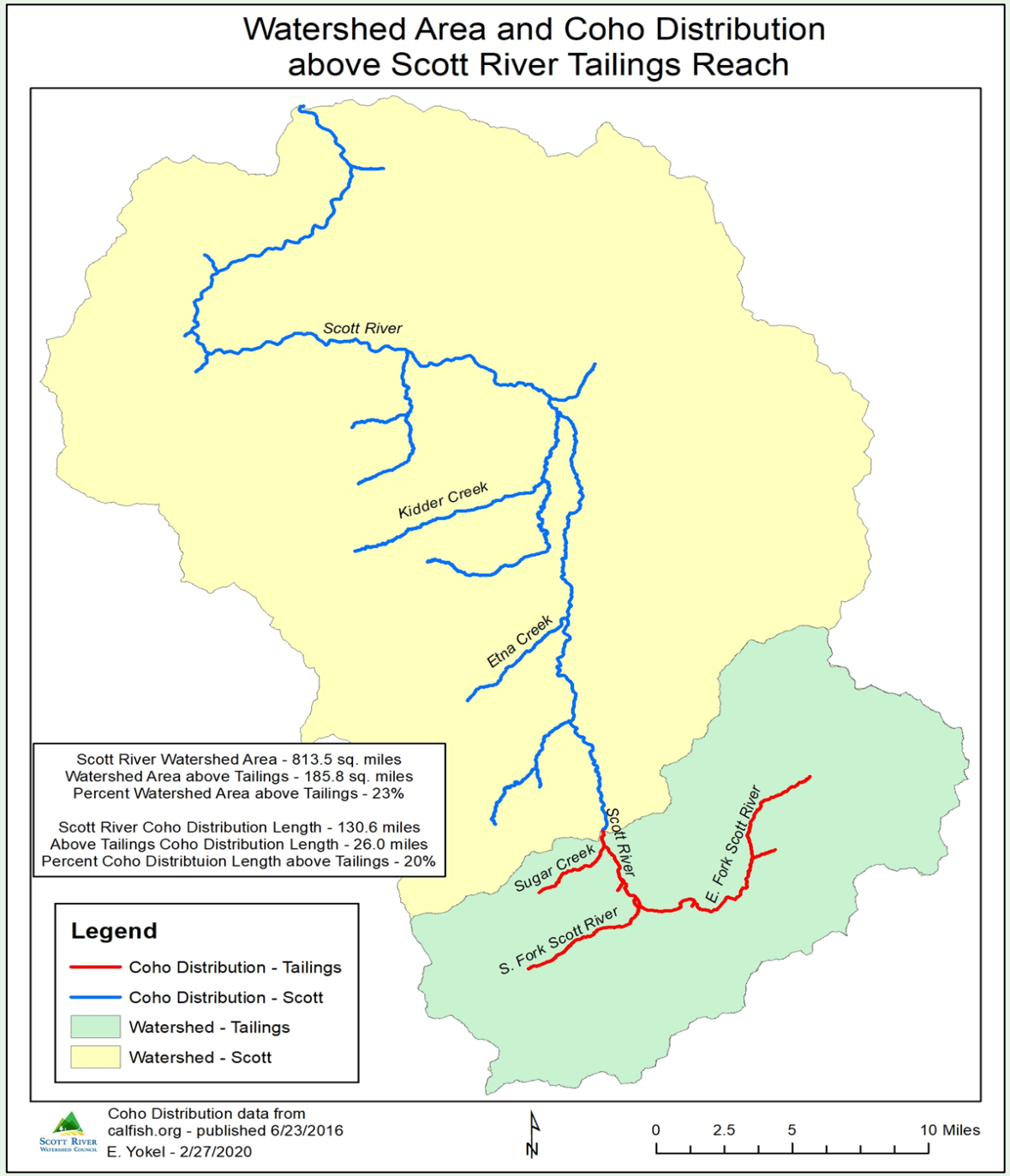
Erich Yokel
Scott River Watershed Council

Jay Stallman
Stillwater Sciences

Ann Willis
UC – Davis
Center for Watershed Sciences

ACKNOWLEDGEMENT

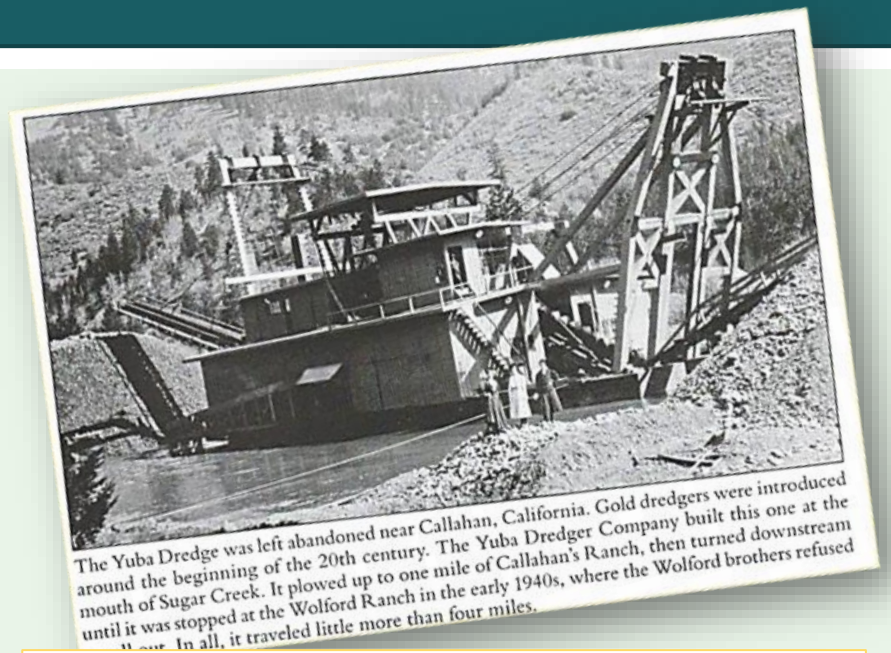
- Scott Valley Landowners



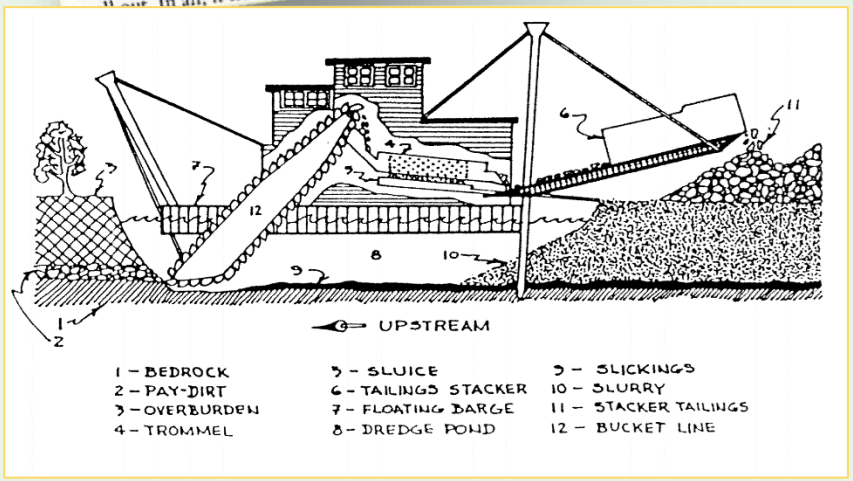
Scott River Tailings

- Scott River Tailings dominate the landscape of the Southern Scott Valley
- Approximately 4.2 miles of the Scott River Impacted by Legacy Dredge Tailings
- Scott River becomes disconnected through a portion of the Tailings Reach during every Water Year Type
- Approximately 23% of the watershed and 20% of the Coho distribution above the Tailings Reach

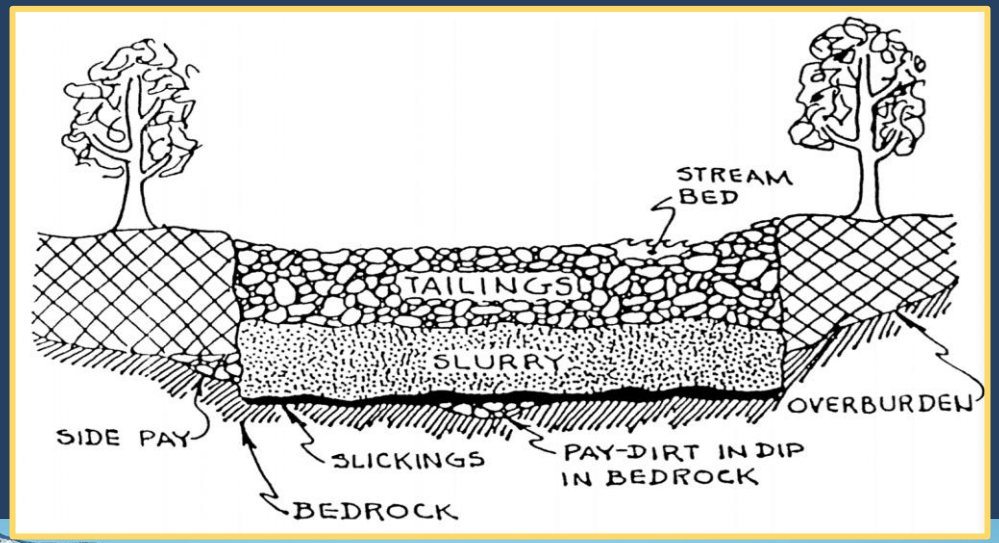
HISTORIC CONDITIONS – THE YUBA DREDGE

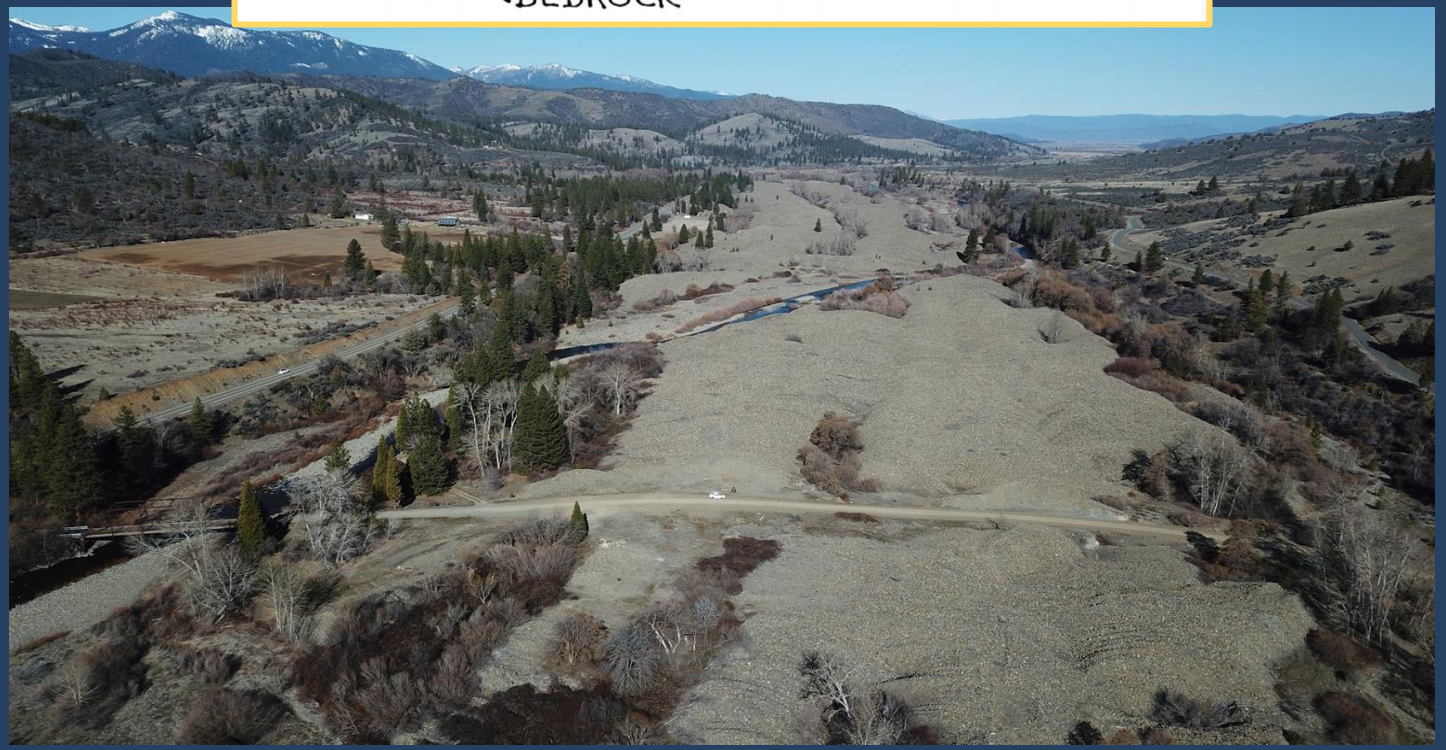


The Yuba Dredge was left abandoned near Callahan, California. Gold dredgers were introduced around the beginning of the 20th century. The Yuba Dredger Company built this one at the mouth of Sugar Creek. It plowed up to one mile of Callahan's Ranch, then turned downstream until it was stopped at the Wolford Ranch in the early 1940s, where the Wolford brothers refused [illegible]. In all, it traveled little more than four miles.



AFTER THE GOLD RUSH

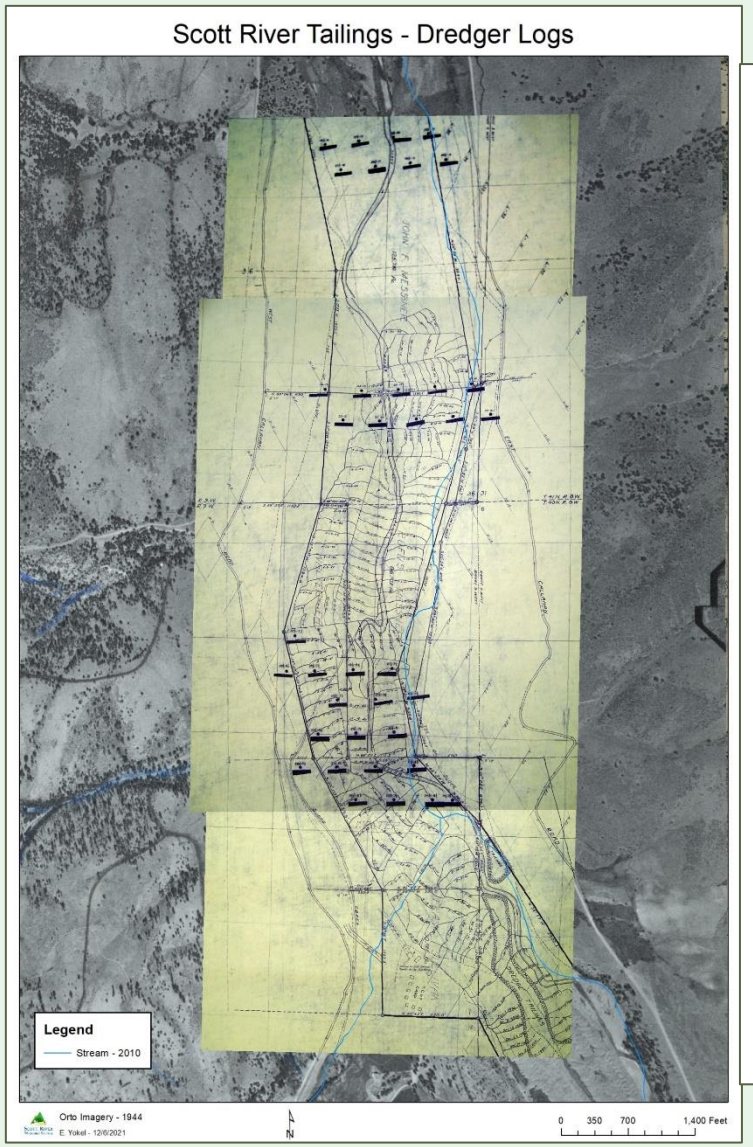


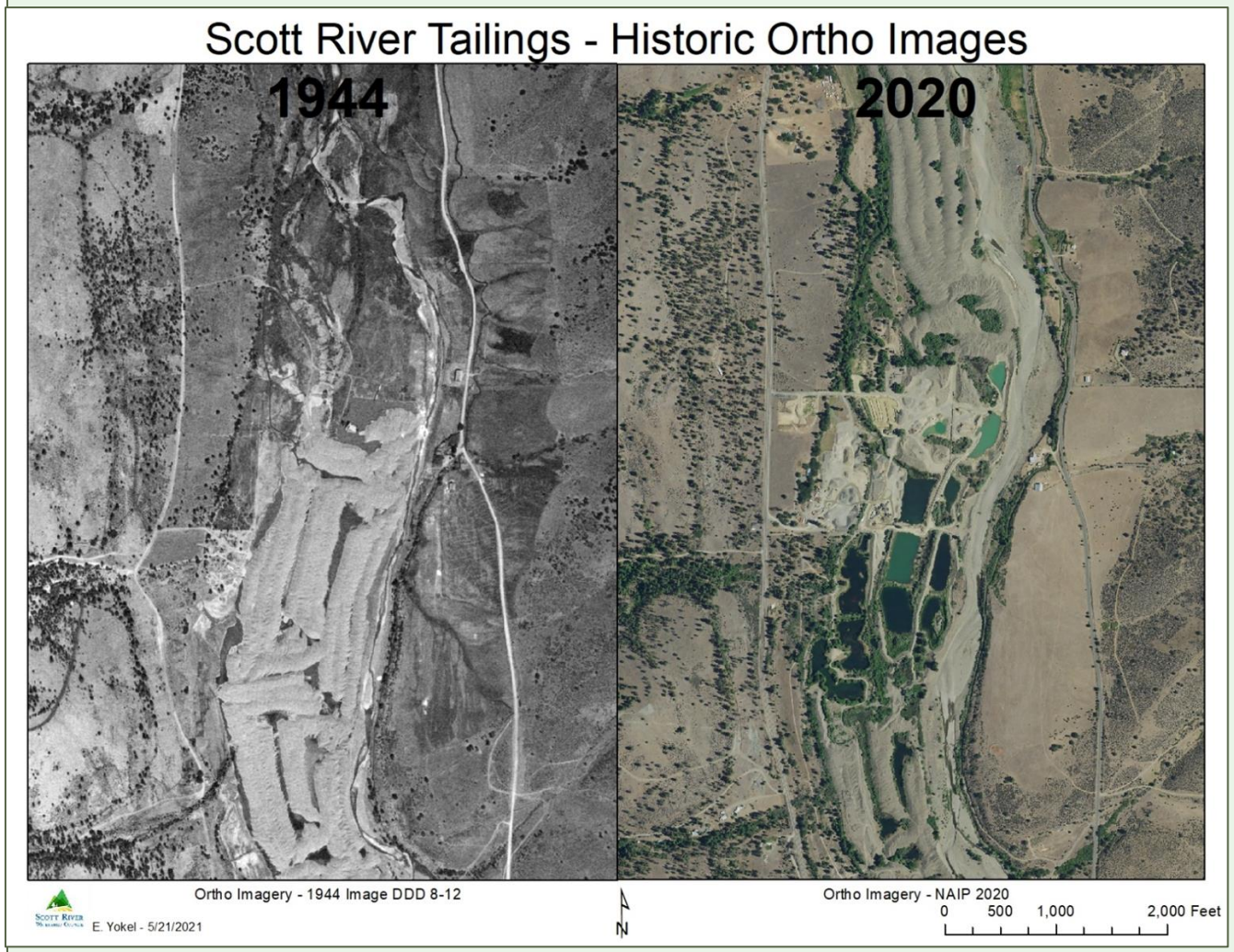


Issues Created by Legacy Impacts:

- Altered Subsurface Structure
- Increased Hydraulic Conductivity
- Floodplain Disconnection
- Altered Floodplain Morphology
- Removal of Alluvium
- Incision
- Lack of Riparian Forest
- Loss of Surface Flow

WHAT HAPPENED??





