ADDRESSING THE THERMAL BARRIER AND REFUGIA IN THE LOWER YAKIMA RIVER

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Presentation to the Yakima River Science and Management Conference
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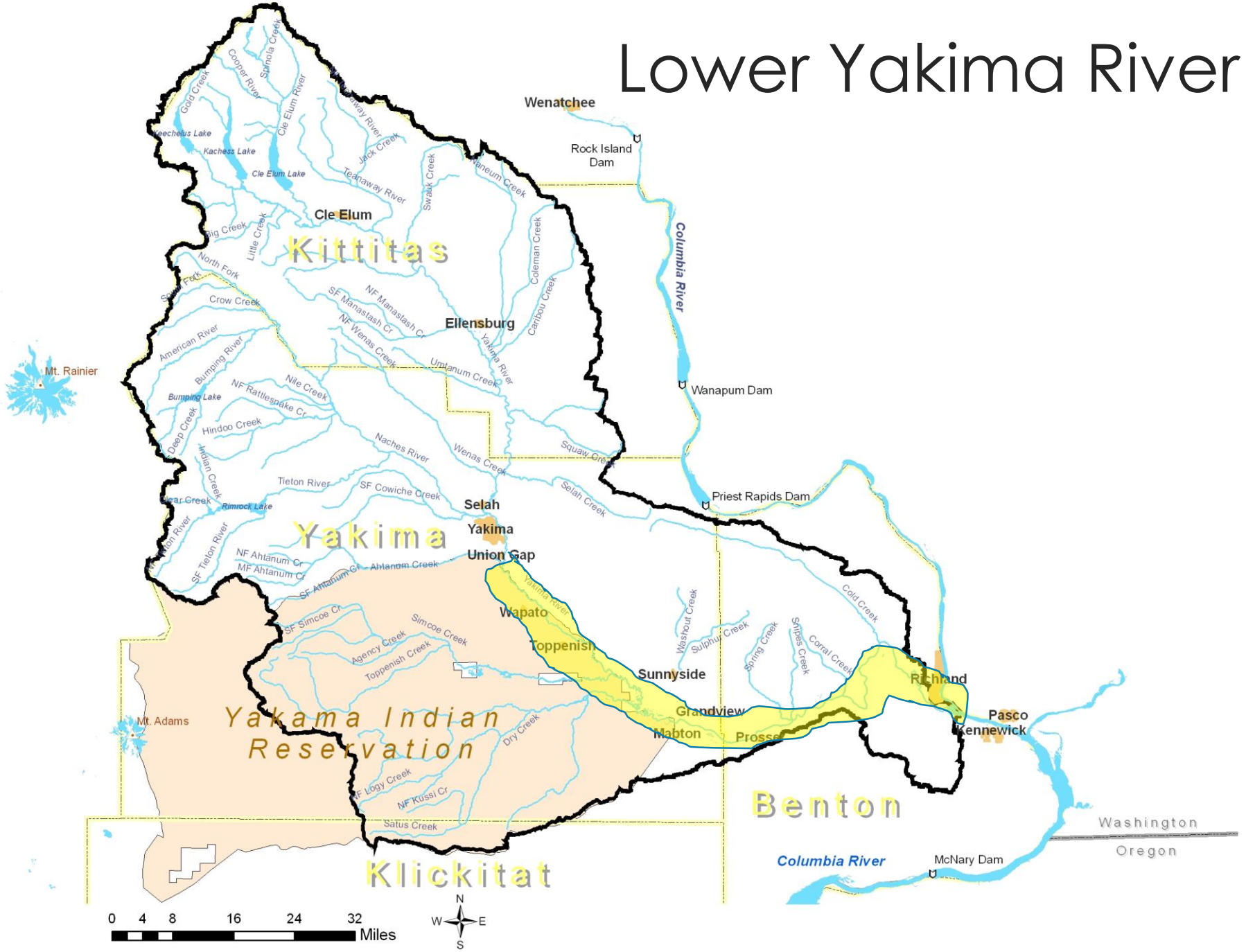
Lower Yakima River



Overview of Temperature Work in the Lower Basin

- BOR- **1997 FLIR data** from headwaters to mouth (Holroyd, 1998)
- USGS – **2002 thermal profile** of Yakima River, Cle Elum to Prosser (Vaccaro, 2006 & 2011)
- Benton CD – **2008 and 2009 thermal profile** of the lower river Prosser to Mouth
- Benton CD & MCFEG - spatial and temporal temperature data at the mouth of the Yakima River 2009, 2011-2017

BOR 1997 FLIR Data

- Captured river surface temperature (August 15,1997)
- Documented downstream warming of surface temperatures
- Highlighted "cooler" water influents – macro scale

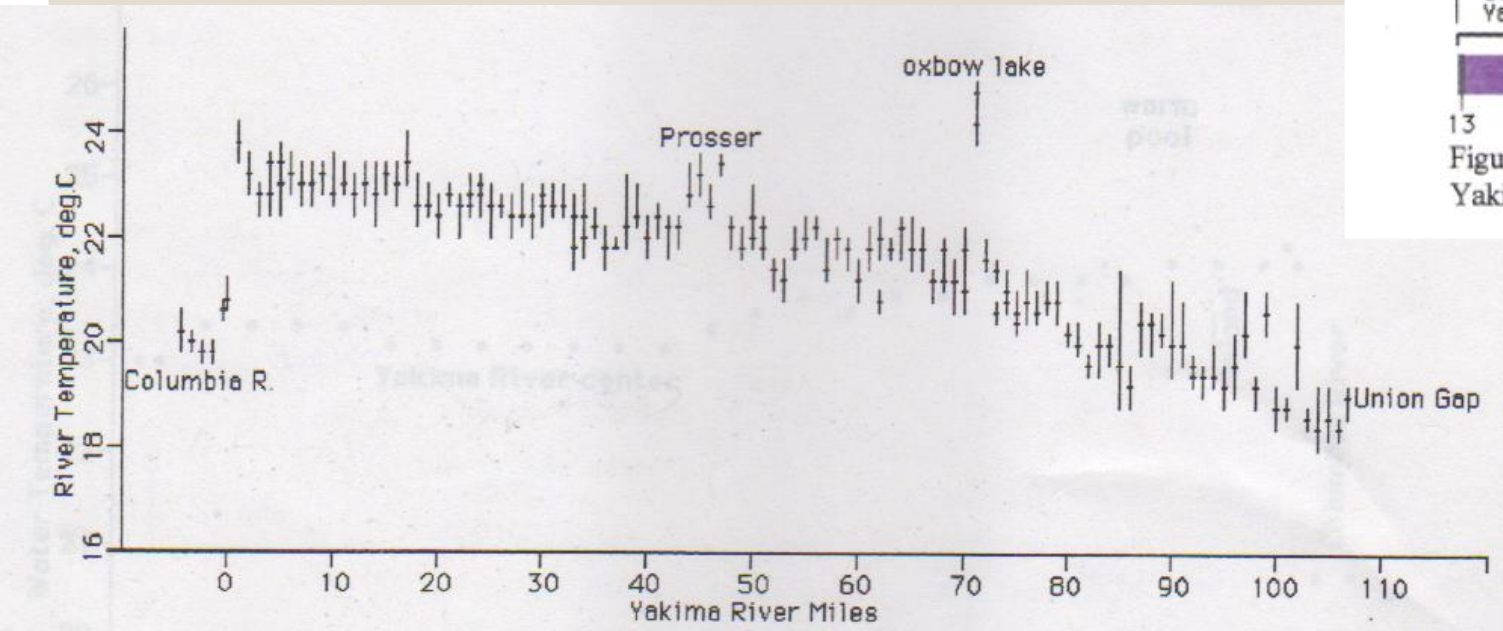


Figure 4. The Yakima River warms as it travels from Union Gap to the colder Columbia River.