Georeference Dredger Logs & Historic Aerial Photos

1944
1955
1965
1974
1980
1994
1999
2005
2010
2012
2014
2016
2018
2020

Bold - NAIP

Scott River Tailings - Historic Ortho Images

Ortho Imagery - 1944 DDD 08-11

Ortho Imagery - NAIP 2020

0 600 1,200 2,400 Feet

N

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CHANGE IN SCOTT RIVER ALIGNMENT

Dredging Moved Channel from West to East side of Valley

Hypothesize that it is more complicated

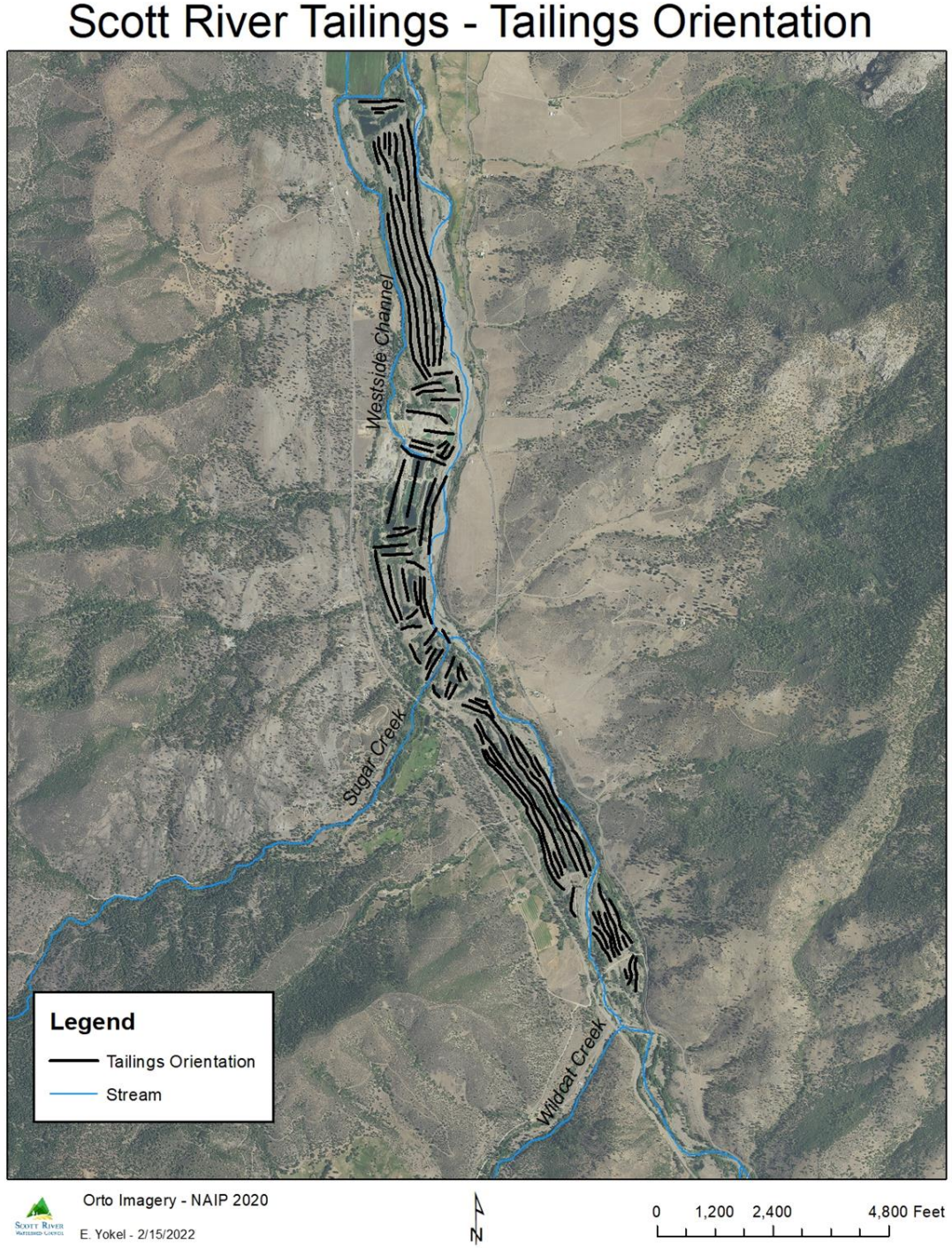
Pre dredging - Scott River meandered through Valley

350 - 420 m wide

Post dredging - Scott River constrained by Tailing Piles on West and Bedrock on East

50 - 190 m wide

Westside Channel transports water on west side of Tailings

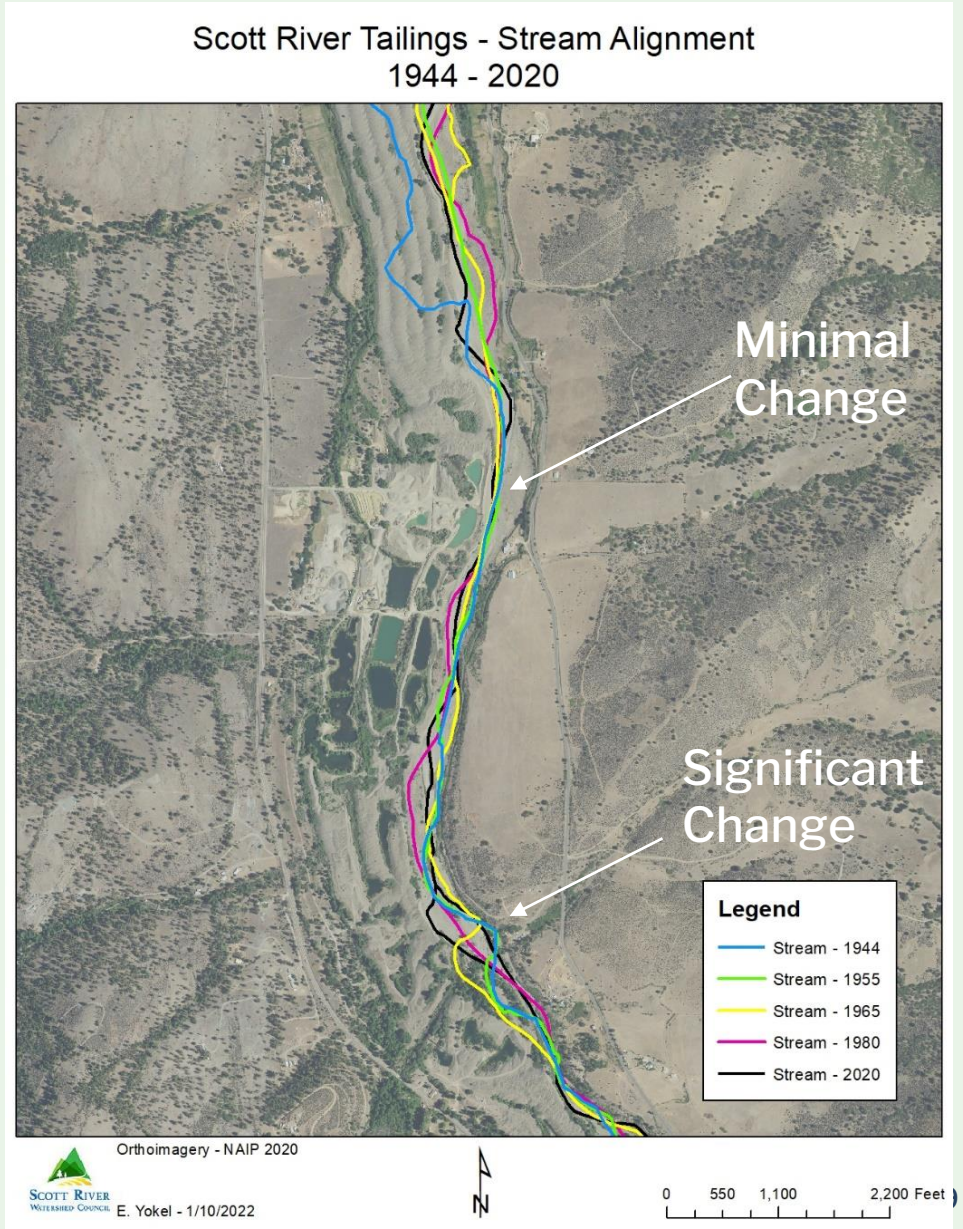


Tailings Orientation

- Majority of Tailings oriented from South to North – along flow line of Scott
- Areas of Tailings oriented from West to East – Sugar Creek and Moore's Gravel
- What are the affects of the different Tailings orientation on stratigraphy and hydraulic conductivity?

SCOTT RIVER CHANNEL ALIGNMENT CHANGE

Signification alterations in the channel alignment observed at the confluence of Sugar and Scott after the 1964 Flood

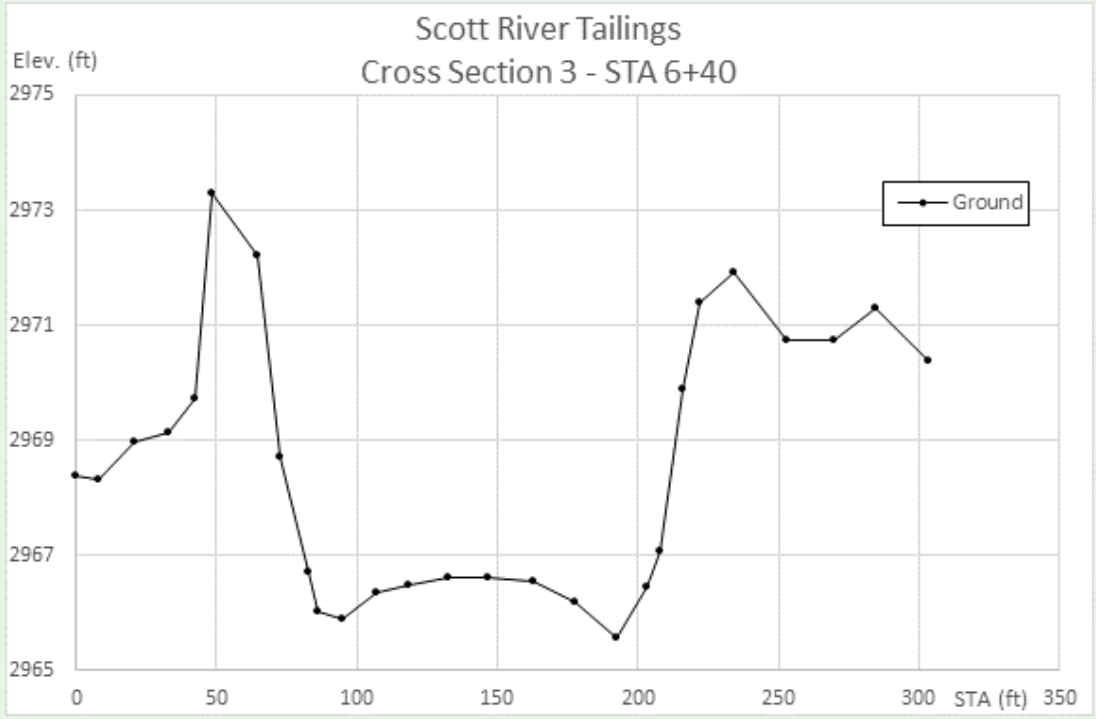


Existing Conditions

Elevation Data

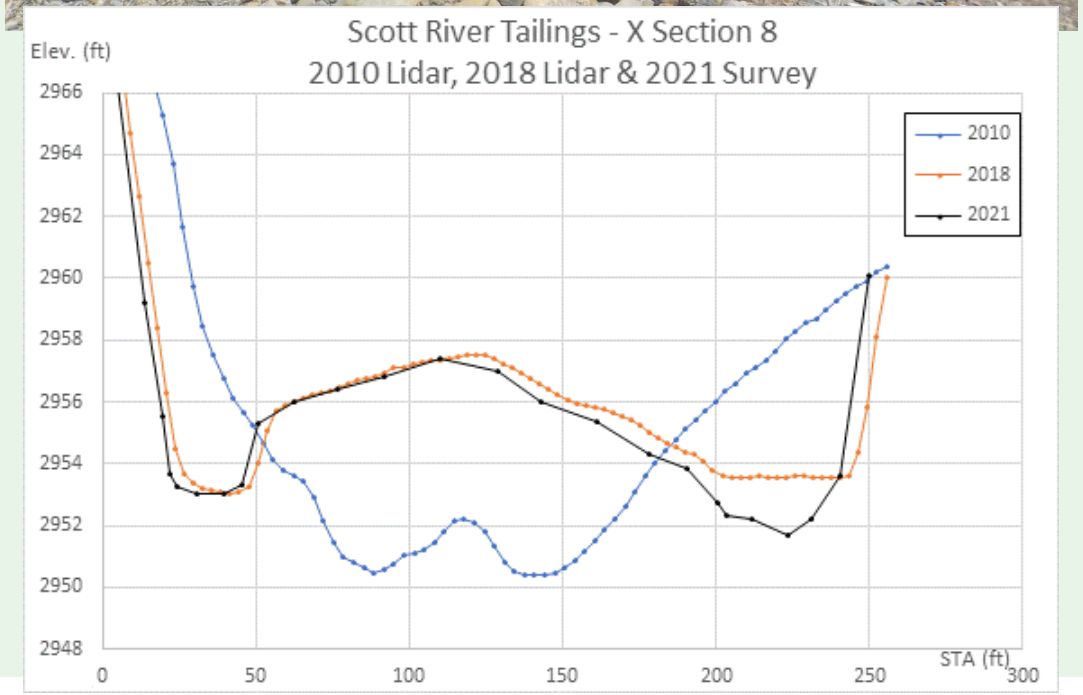
2010 USFWS and 2018 FEMA Lidar DEMs

Topographic surveys of project reaches - 2010 - 2021

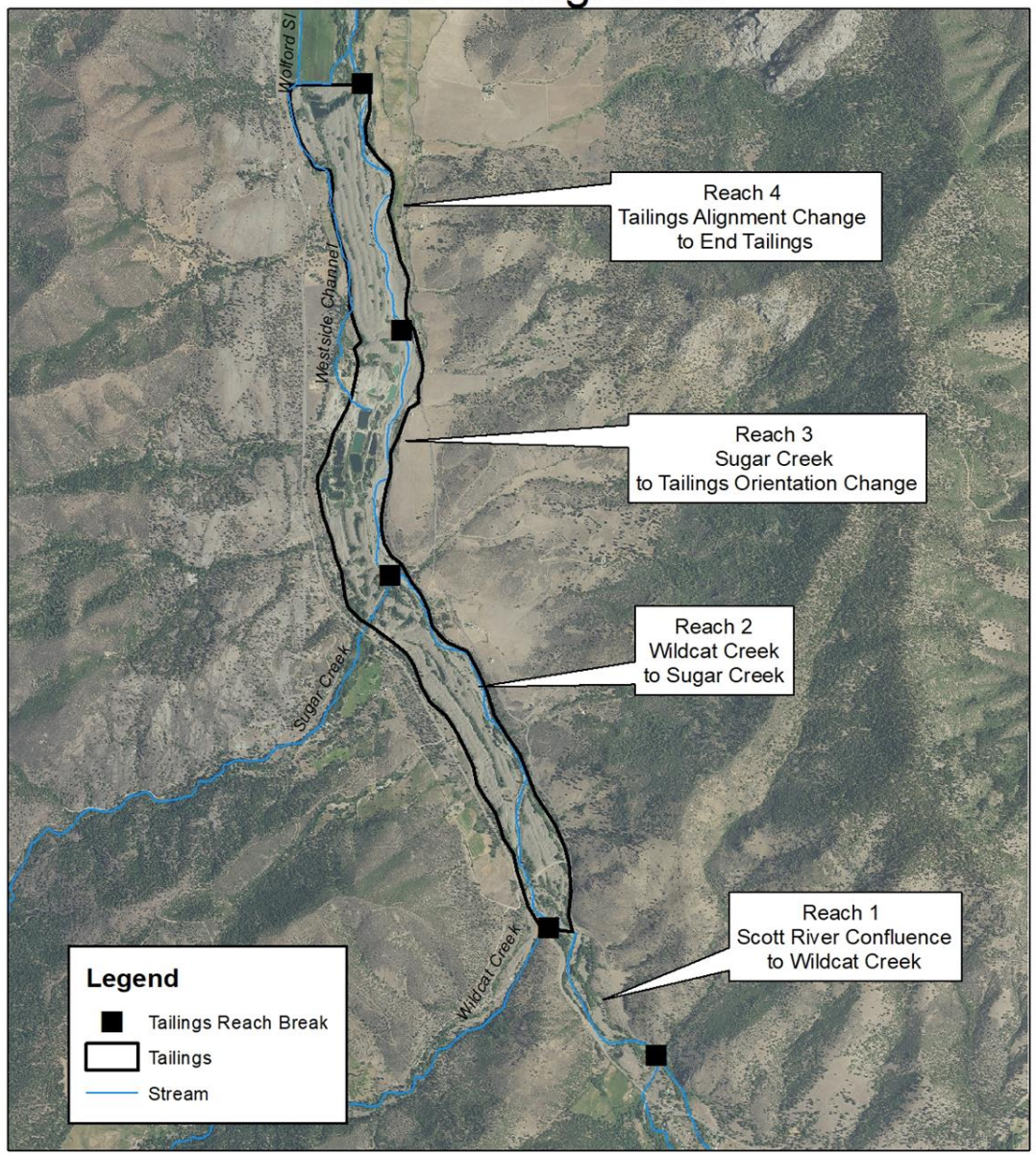


- **Cross section of Constrained Channel in area of minimal channel migration**

- **Comparison of 2010 & 2018 DEMs and 2021 topographic survey documents channel alteration - February 2015 Flood**



Scott River Tailings Reach Designation



Orthoimagery - 2020 NAIP

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E. Yokel - 2/14/2022

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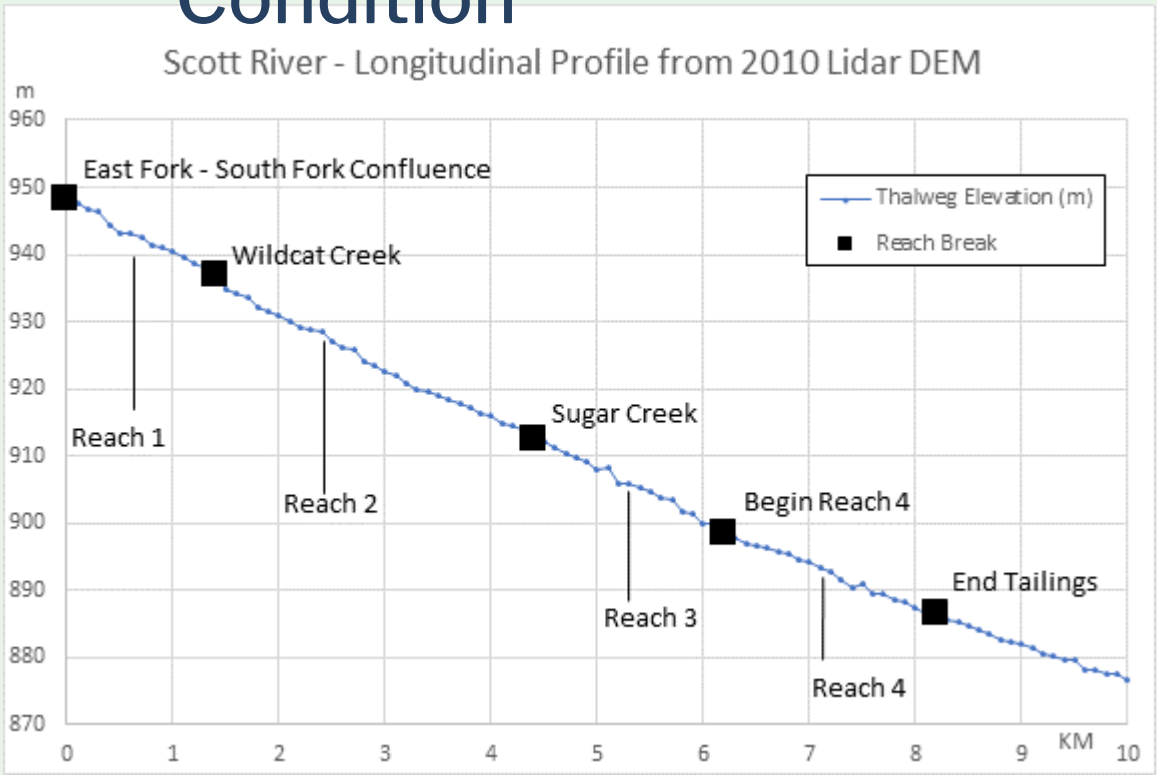
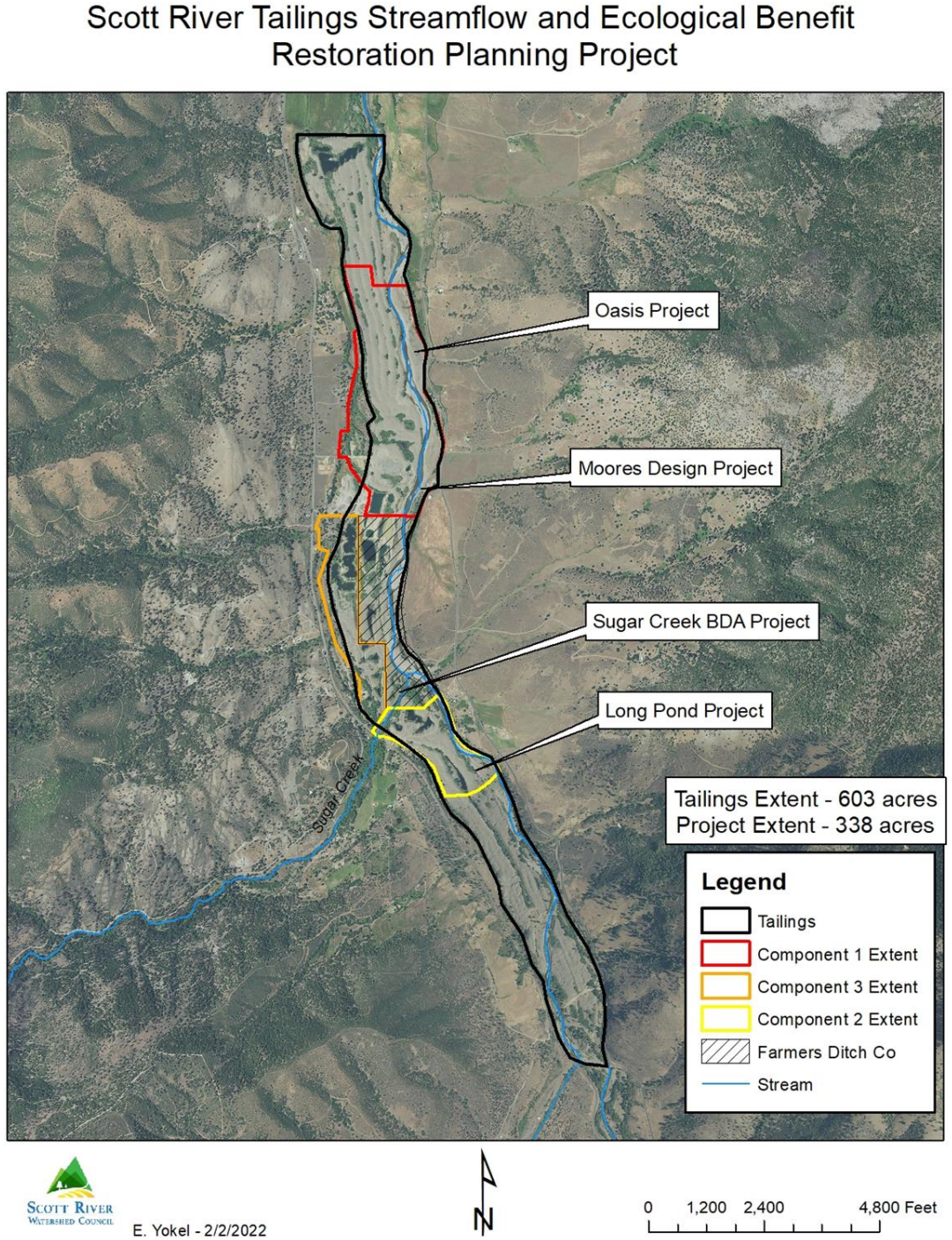
0 0.25 0.5 1 Miles

Existing Stream Condition



	RKM From	RKM To	Gradient	Sinuosity
Reach 1	92	90.6	0.8%	1.2
Reach 2	90.6	87.6	0.8%	1.1
Reach 3	87.6	85.8	0.8%	1.1
Reach 4	85.8	83.8	0.6%	1.2



Existing Restoration and Design Projects and Environmental Monitoring

Existing Projects

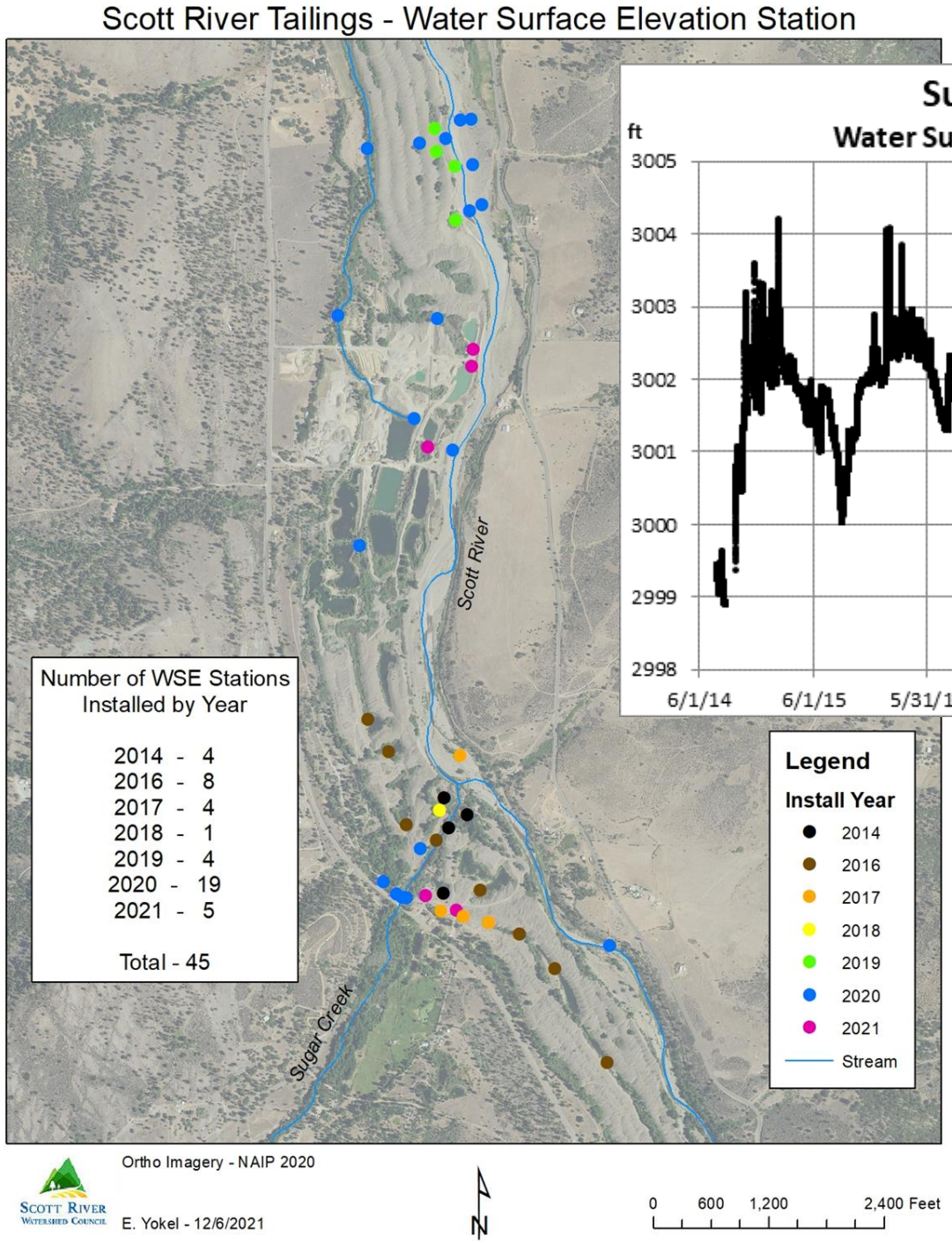
- Sugar Creek BDAs
- 2014 - Present

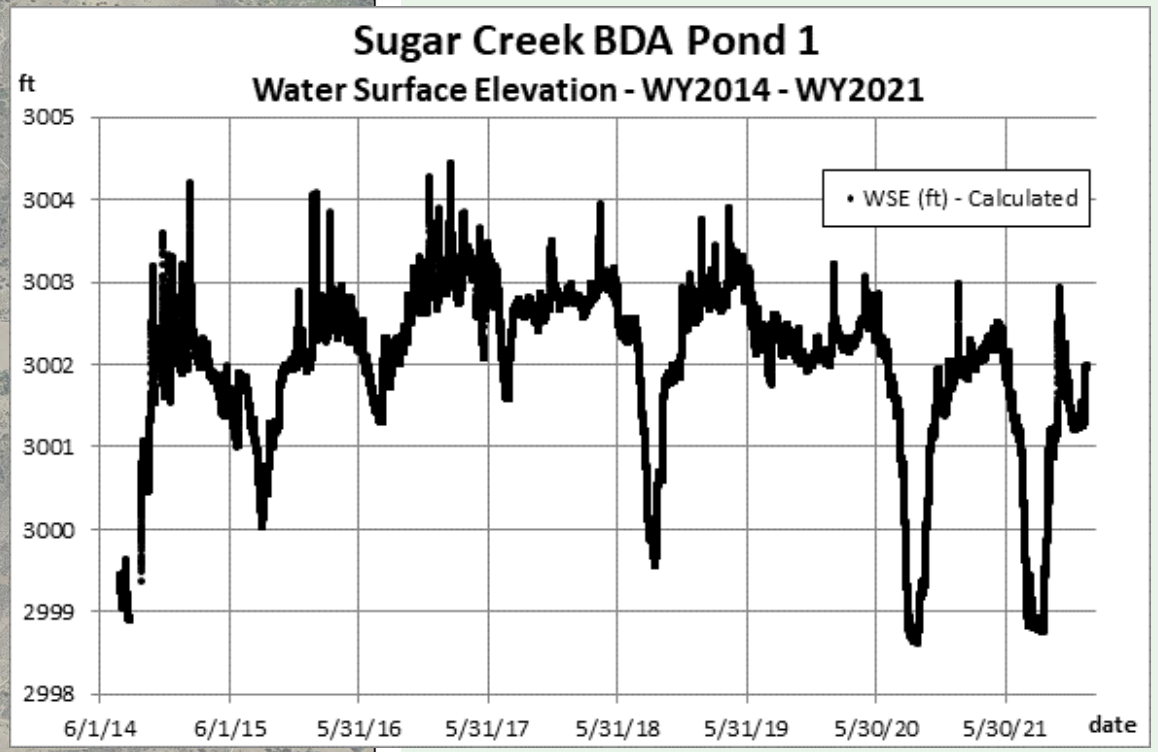
- Long Pond existing conditions and Design 2017 - Present

- Scott River Tailings Oasis Restoration Project
- 2019 - Present

- Sugar Creek Floodplain Restoration Project
- 2020 - Present

- Scott River Tailings Restoration Planning & Design
- 2020 - Present





WATER SURFACE ELEVATION

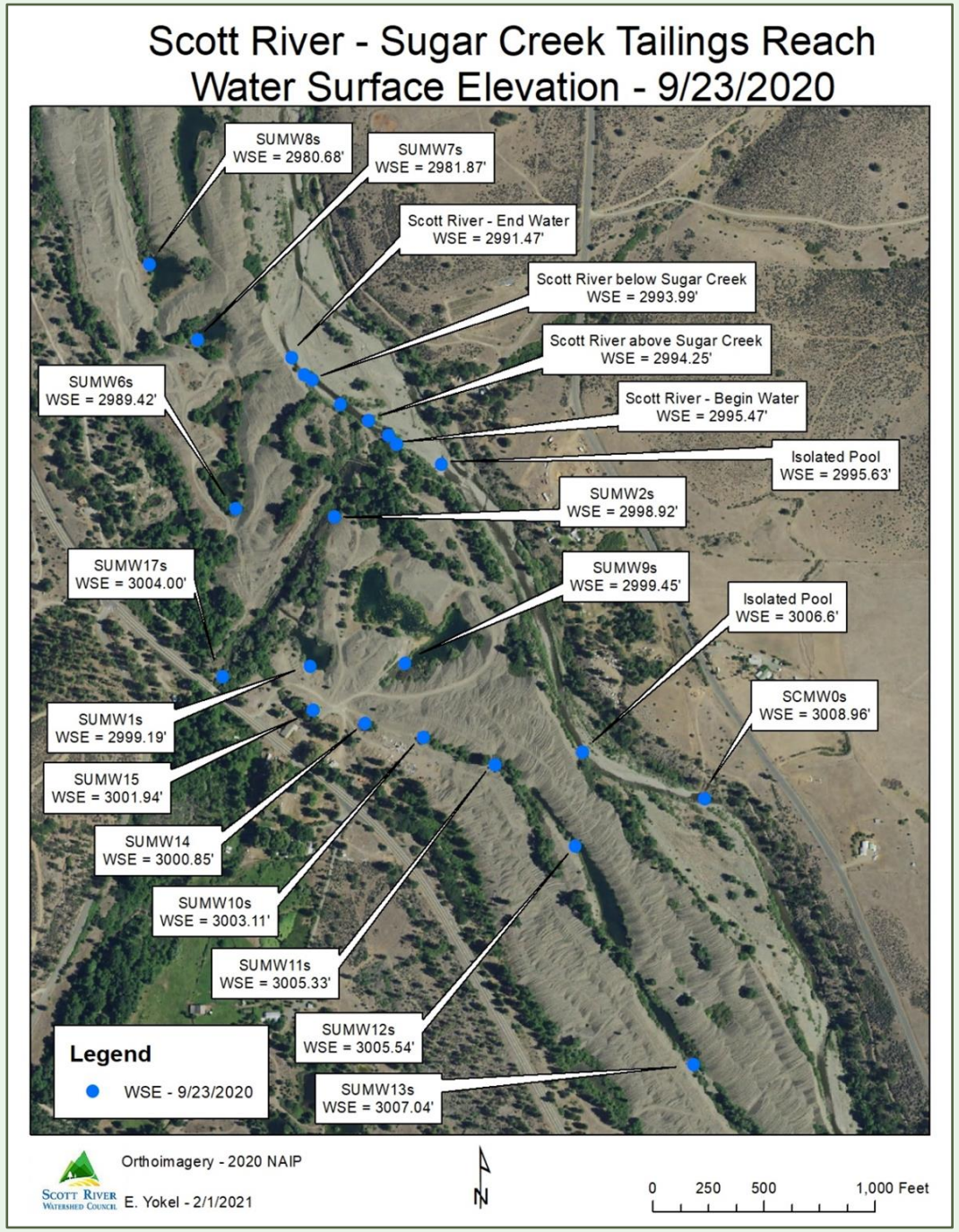
Established first WSE Stations (4) in 2014 around Sugar Creek BDAs