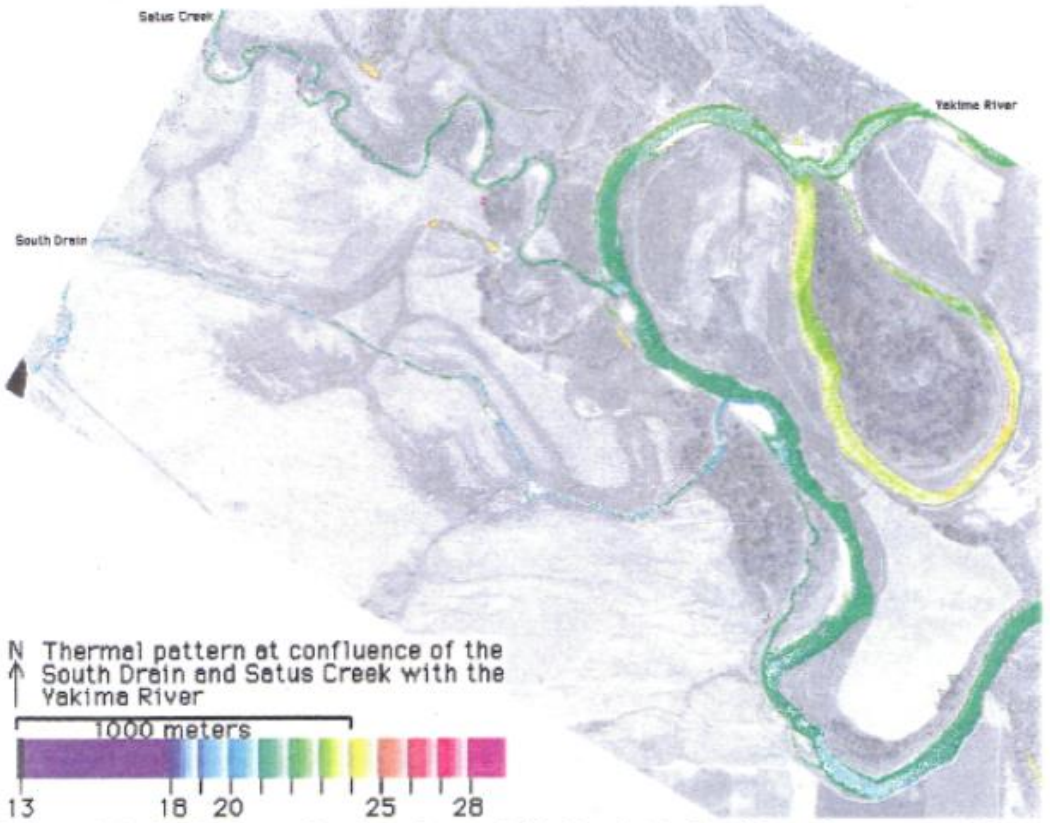
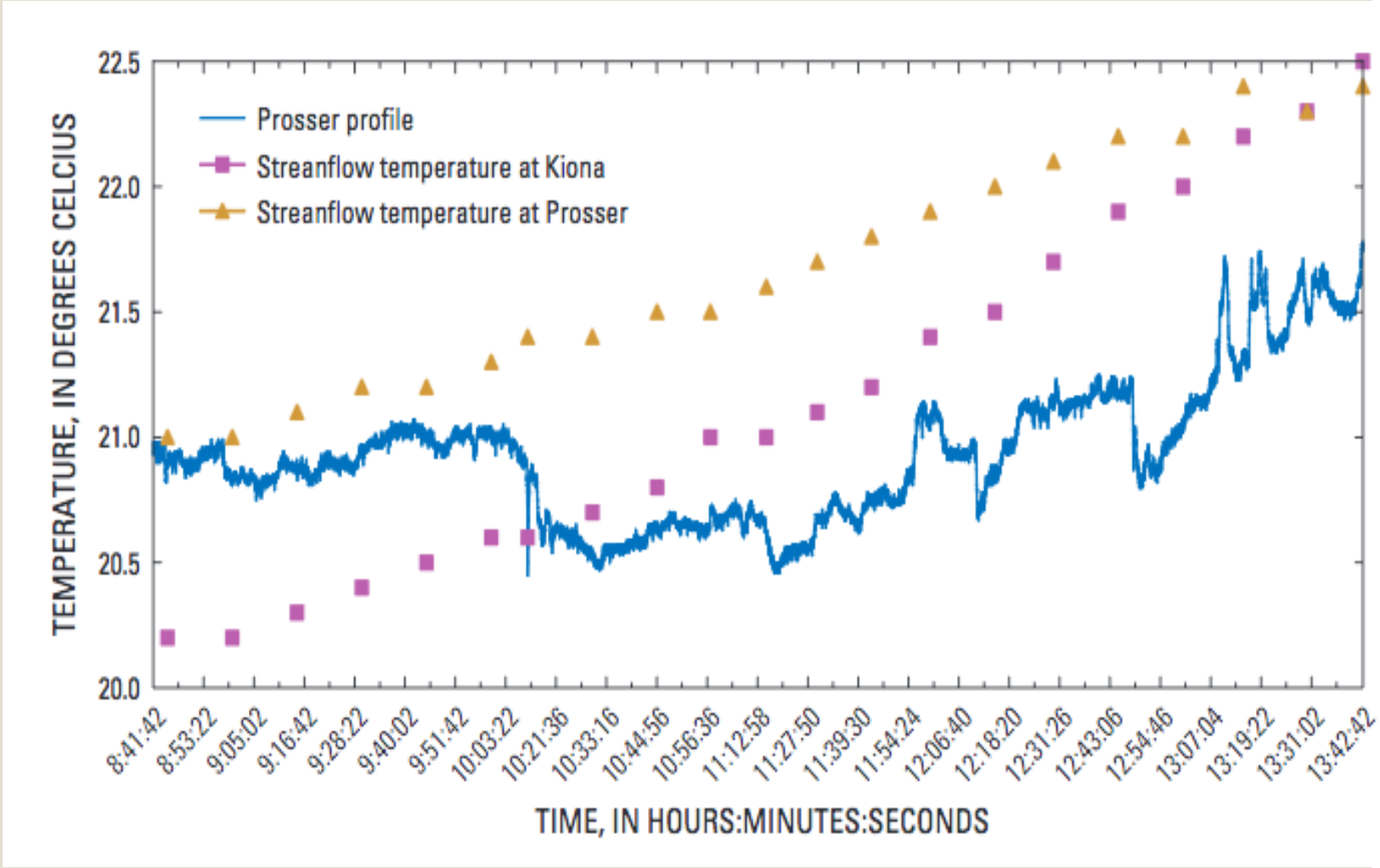


Figure 14. Both Satus Creek and especially South Drain add cooler water to the Yakima River.

Holroyd, E. , 1998. Analyses of the Thermal Mapping Data for the Lower Yakima River. US Department of the Interior, BOR. No. 8260-98010