Document continuous WSE and Temperature

Expanded spatial distribution of the network North and South of Sugar Creek 2016 - 2018

Established network at Scott River Tailings Implementation Project (Oasis) and Design Project in 2019 - 2021

WSE calculated to Mean Sea Level (NAVD88)



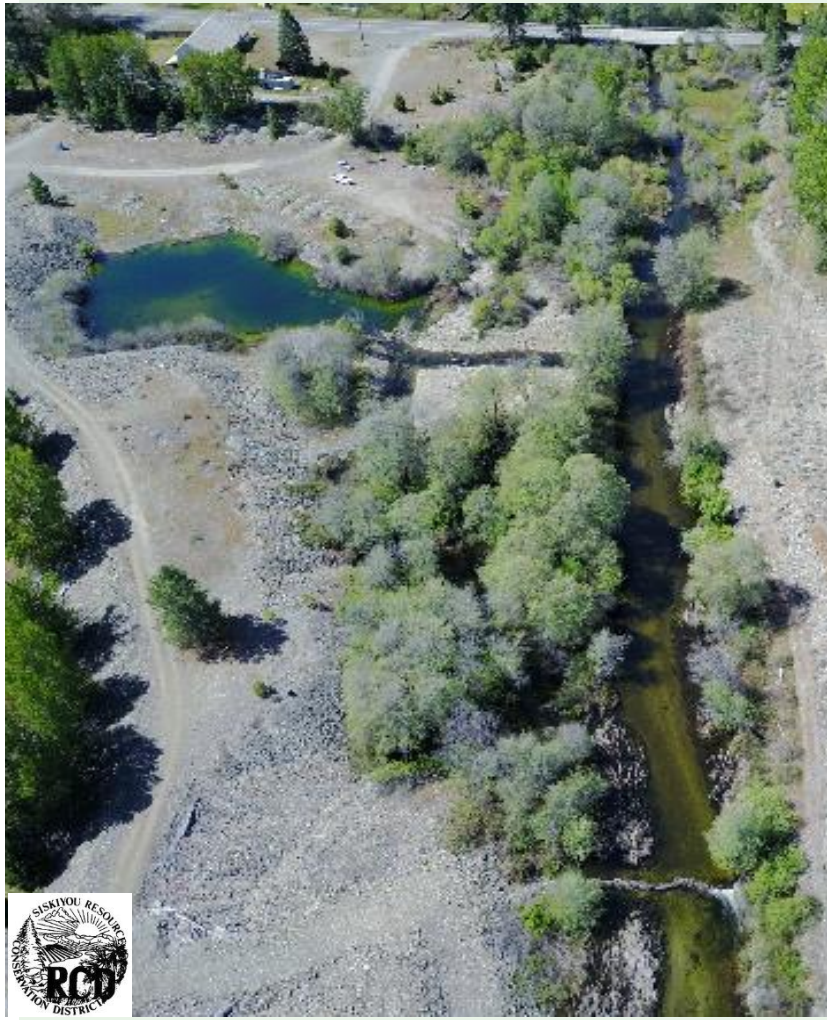
Water Surface Elevation

Sugar BDA Maintenance Sealing generates an increase in BDA Pond WSE and the WSE in adjacent surface water and groundwater

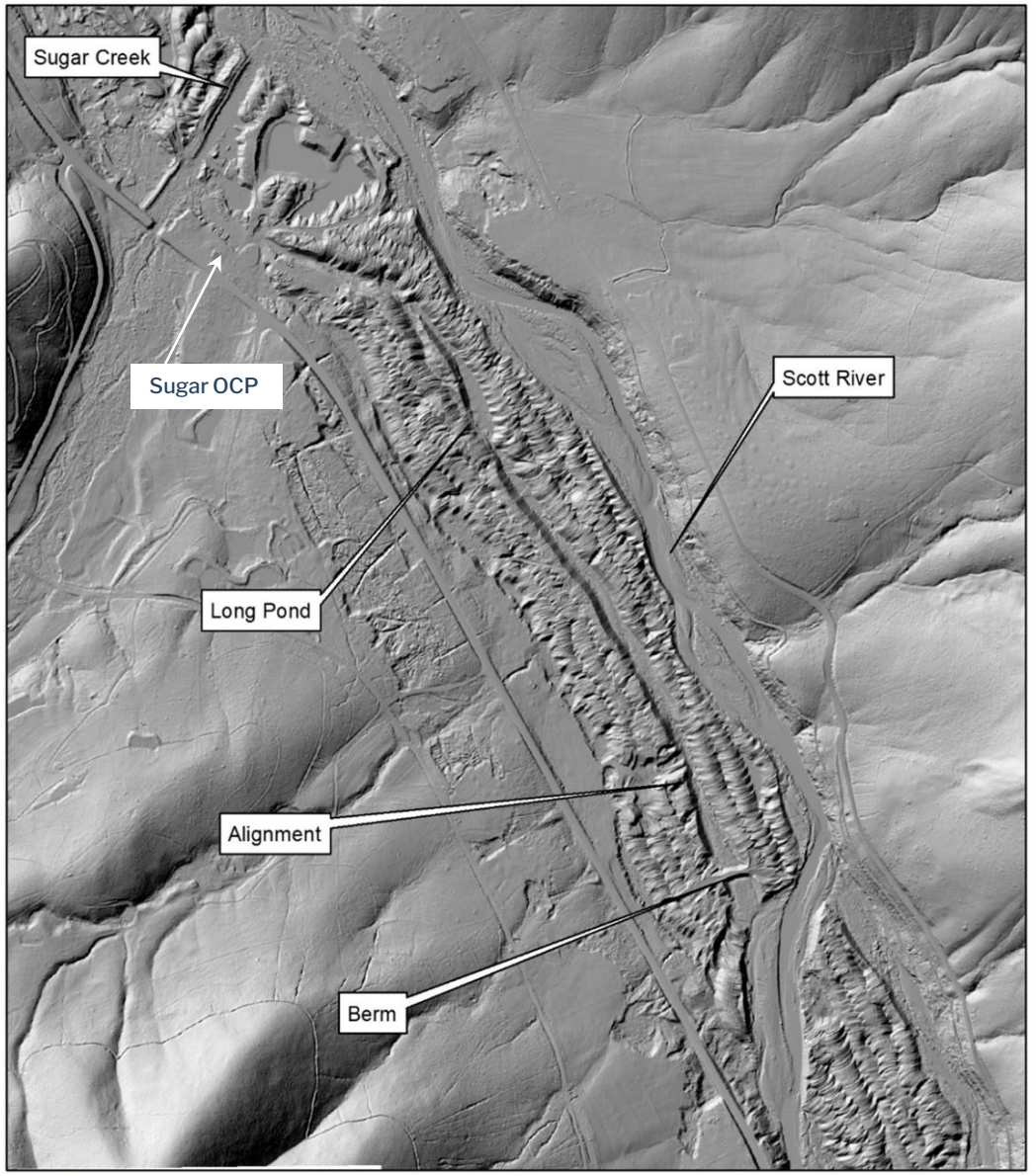
Loss of surface water discharge and dewatering occurs in BDA Pond during drought years (2018, 2020 and 2021)

Periodic RTK surveys during summer base flow performed to document WSE and stream connectivity performed in the Scott River – Sugar Creek – Long Pond Project Area

Sugar Off Channel Pond



Scott River - Long Pond Alignment

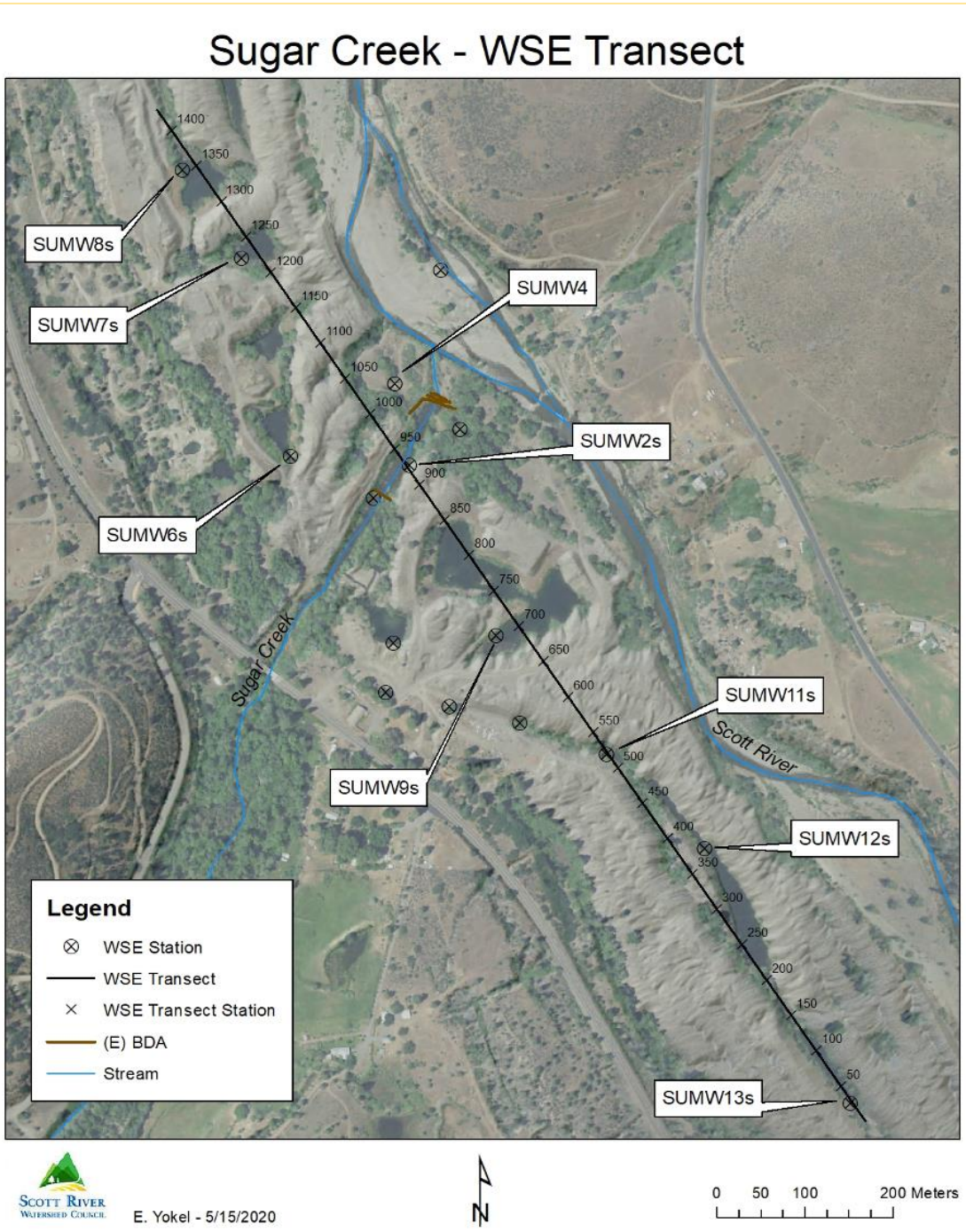


SUGAR OCP AND LONG POND

Connected GW fed Pond adjacent to Sugar Creek in 2015. Documented significant utilization by juvenile Coho

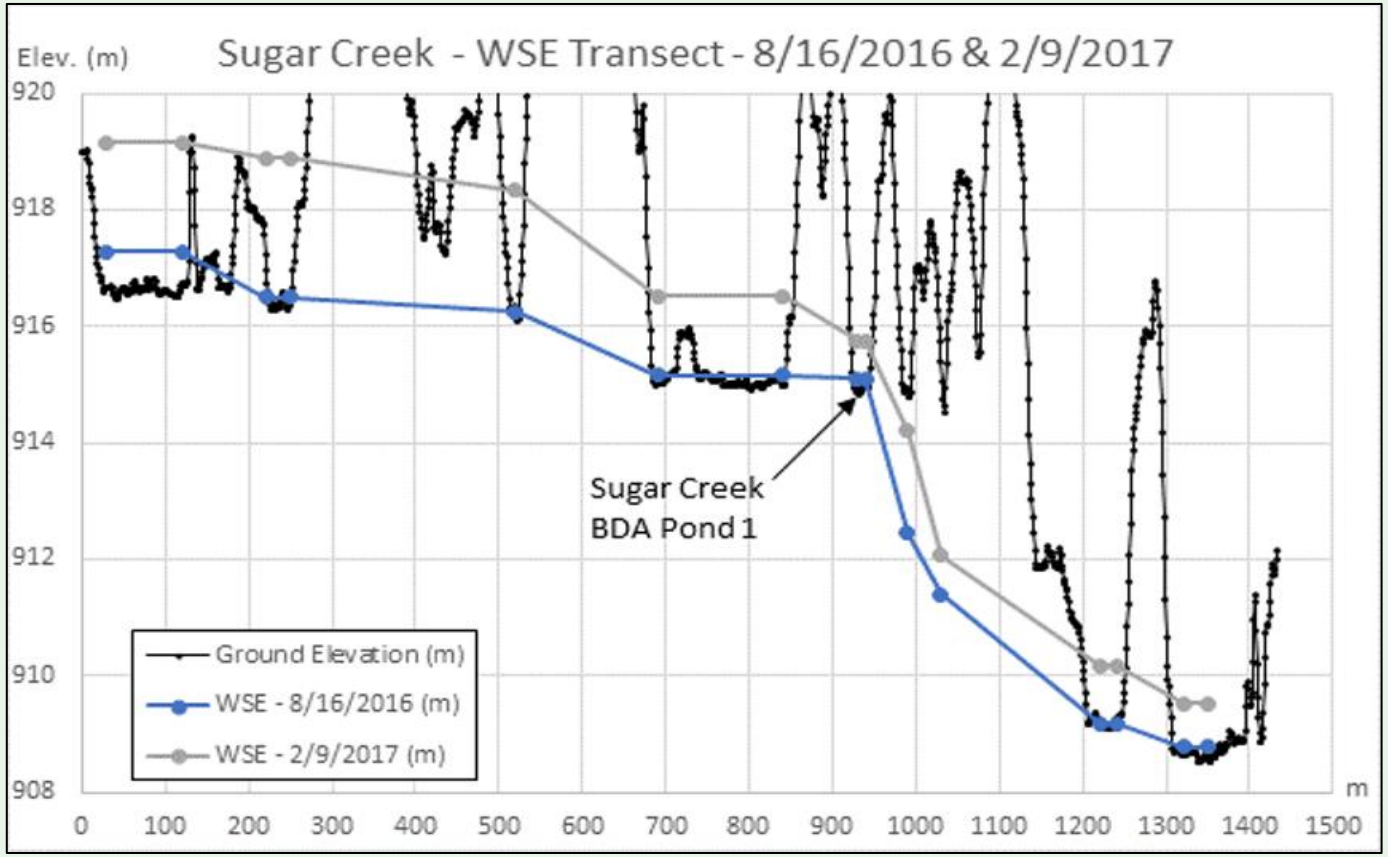
Identified the large bodies of surface water within the tailings upslope of Sugar Creek and the Sugar OCP as potential refugia for Coho Salmon

Characterize the WQ and developed the Long Pond Restoration Design

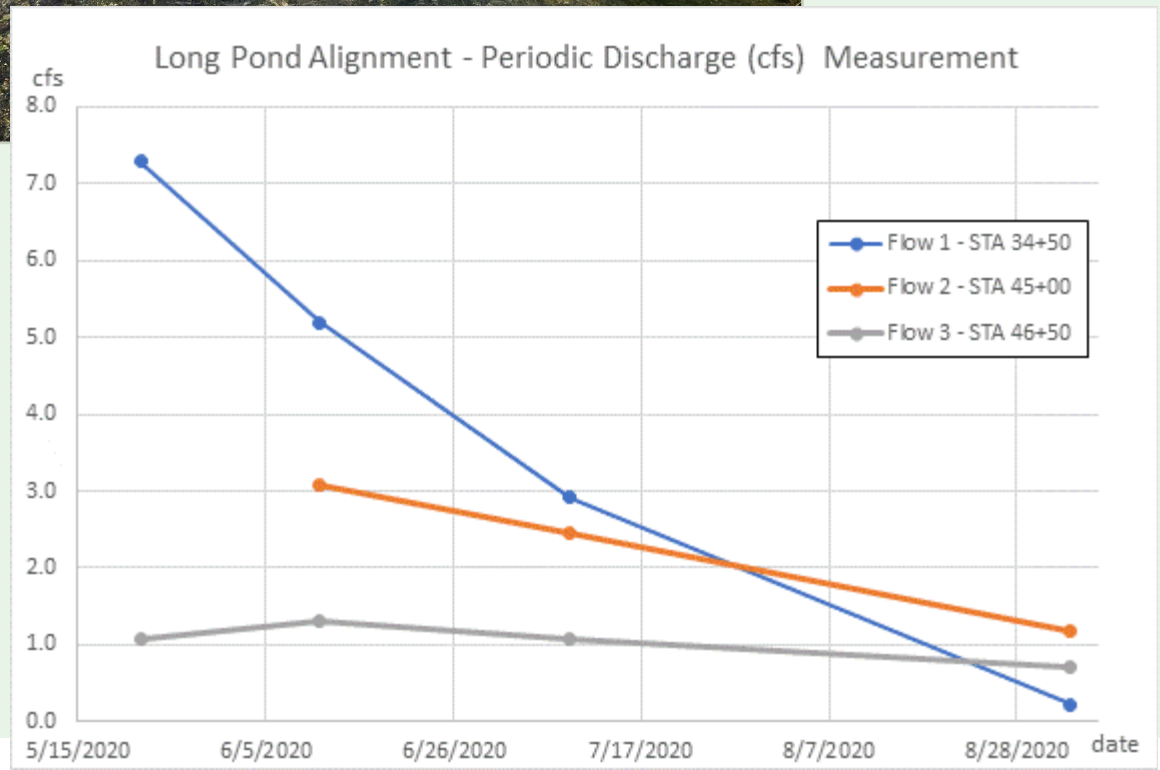


Utilized WSE Stations to develop a transect of WSE parallel to the Valley Slope during summer base flow and a winter runoff event

WSE decreases significantly downstream of Sugar Creek



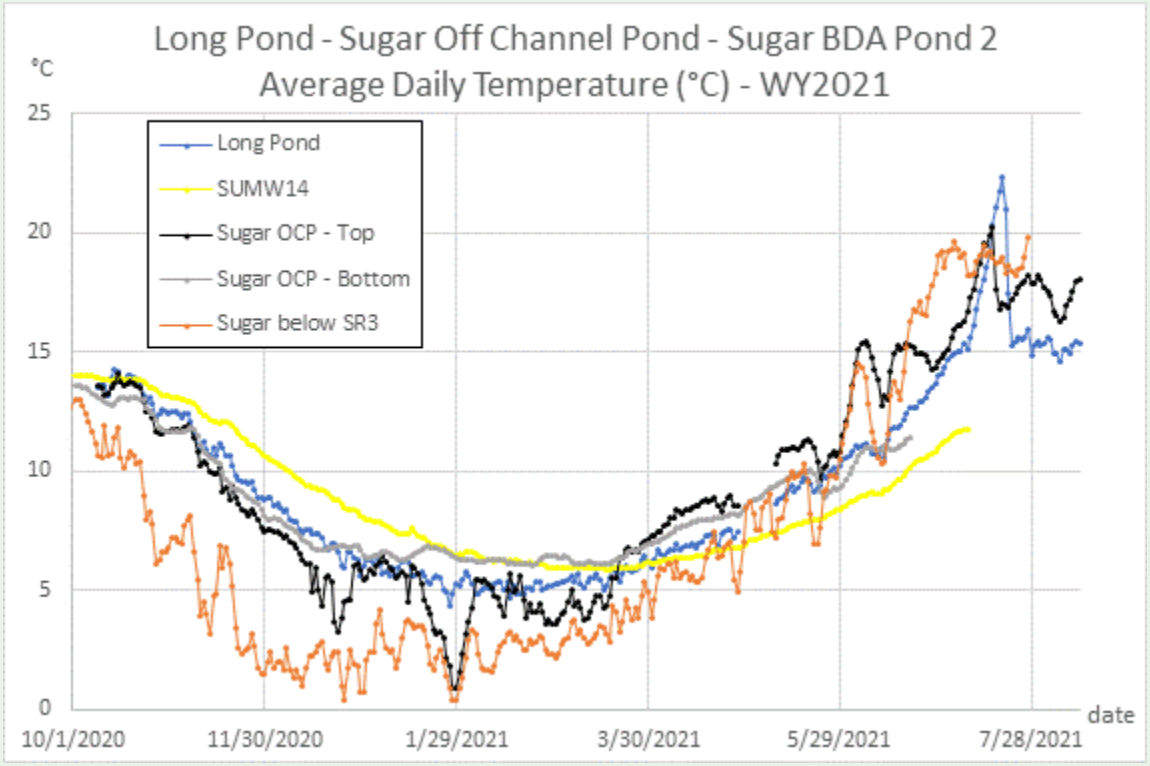
Surface Water Discharge Monitoring

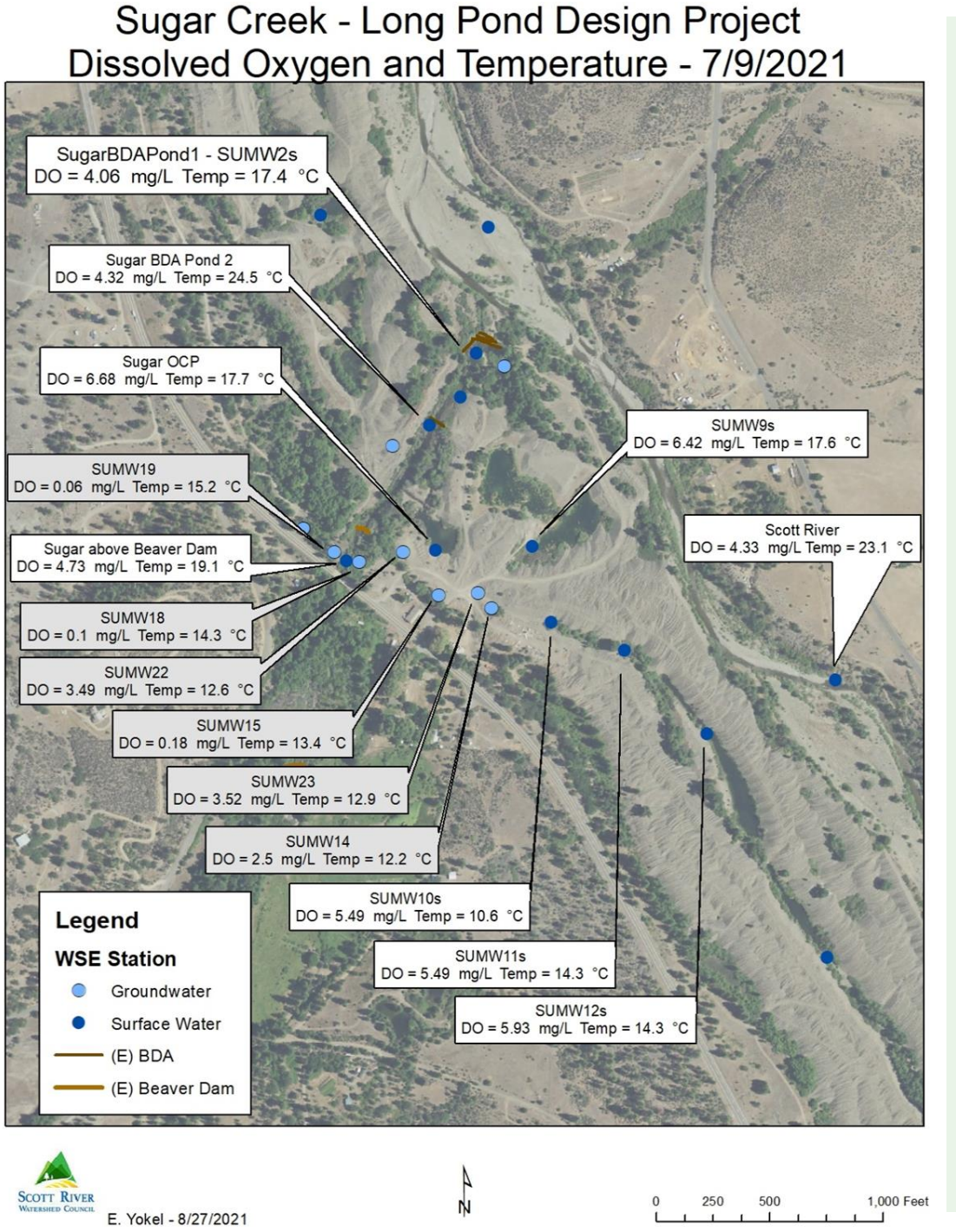


Water temperature and Dissolved Oxygen

Analyzed continuous temperature data and performed continuous and periodic DO monitoring

Utilize temperature regimen characteristics and DO to characterize groundwater and surface water



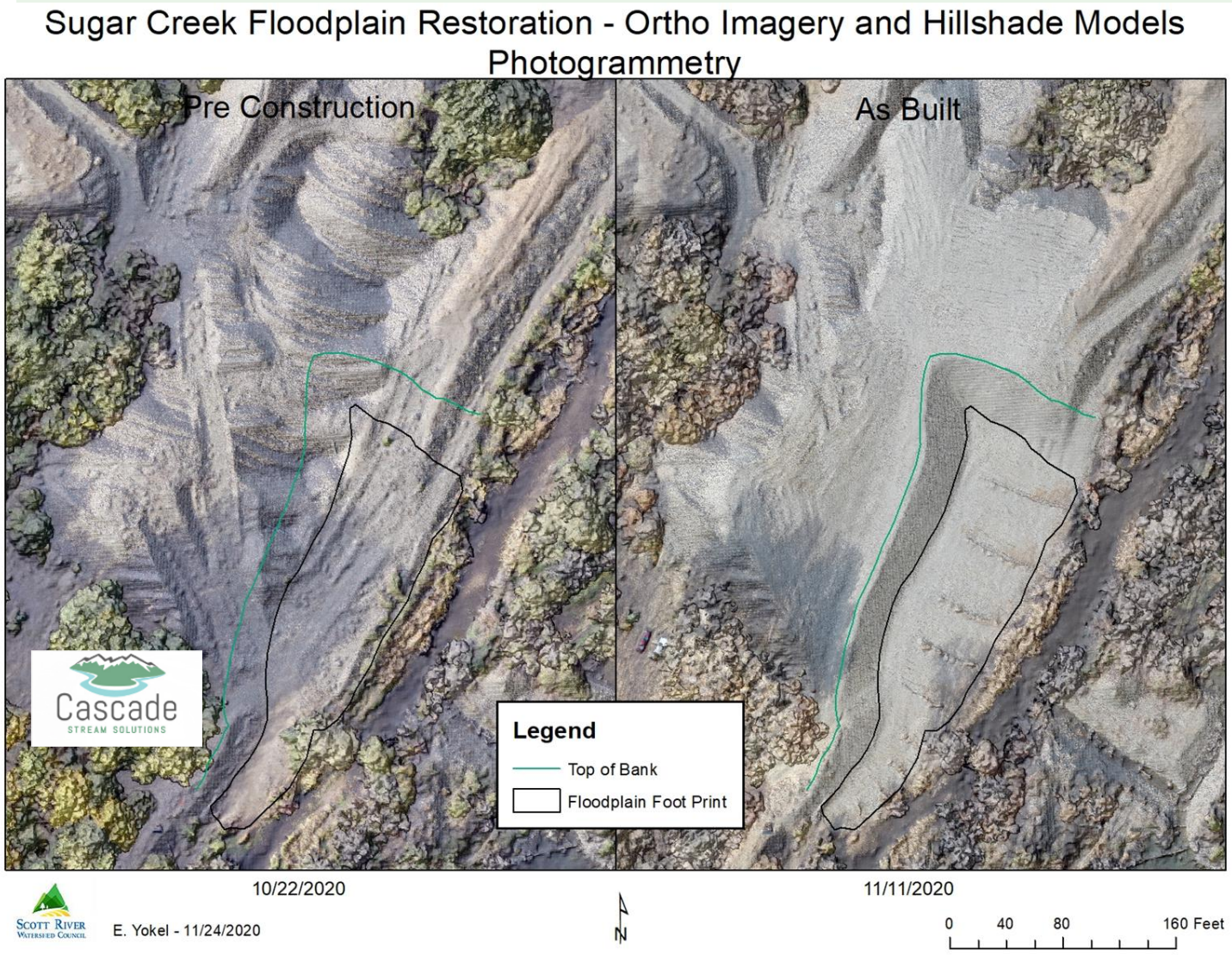


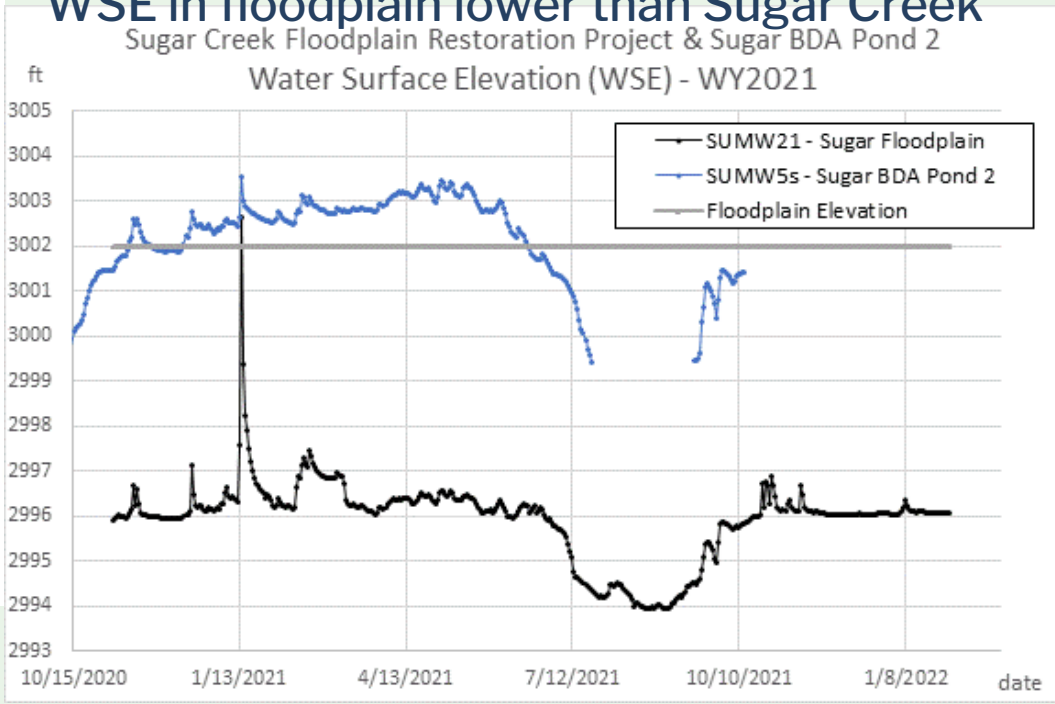
Sugar Creek Floodplain Restoration – 2020

Graded tailings adjacent to Sugar Creek

A significant quantity of surface water percolated into the graded surface during a runoff event

WSE in floodplain lower than Sugar Creek





Sealed graded surface of floodplain with injected washed sand

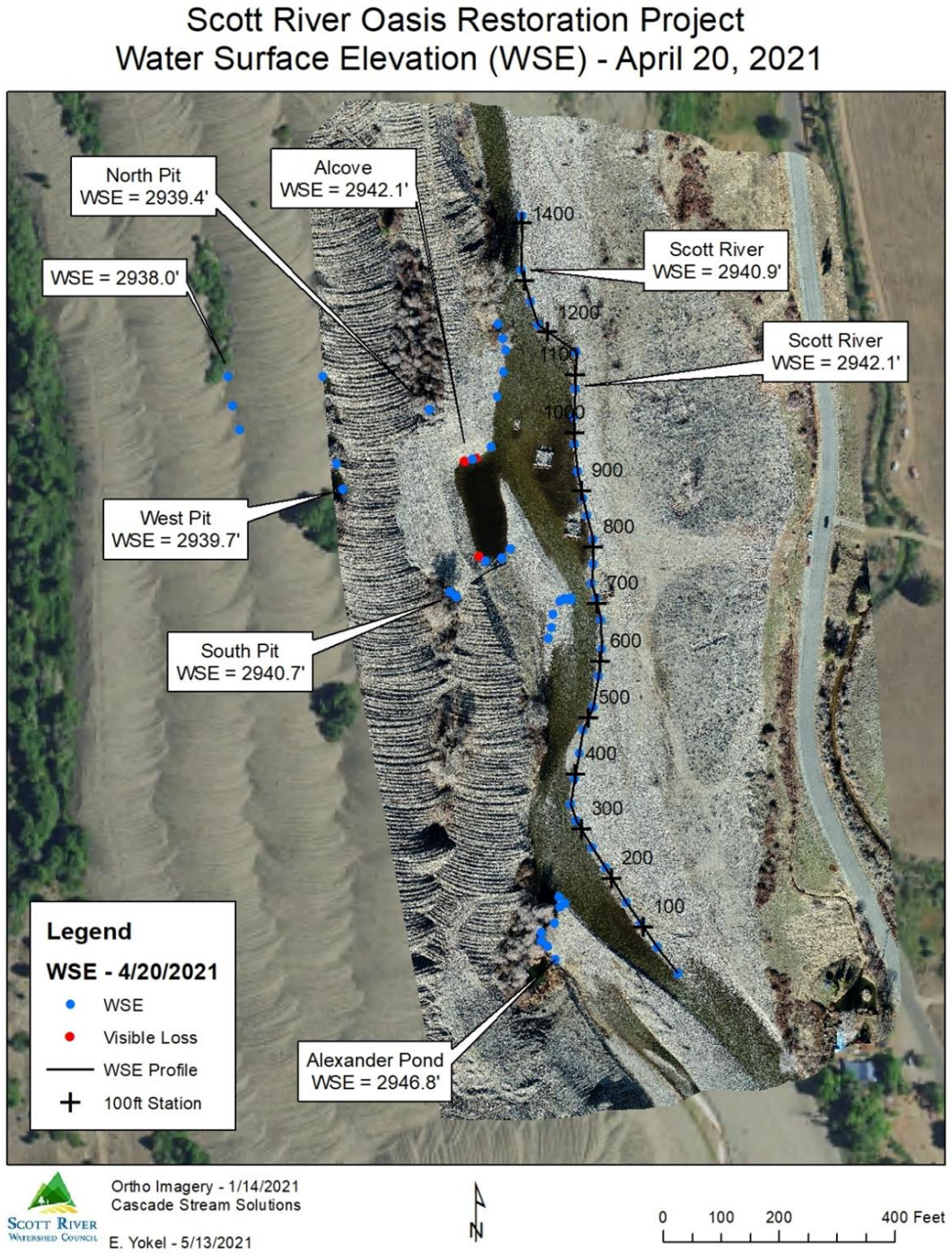
Treatment remediated the high percolation rate