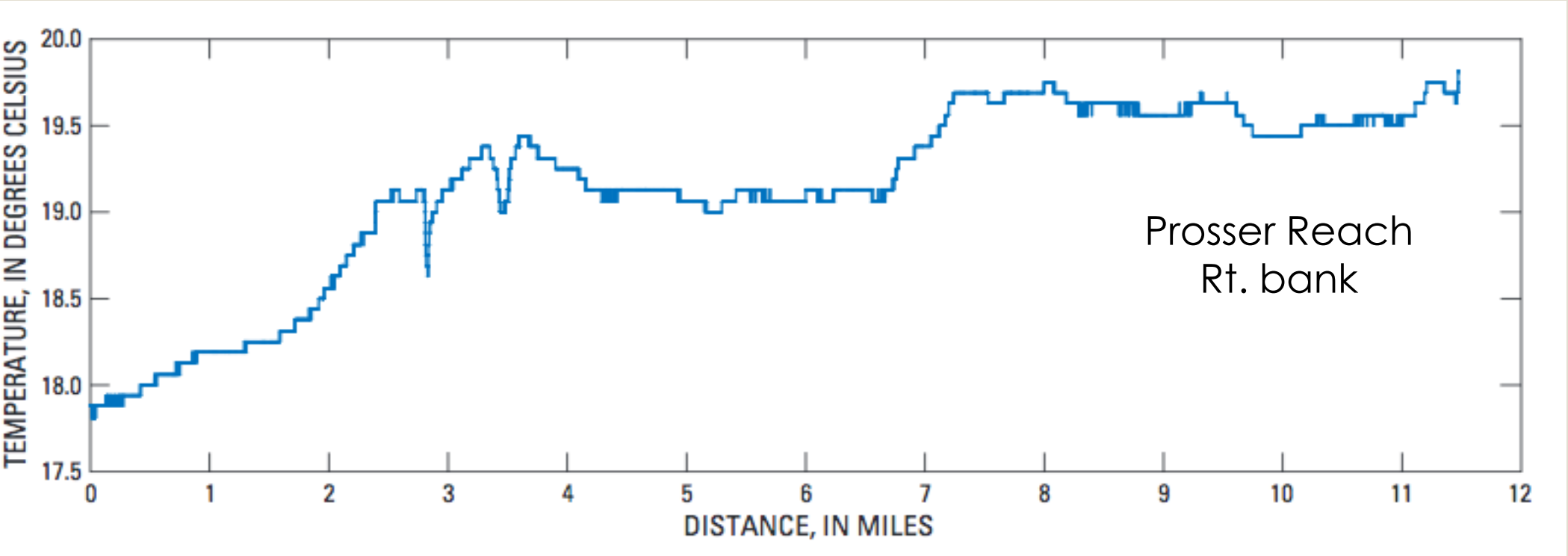
USGS Thermal Profile

- Identify ground water discharge & microscale thermal heterogeneity
- Seepage estimates - Prosser reach gains 8-41%
- Suppresses daily warming in part of the reach
- Exchanges may benefit migrating salmon and maintain habitat for fall chinook redds



Vaccaro, J.J and K.J. Maloy, 2011, River Aquifer Exchanges in the Yakima River Basin*:* United States Geological Survey*.* Scientific Investigations Report 2011-5026, 112p.

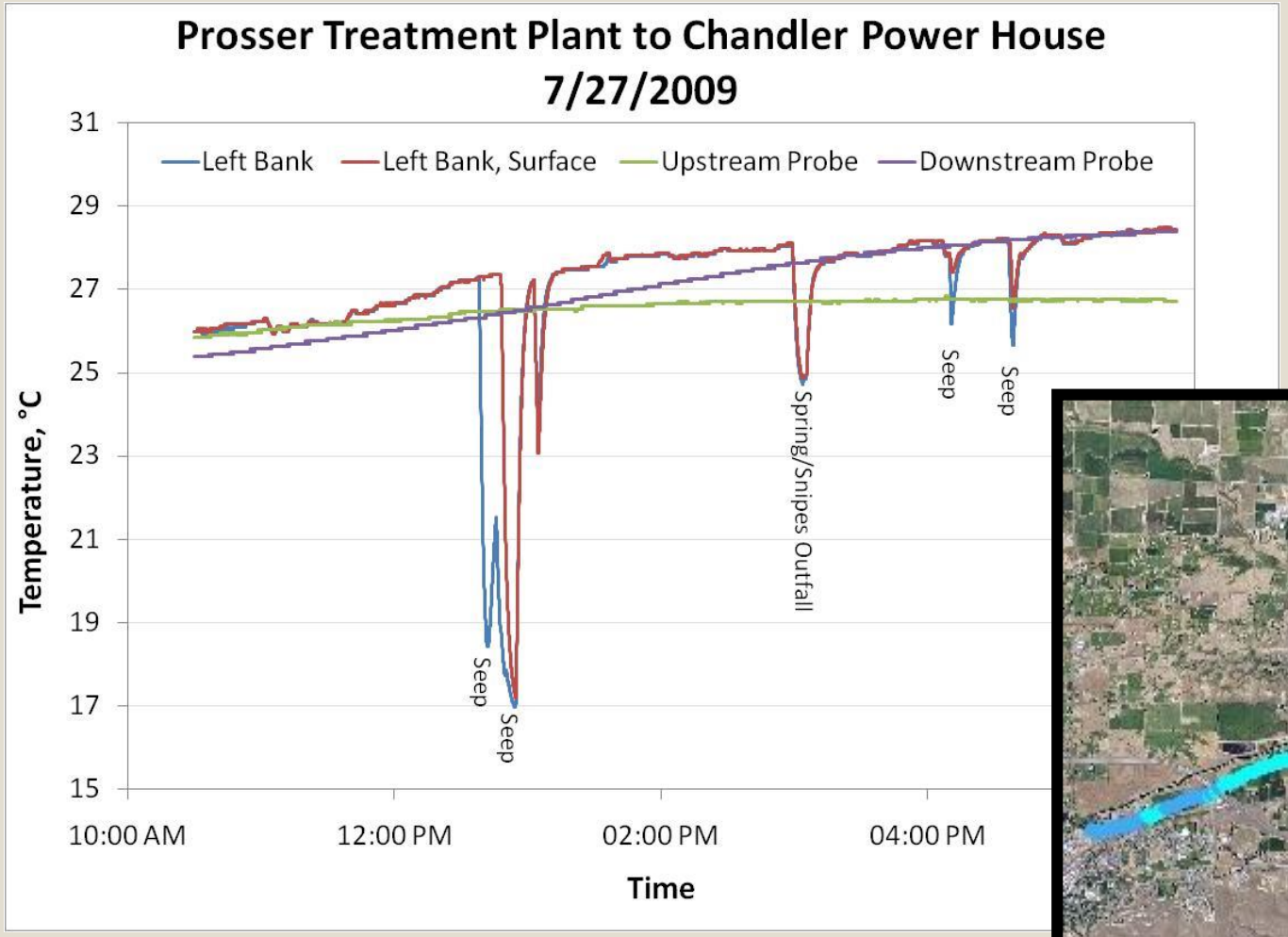
BCD Lower Yakima River Assessment



BCD data, reported in Vaccaro, J.J, 2011, River Aquifer Exchanges in the Yakima River Basin: United States Geological Survey. Scientific Investigations Report 2011-5026, 112p.