Water on sealed surface perched above water table

Installed Scott Tailings “Oasis” Restoration project in 2020

Significant flow losses were observed at the alcove during the reconnection of the channel in 2020 – 2021

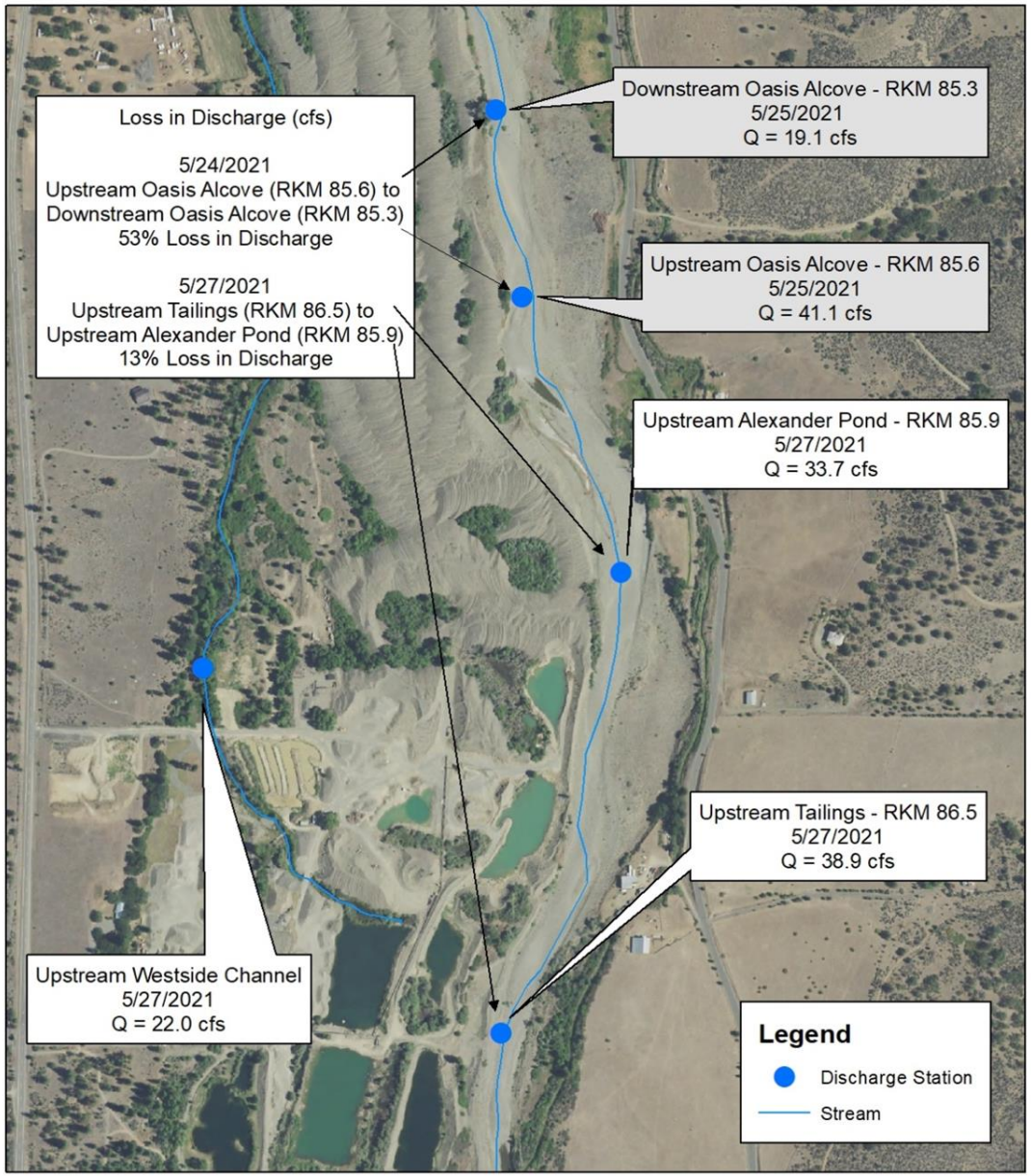
Survey of water surface elevation in Scott River and adjacent tailings indicate gradient towards the Northwest



Sediment deposition after initial runoff event – WY2022

Capture and storage of fire derived sediment

Scott River Tailings - Stream Discharge (cfs) - May 25 & 27,2021



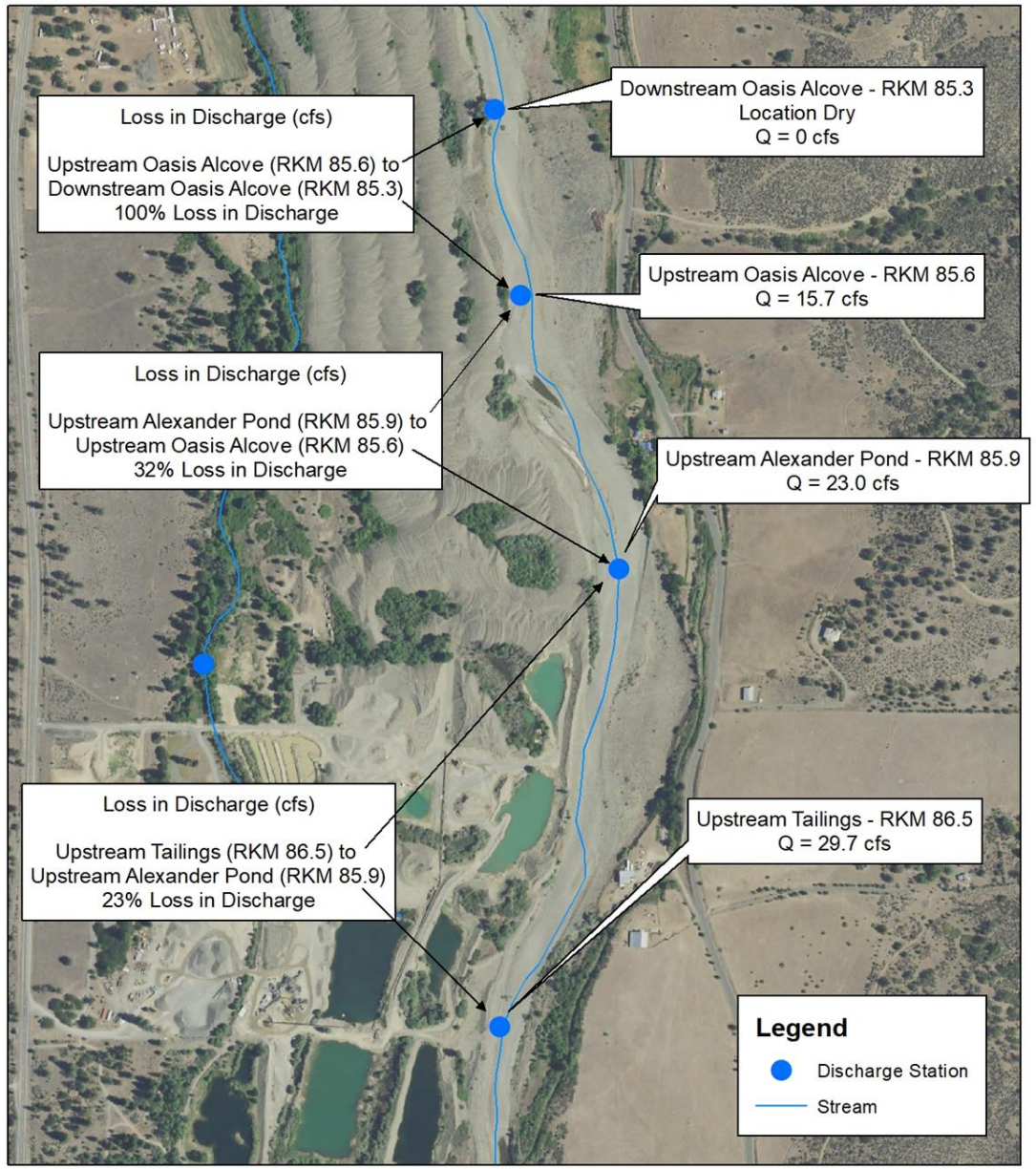
Performed stream discharge measurements to document discharge loss at alcove and upstream

Documented losses in Scott River

Documented significant discharge in Westside Channel

Regraded and sealed alcove in 2021 to mitigate percolation

Scott River Tailings - Stream Discharge (cfs) - June 3, 2021



Ortho Imagery - NAIP 2020

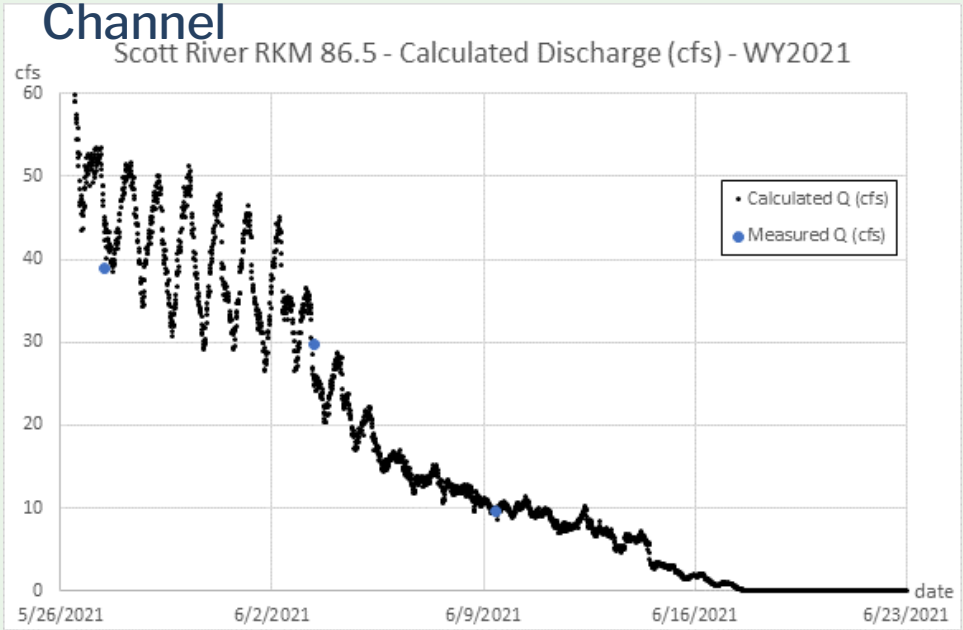
Scott River Watershed Council

E. Yokel - 6/7/2021

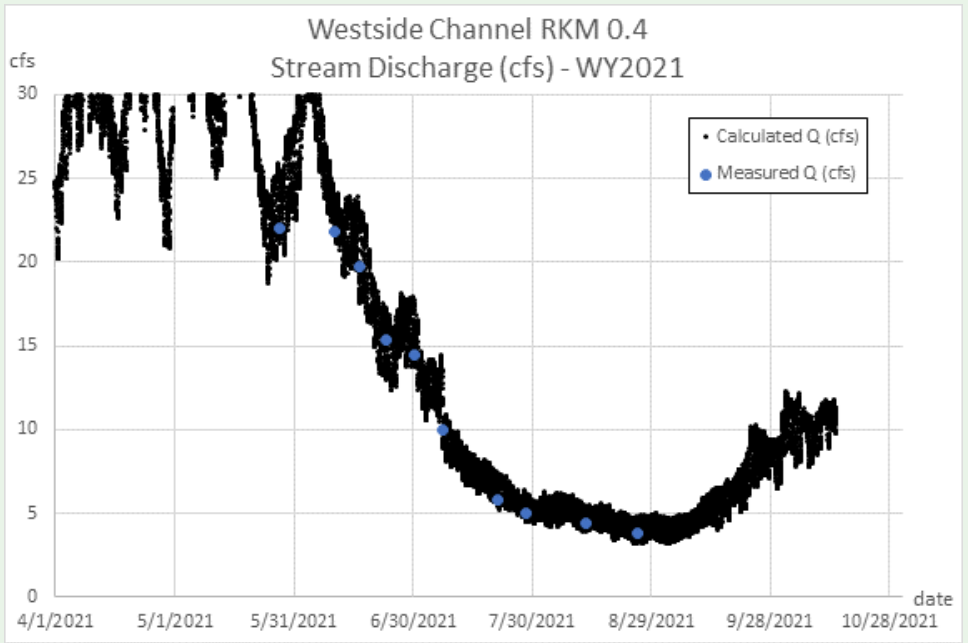
N

0 250 500 1,000 Feet

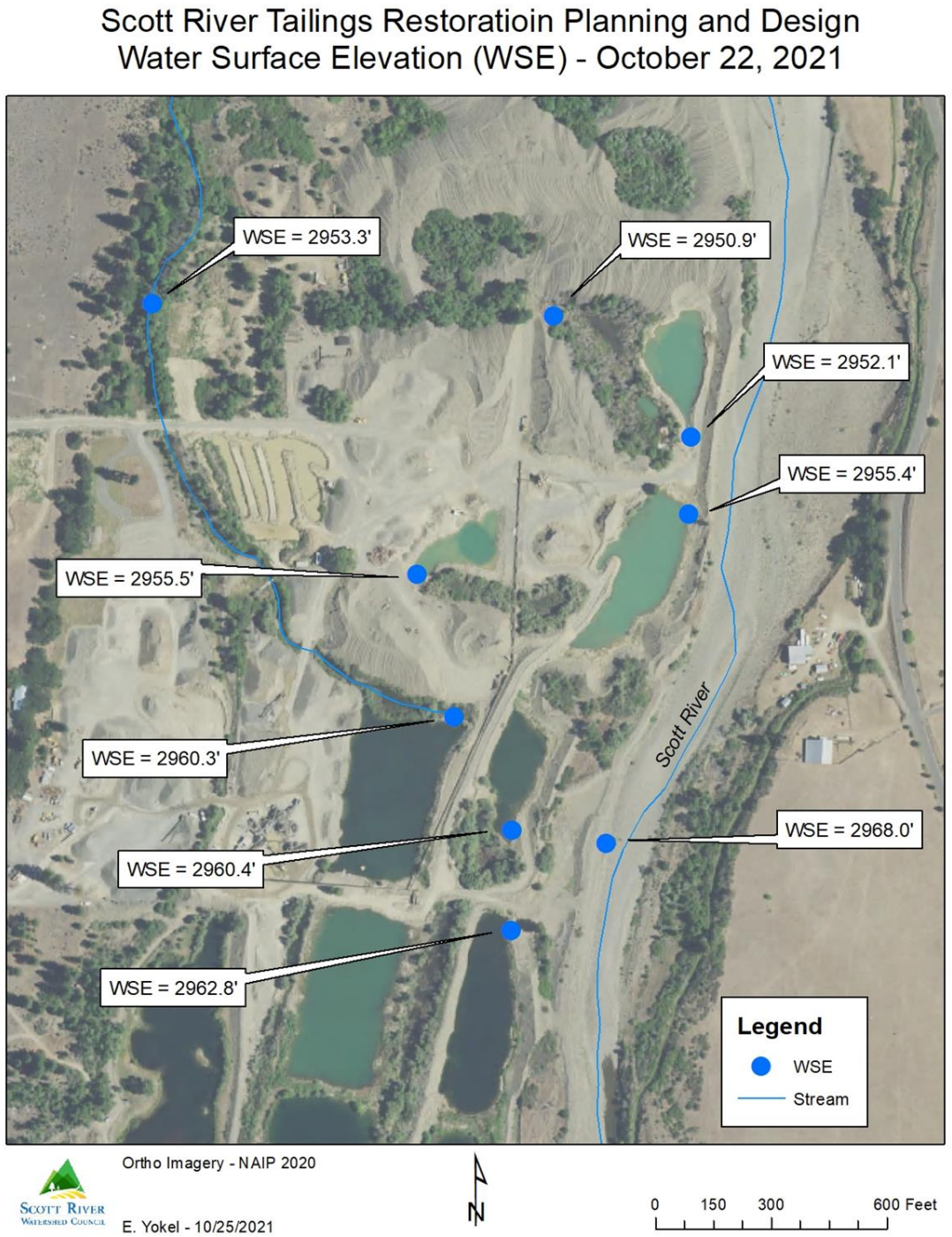
Stream Discharge – Scott River and Westside Channel