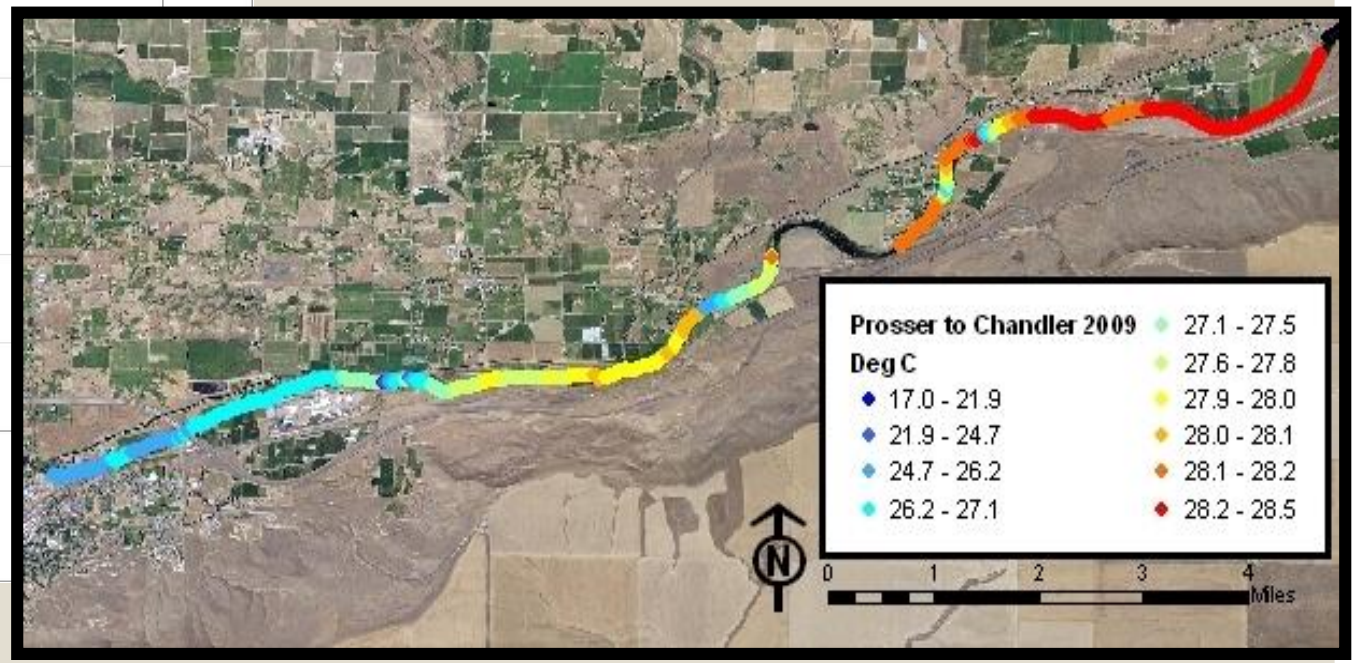
- Documented river temperature & depth for thermal refuge potential
- Prosser to the Confluence – 2008 and 2009 low flow conditions
- Prosser float data indicates large amount of groundwater influence in this reach. Consistent with Vaccaro's work.

Lower Yakima River Assessment



Left, Right and Thalweg Data Collected

Thermal profile of "cooler" incoming seeps on left bank of Yakima River



Implementation of priority actions

1) Yakima River Delta and Bateman Island Causeway
4) Side Channel Restoration and Protection (Prosser to Richland)
7) Protection, Enhancement, and Further Analysis of Thermal Refugia Potential
8) Water Stargrass Management

Appel et al., 2011. Assessment of the Lower Yakima River in Benton County, Washington. pp. ii – iv.

Action #8: Water stargrass management

- Bank to bank monoculture from Prosser to delta
- Observed in a range of habitats (e.g., silted slack water, cobble substrate)
- Displaces the river
- Creates challenges for water quality (temperature, DO, pH) – magnitude?
- Enhances sediment deposition
- Impact on fish?

Lower Yakima River Water Quality and Macrophyte Dynamics Study – BCD, USGS

- Collection of Continuous Water Quality, Nutrient and Flow Data 2017-2019
  - First real-time turbidity data for lower Yakima River
  - 3 Sites (Prosser, Kiona, Van Giesen Bridge)
- Determine percent cover and biomass of Macrophyte
  - Ideally, develop a regression model to predict biomass as a function of cover

Action #8: Water Stargrass Management

Goal: To understand temporal interactions of water quality, nutrients and macrophytes on the lower Yakima River

- How are daily **DO fluctuations** from macrophyte growth likely to **influence habitat** and **migration** potential?
- How do we utilize an understanding of the complex interactions between bed sediment nutrients, temperature, flow, and macrophyte growth **to aid in management decisions** necessary to **improve water quality** and **habitat flow conditions**?
- How does macrophyte growth influence **predator population dynamics** in the lower Yakima River