Scott River



Westside Channel

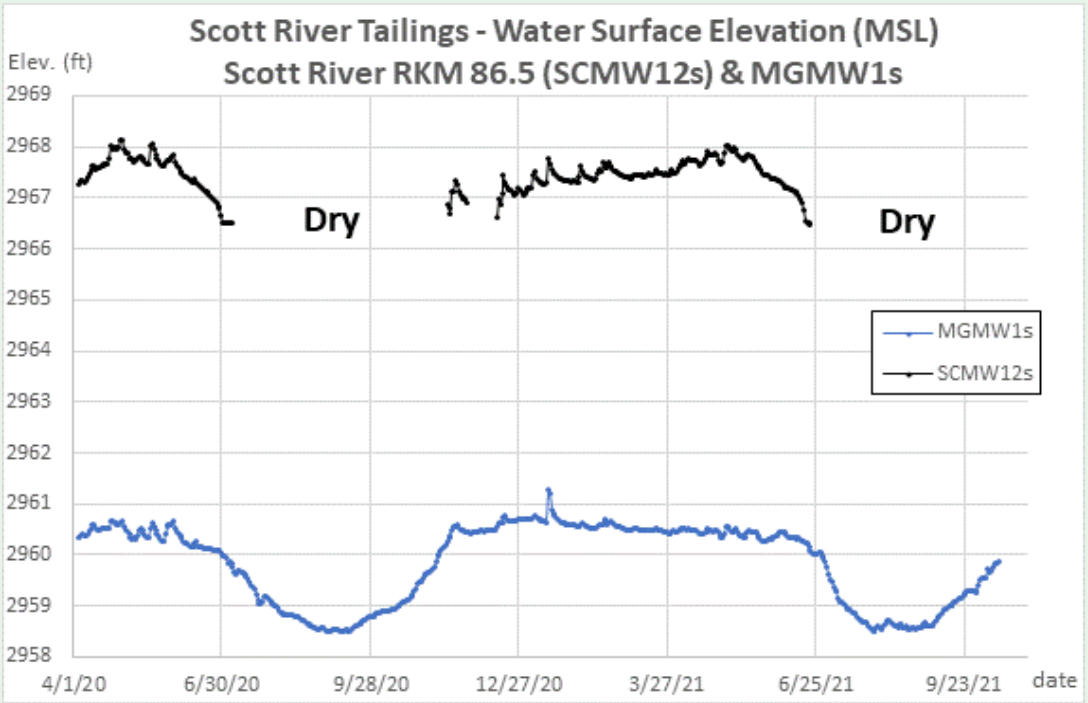


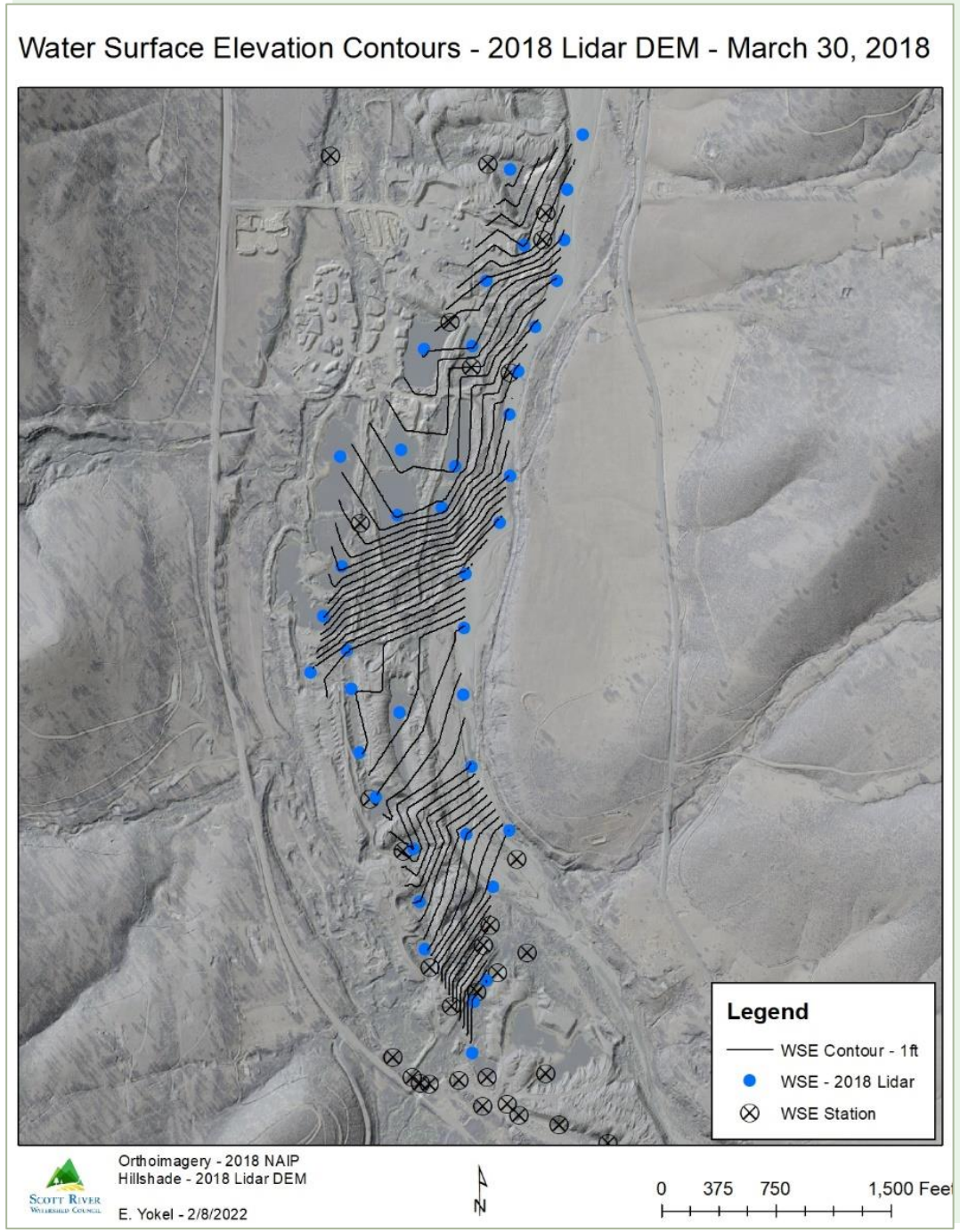
Water Surface Elevation – Sub Reach 3

Scott River WSE 7+ ft higher than WSE of adjacent ponds

WSE gradient more complicated than downstream site

Role of stratigraphy on hydraulic conductivity

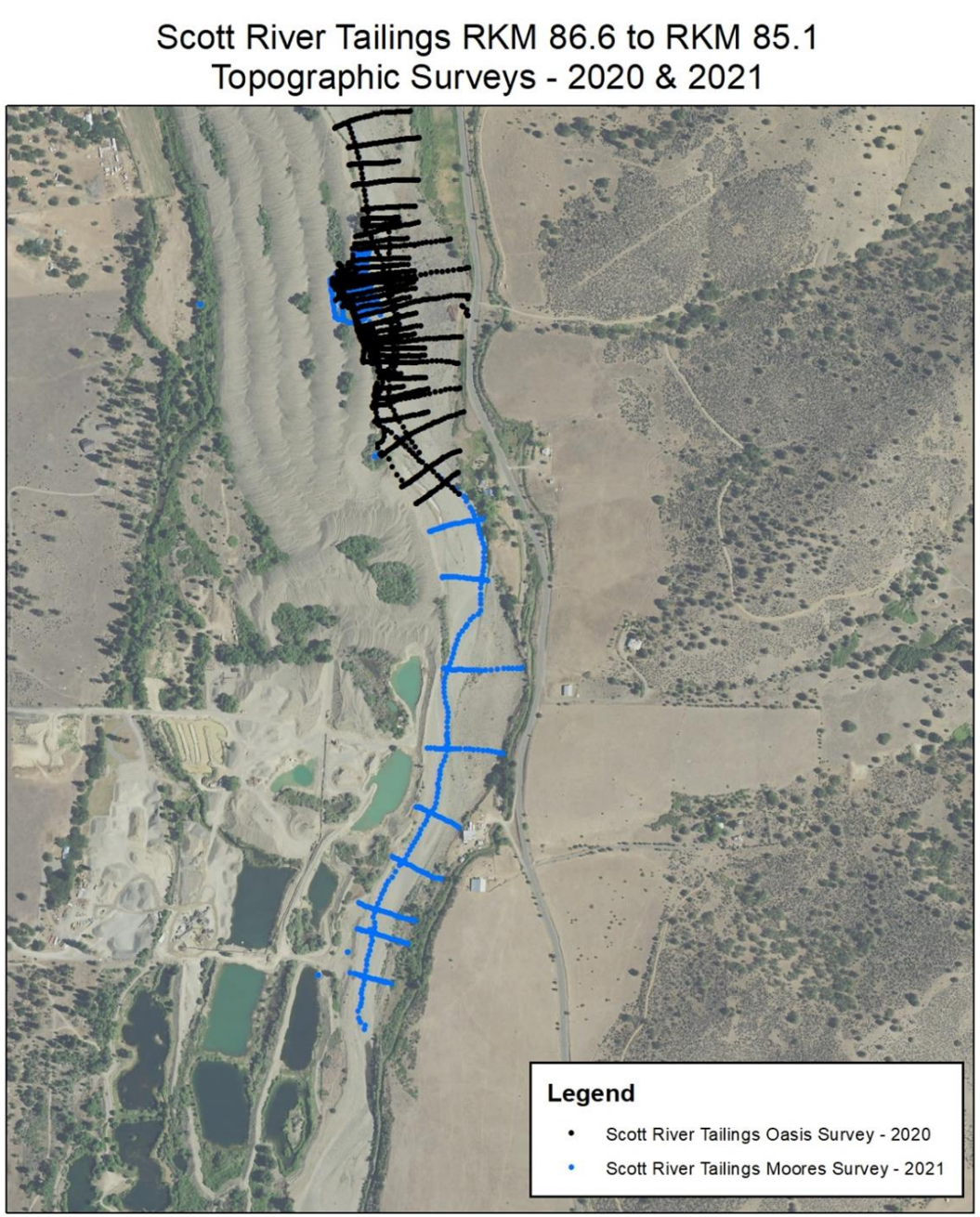




2018 Lidar DEM – Acquired March 30, 2018
Discharge at USGS Gage = 450 cfs

Developed WSE Contours from DEM

Areas of steeper and shallower gradients



Topographic Surveys

Streambed Substrate Characterization

- **Restore and enhance critical habitat for listed and at-risk anadromous fish**
  - Slow water winter rearing and refugia
  - Cold water summer rearing and refugia
  - Spawning
  - Migratory connectivity
- **Restore processes required to create and sustain critical habitat and related ecosystem services**
  - Surface and subsurface hydrology
  - Geomorphology
  - Water quality and temperature

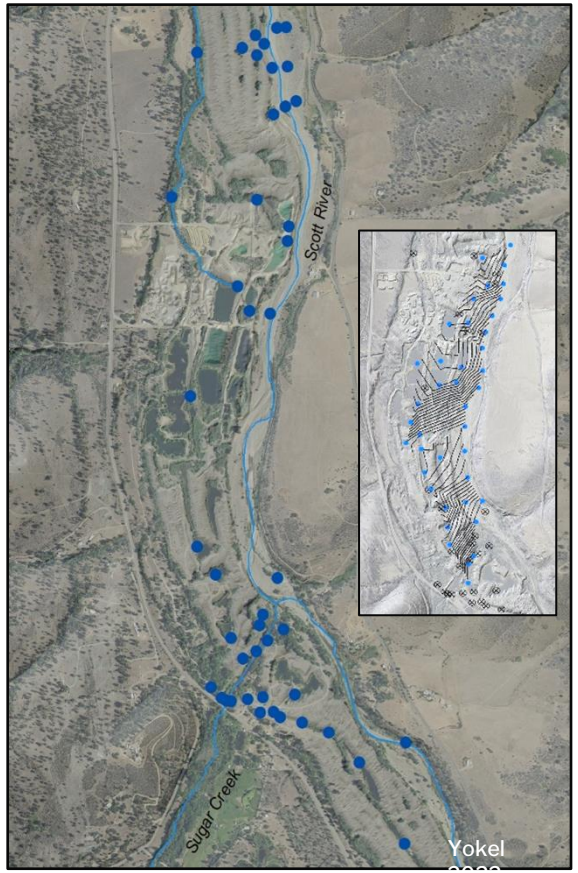
UNCERTAINTIES

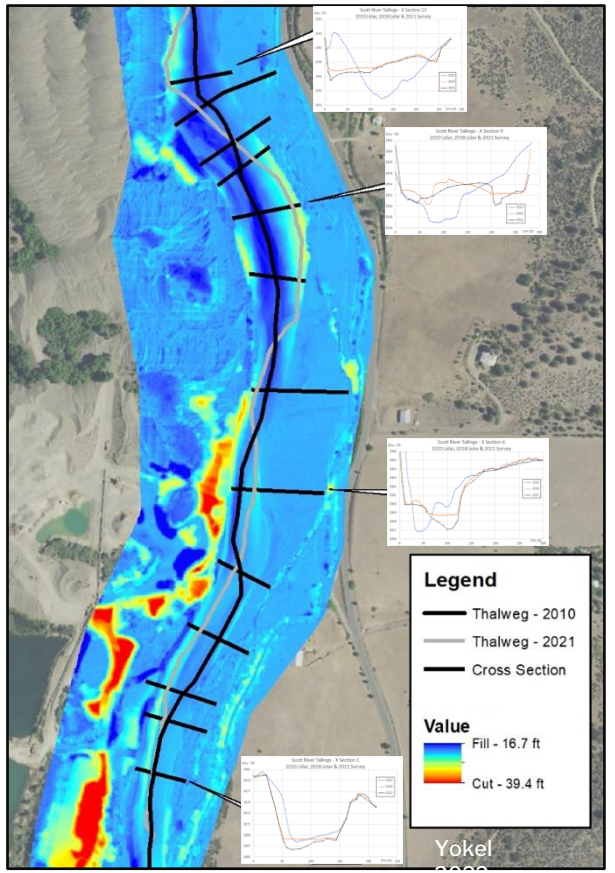
- Upper basin hydrology
- Valley bottom stratigraphy
- Surface water and groundwater interactions
- Fluvial processes within the confined river corridor
- Water temperature dynamics
- Hazardous materials (e.g., mercury, arsenic, lead)
- Land ownership, land use, and infrastructure
- Climate change effects

VISION OF PLANNING PROCESS

1. Compile information about unimpaired, historical, and existing conditions.

2. Continue and densify data collection efforts aimed at empirically characterizing hydrologic, geomorphic, physiochemical (e.g., temp, DO), and physical habitat conditions.

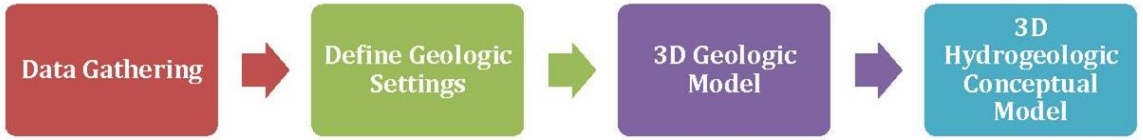


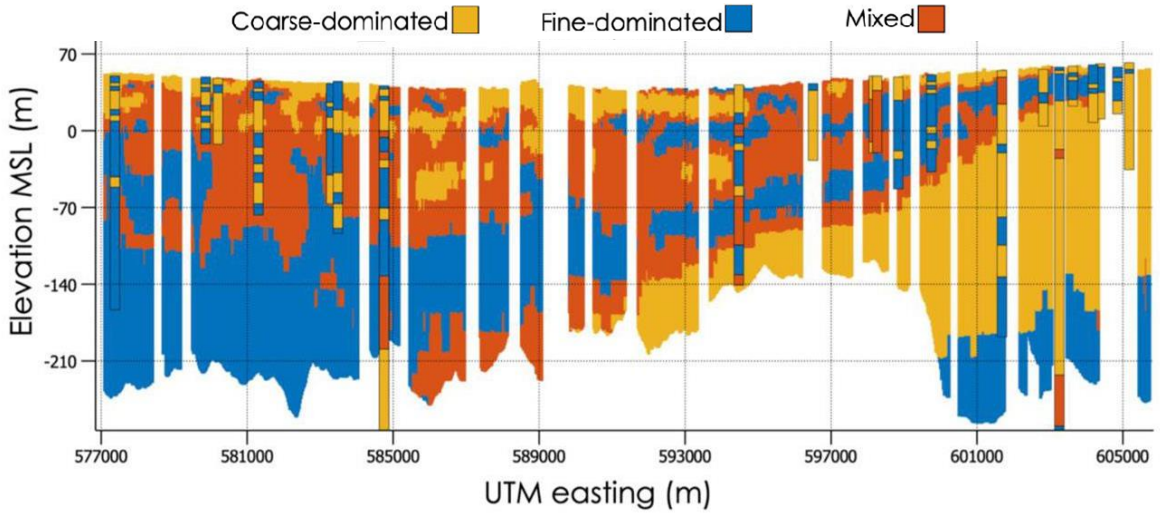


VISION OF PLANNING

3. Develop tools for better understanding processes controls and predicting responses to potential large-scale restoration actions.