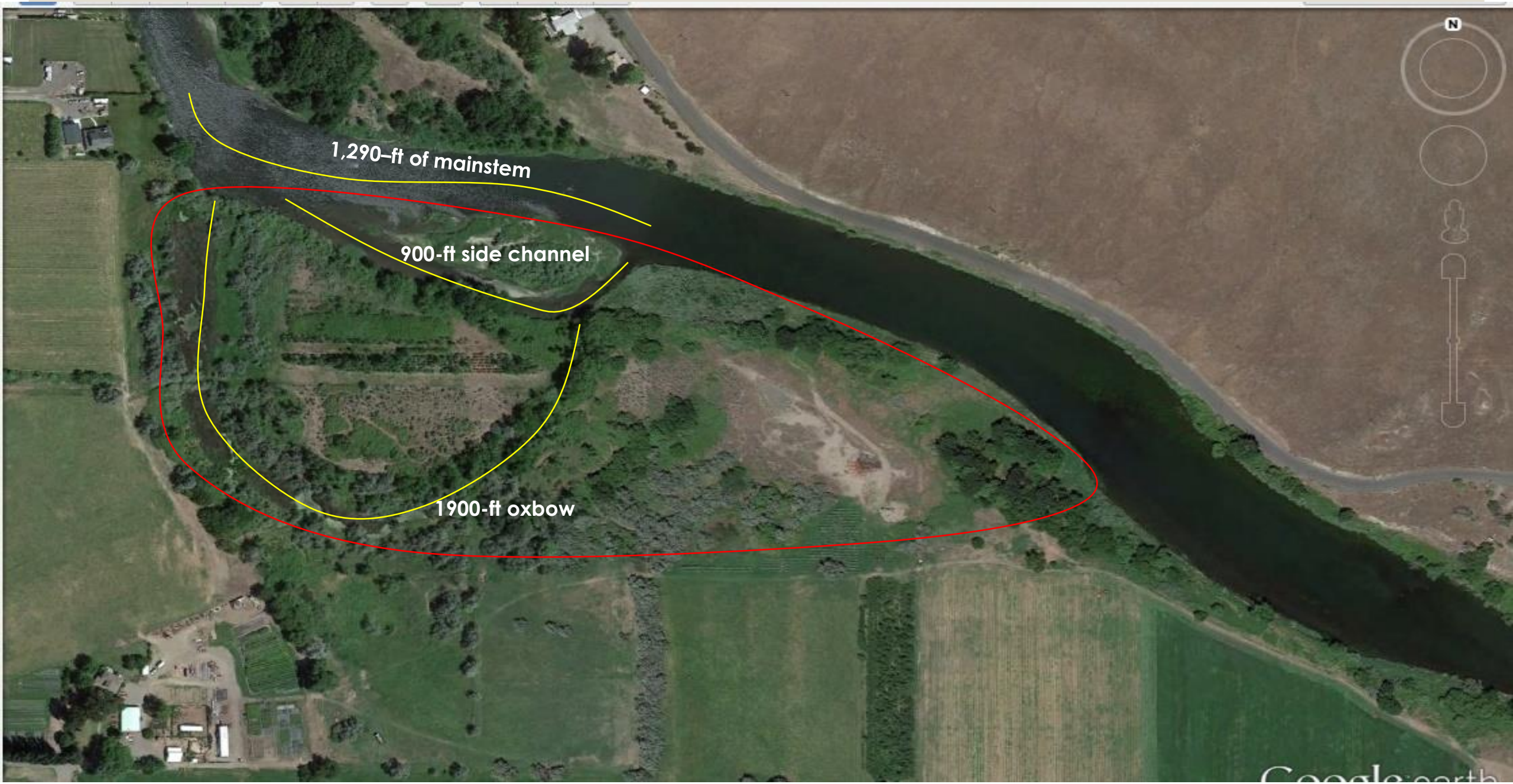
Action #7: Thermal refuge

Data Gaps:

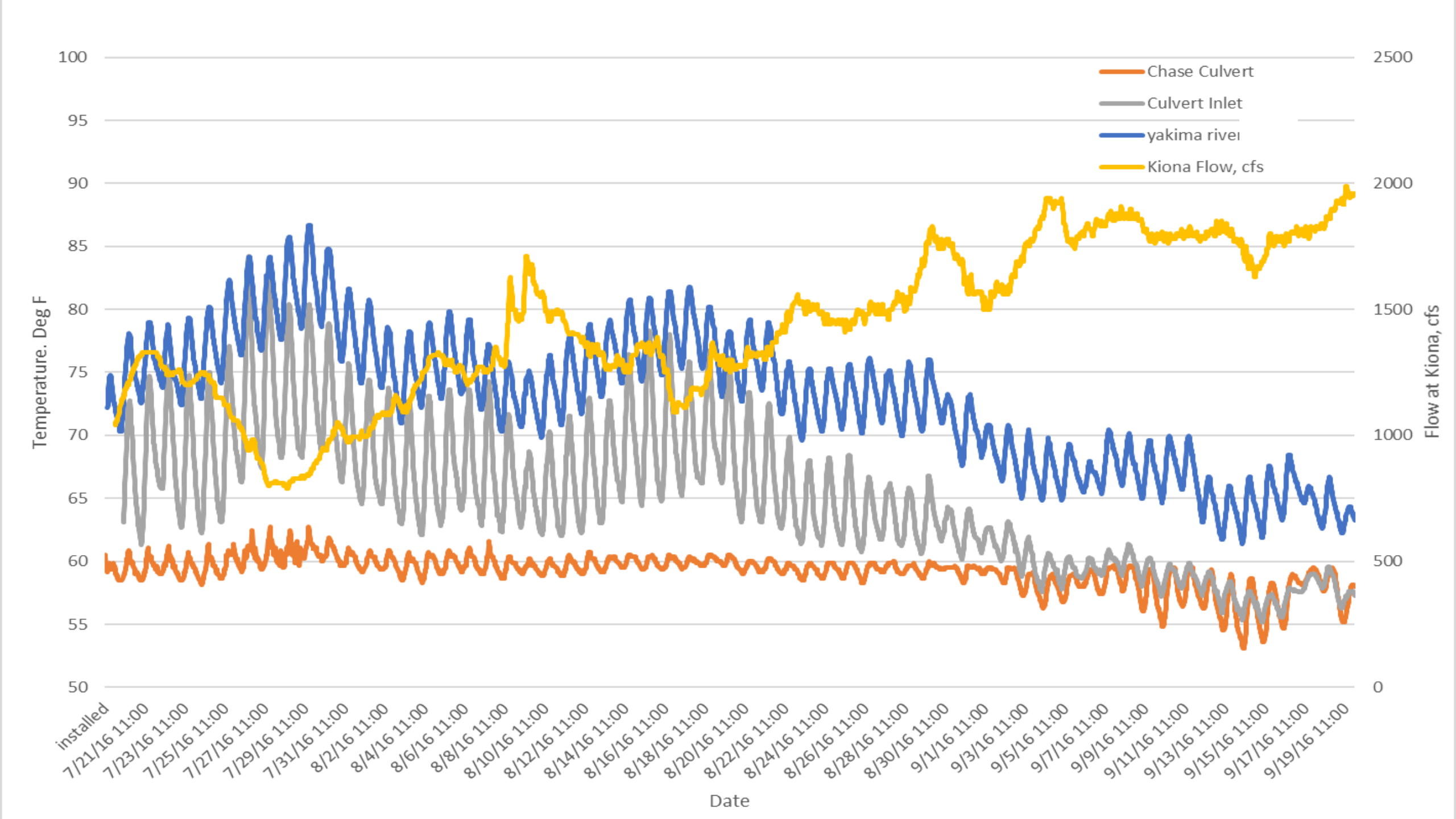
- Investigate temporal and spatial stability of key thermal refuge locations
- Investigate potential to enhance or create thermal refuge locations by utilizing natural landscape features
- Investigate macrophyte dynamics on thermal refuge locations in side-channels

- Work to be completed through partnerships with MCFEG, KID & USGS through a variety of funding sources

Action #4: Side channels


1,290–ft of mainstem
900-ft side channel
1900-ft oxbow
N


RIght bank -- temperature
Right bank upstream -- temp
Logger in river - temp
Culvert outlet - temp and stage
Side channel inlet -- temp and stage
Mid-side channel -- substrate
Demoss Ro
Chase culvert inlet - temp
Spring 2 - temp
Oxbow head - temp
Spring 1 - temp
676 ft
© 2016 Google
Google earth
07/19/2016 12:18


Chase Culvert
Culvert Inlet
yakima river
Kiona Flow, cfs
Temperature. Deg F
Flow at Kiona, cfs
Date
100
95
90
85
80
75
70
65
60
55
50
2500
2000
1500
1000
500
0
installed
7/21/16 11:00
7/23/16 11:00
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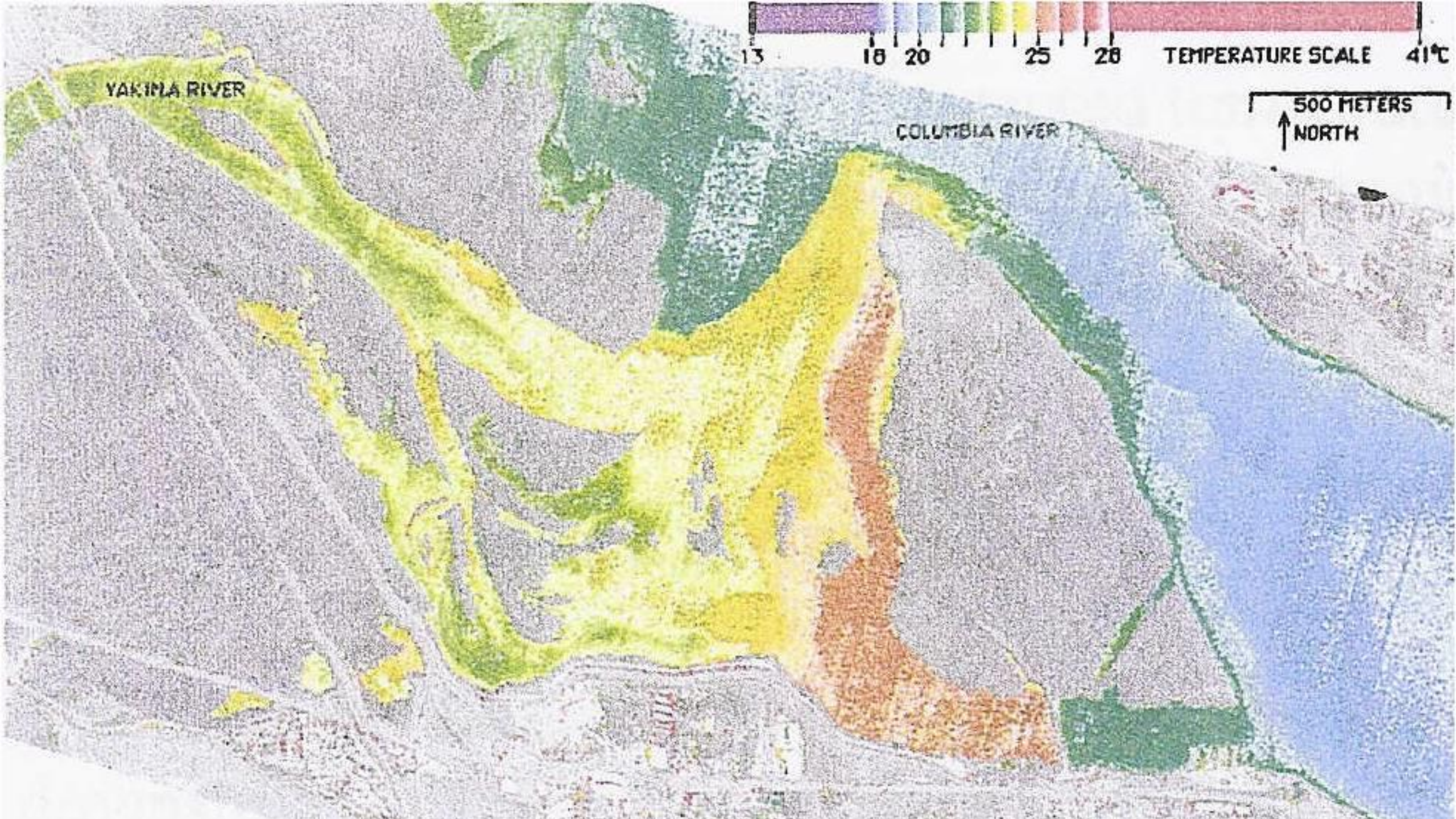
Action #1: Yakima River Delta