   - Hydrogeologic conceptual model (DWR AEM, dredger logs, other geologic and geophysical information)





Knight 2020

VISION OF PLANNING

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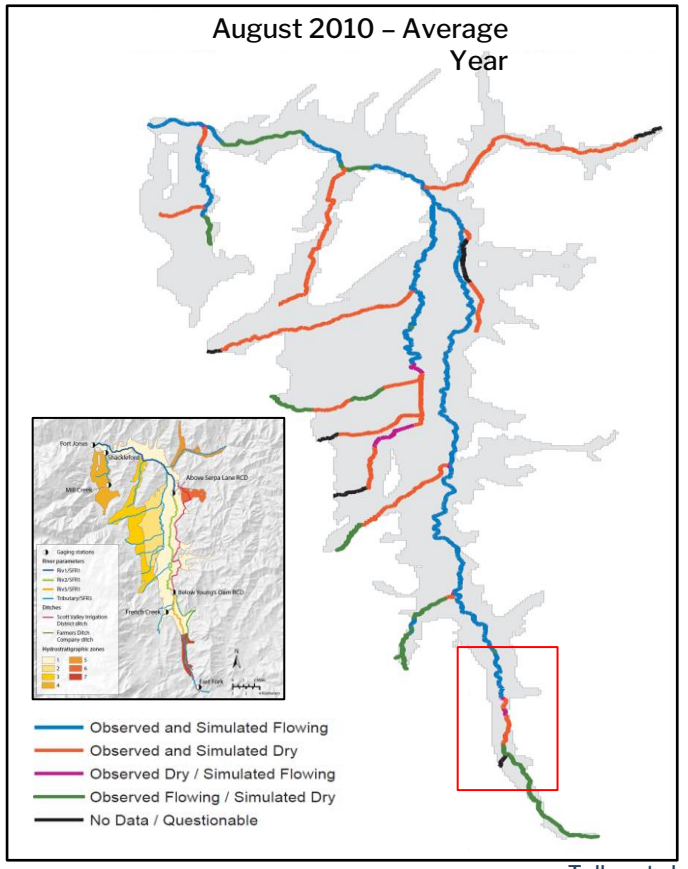
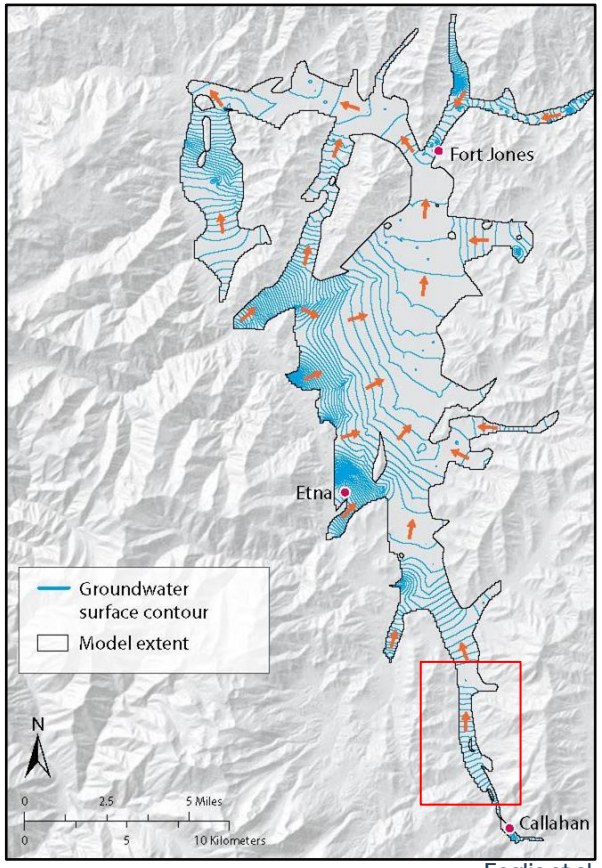
   - Groundwater-surface-water model (downscaled SVIHM).



Tolley et al.



Foglia et al.

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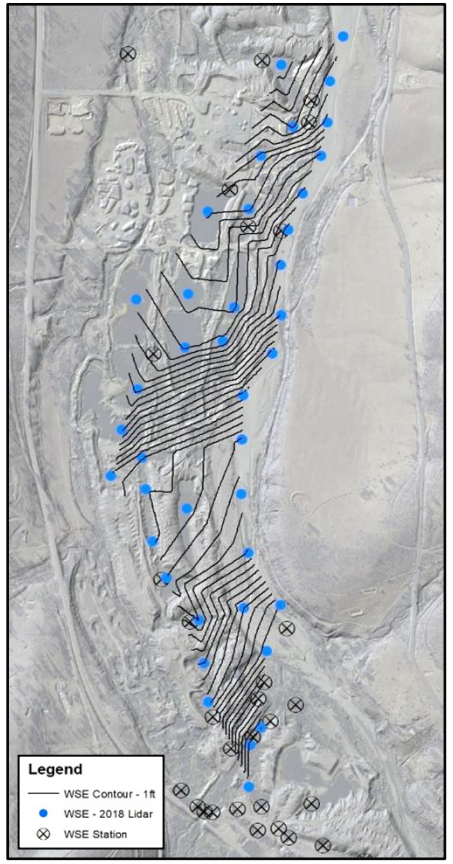
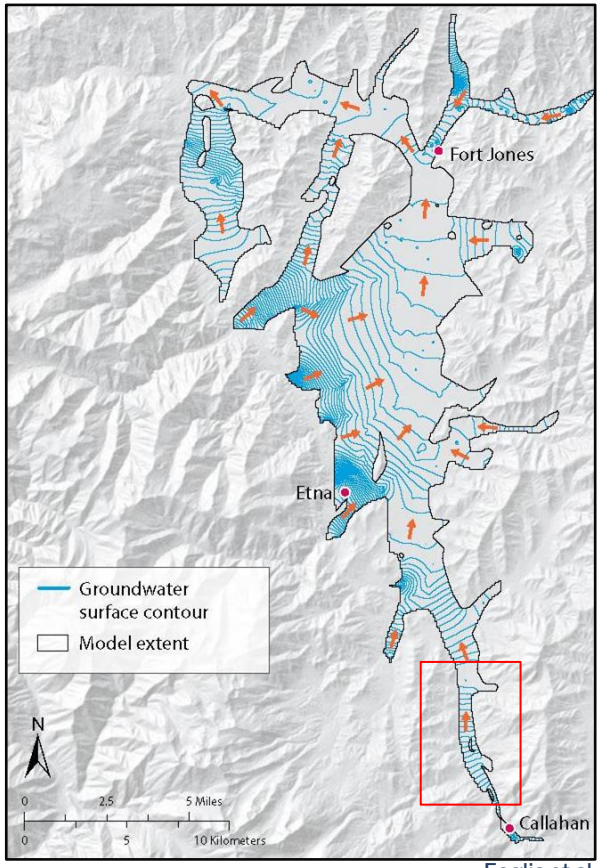


Yokel



Foglia et al.

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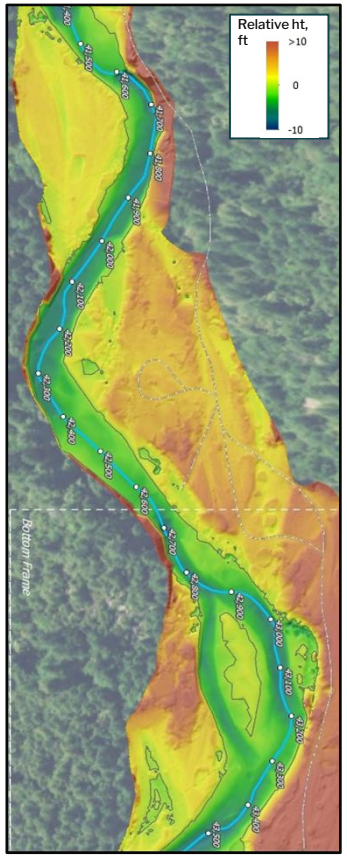
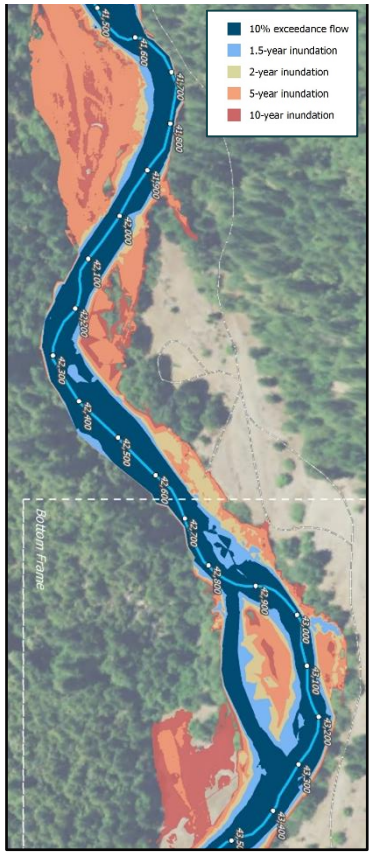
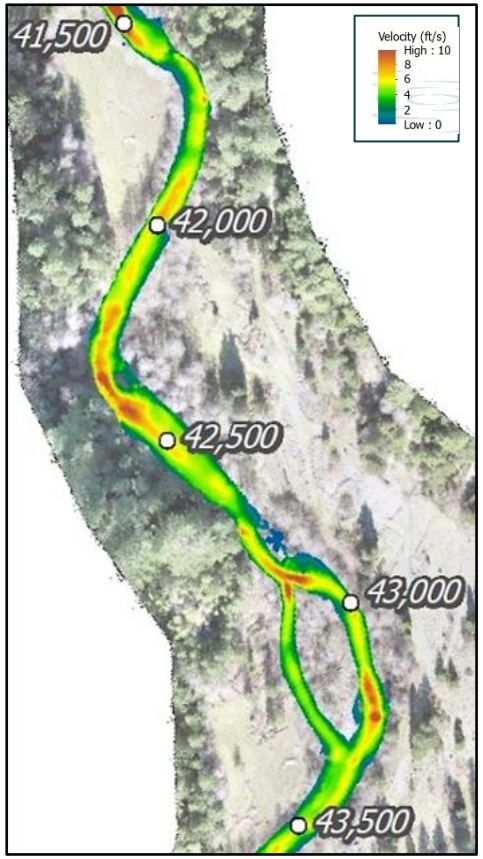
   - Groundwater-surface-water model (downscaled SVIHM).
   - Reach-scale hydrodynamic and sediment transport model



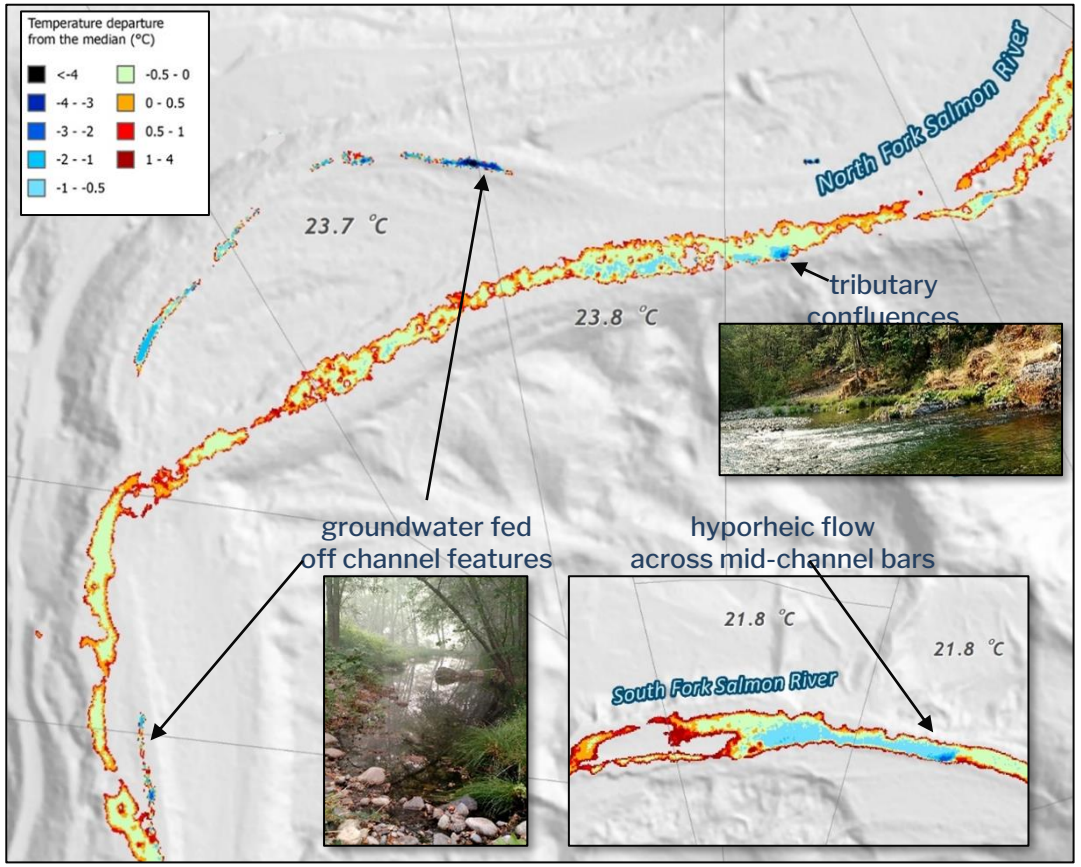




VISION OF PLANNING

3. Develop tools for better understanding processes controls and predicting responses to potential large-scale restoration actions.

   - Hydrogeologic conceptual model (DWR AEM, dredger logs, other geologic and geophysical information)
   - Groundwater-surface-water model (downscaled SVIHM).
   - Reach-scale hydrodynamic and sediment transport model
   - Temperature model



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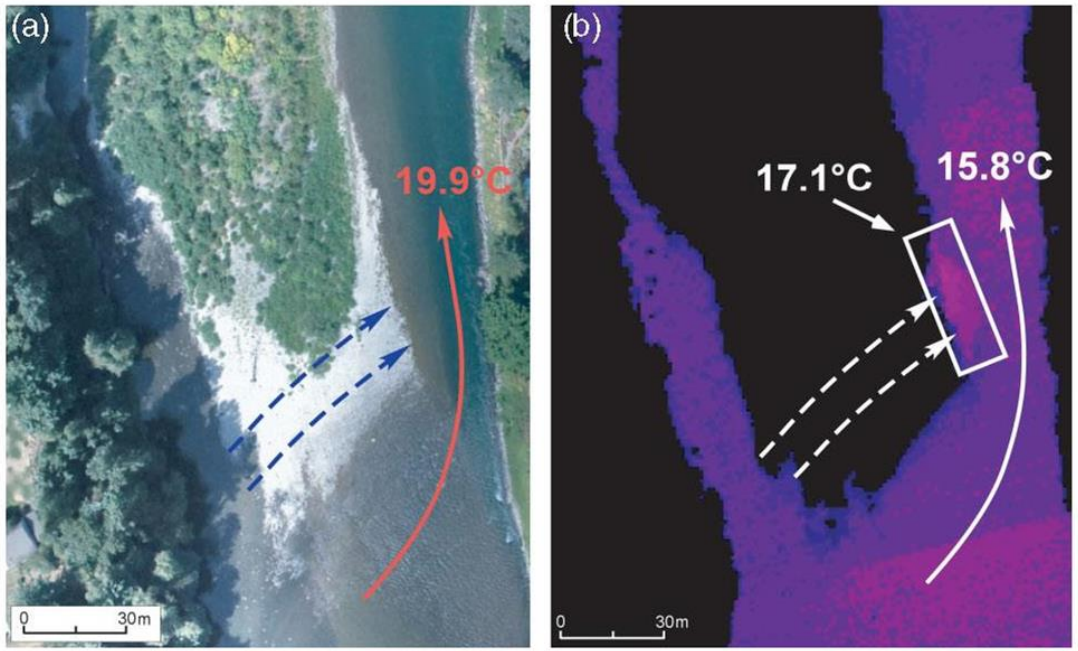


VISION OF PLANNING

4. Stratify tailings reach into process-based subreaches:
   - **Subreach 1:** South Fork-East Fork confluence to Wildcat Creek
   - **Subreach 2:** Wildcat Creek to Sugar Creek
   - **Subreach 3:** Sugar Creek to Major Change in Tailings Orientation
   - **Subreach 4:** Major Change in Tailings Orientation to downstream end of tailings


Subreach 1

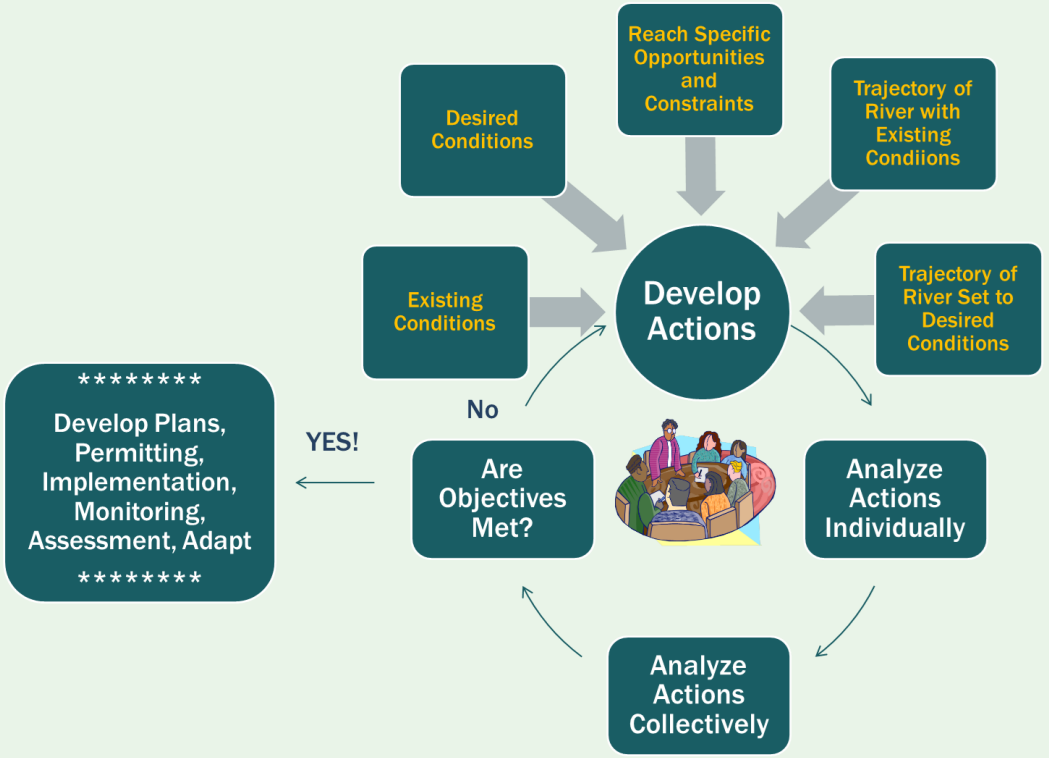

Subreach 2


Subreach 3


Subreach 4

VISION OF PLANNING

4. Identify effective actions [WHAT]
   - Mechanically rehabilitate channel and floodplain
   - Manage surface water and groundwater storage
   - Modify controls on surface-groundwater flow
   - Implement low tech process-based habitat restoration
   - Revegetate riparian corridor
   - Restore headwater reaches and source areas
5. Combine actions into process-based approach and analyze effects [WHERE]
6. Develop priorities and phasing [WHEN]
7. Design and implement individual projects as part of coordinated, prioritized and phased approach [HOW]
8. Monitor effectiveness and long-term trends [ADAPT]



NEXT STEPS

- Learn from past planning efforts and recent implementation projects in tailings reach and other analogous settings.
- Pilot the planning process and tool development in Moores Project Reach.
- Successfully fund reach-scale planning effort.

Thank You

Questions?

erich@scottriver.org

jay@stillwatersci.com