13
18
20
25
28
TEMPERATURE SCALE
41°C
YAKIMA RIVER
COLUMBIA RIVER
500 METERS
NORTH

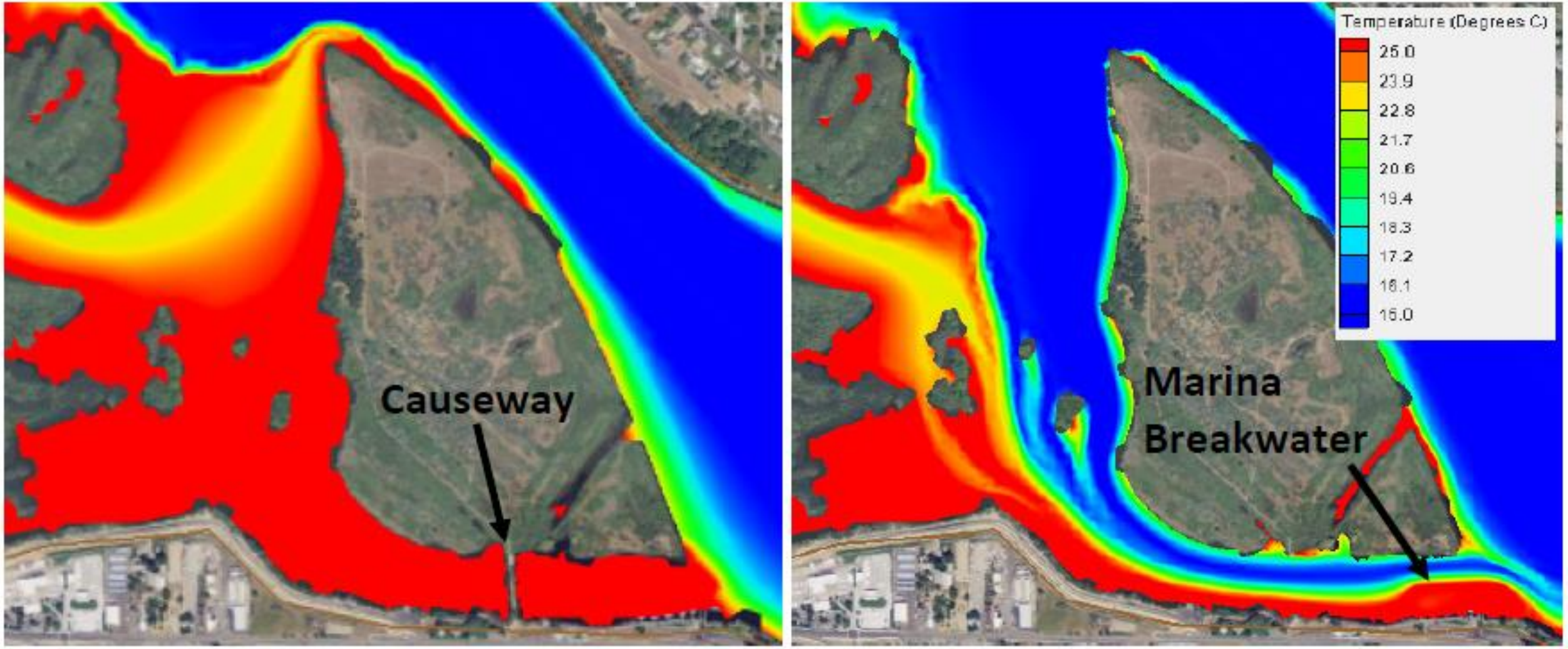


Figure EX1: Simulated Temperatures for a Moderately High Columbia River Discharge on July 8, 2012, (Left) Existing Conditions, (Right) Alternative 8, Full Causeway Removal with a Breakwater around Marina

Source: plan.critfc.org

Source: Michael Porter, YN

Maximum Spring (March 15 – May 31) 7-DADMax Temperature

Alternative	Measured in channel west of island	
	2012	2014
Existing Conditions	19.6 ºC	21.1 ºC
560 foot Full Breach	17.6 ºC	18.5 ºC

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