Grant County
PUBLIC UTILITY DISTRICT
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PRCC Habitat Subcommittee

Conference Call

Thursday, 14 August 2025
1:00 p.m. – 2:45 p.m.

Final Meeting Minutes

PRCC Habitat Subcommittee Members

Tracy Bowerman, Shelby Fowler (alt), USFWS	Chris Fisher, CTCR
Dave Duvall, Deanne Pavlik-Kunkel (alt), GPUD	Brandon Rogers, Hans Smith (alt), YN
Scott Carlon, NMFS/NOAA	Carl Merkle, CTUIR
Jeremy Cram, Cody Gillin (alt), WDFW	Erin Harris, GPUD
Nathan and Clayton Buck, Wanapum	Tracy Hillman, BioAnalysts, Chair

Meeting Attendees

Chris Fisher, CTCR	Dave Duvall, GPUD
Jeremy Cram, WDFW	Tracy Bowerman, USFWS
Brandon Rogers, YN	Shelby Fowler, USFWS
Scott Carlon, NMFS/NOAA	Chris Mott, GPUD
Mark Ingman, Cascadia Conservation District*	Erin Harris, GPUD
Tracy Hillman, BioAnalysts, Chair	

* Guest who joined the PRCC Habitat Subcommittee meeting for the Wenatchee-Okanogan Comprehensive Thermal IR Surveys for Cold Water Species discussion with Cascadia Conservation District.

Action Items:

- Members will identify questions for Cascadia Conservation District regarding the Wenatchee and Okanogan Comprehensive Thermal IR Surveys for Cold Water Species specification sheet and provide those to Tracy Hillman by Friday, 22 August 2025.
- Tracy Hillman will share the updated project tracking list with the PRCC HabSC.

Decision Items[1]:

- **Decision**: The PRCC HabSC approved the purchase of the 8.67 acres of riparian/floodplain habitat (Kedrowski Acquisition Project for $134,000) and would like the sponsor to proceed with the survey and land permits that are required to segregate the floodplain area from the larger property.
- **Decision**: The PRCC HabSC approved the purchase of the White River Ohme Acquisition for $300,000.
- **Decision**: The PRCC HabSC agreed to retain the awarded funds for the Methow River – Integrated CMZ project until 30 September 2027.

I. Welcome and Introductions

Tracy Hillman welcomed everyone to the meeting and participants introduced themselves.

II. Agenda Review

The PRCC Habitat Subcommittee reviewed and approved the August meeting agenda.

III. July Meeting Notes

PRCC HabSC members reviewed and approved the 10 July 2025 meeting notes.

IV. Review Action Items

The PRCC HabSC reviewed the following action items from the July meeting:

- Dave Duvall will contact Chris Johnson (MSRF) and let him know he can share and discuss the Kedrowski appraisal with the landowner. **Complete.**
- Dave Duvall will contact Mickey Fleming (CDLT) and let her know she can share and discuss the White River Ohme appraisal with the landowner. **Complete.**
- PRCC HabSC members will identify projects that should have a PRCC HabSC sign. **Complete. Members identified the Okanagan Dam fishway, McIntyre Dam, and the COIC project as worthy of signage.**
- Dave Duvall will meet with Tom Dresser to review and finalize the list of projects funded with 601 NNI funds. **Complete. Dave and Tom identified 601 projects in the Habitat Project List spreadsheet. Tracy Hillman will share the updated spreadsheet with the PRCC HabSC.**

V. Project Updates

Members of the PRCC HabSC provided the following updates on funded projects:

- **Primary Appraiser (Pacific Appraisal Associates)** – Dave Duvall reported that there is no update on Pacific Appraisal Associates projects.
- **Primary Appraiser (Noble Ag Land Valuation) –** Dave Duvall reported that Mark Noble is currently reviewing the appraisal contract.

[1] All decision items listed here were approved by PRCC HabSC members.

- **ORRI VDS Backwatering Project** – Chris Fisher reported that there is no update on this project. He believes the Okanagan Nation Alliance (ONA) is developed restoration designs for additional structures.
- **Lower Wenatchee Instream Flow Enhancement Project, Phase II Project** – Tracy Bowerman reported that the sponsor (Trout Unlimited; TU) continues to prepare for project implementation this fall. The sponsor is working with landowners adjacent to the ditch to get approval for construction access. They are also coordinating with USFWS regarding National Environmental Policy Act (NEPA) and federal cultural compliance for the project. The NEPA documentation was received on 1 August, and the sponsor anticipates receiving cultural clearance in August. On 18 July, the sponsor coordinated a meeting with the Jones Shotwell Ditch Company board to discuss project status, implementation planning, and identify outstanding items. Finally, the sponsor continued to track the final draft of the Trust Water Right Agreement. They anticipate approval of the final revision and execution in August.
- **Peshastin Creek RM 2.5 Project** – Tracy Bowerman indicated that Cascade Fisheries (CF) continued to coordinate with the Corps to work through Clean Water Act permitting and Section 106 compliance of the National Historic Preservation Act. In July, their consultant edited the cultural report based on a meeting with the Corps archeologist and the Department of Archaeology and Historic Preservation (DAHP). The cultural report was submitted to the Corps and final consultation was initiated on 21 July. The sponsor heard from the Federal Emergency Management Agency (FEMA) that their technical review of the sponsor's Conditional Letter of Map Revision (CLOMR) application is complete. The sponsor will publish a legal notice as part of the CLOMR process. The design engineer completed the draft final design, and the sponsor is currently reviewing the designs. They continue to work through permitting steps, which include ongoing work with FEMA and Chelan County on CLOMR approval, work with WDFW on Hydraulic Project Approval (HPA), and work with Ecology on the 401 water-quality certification.
- **Bockoven Entiat and Stormy Acquisition Projects** – Jeremy Cram reported that there is no update on this project. The landowner has put the sale on pause.
- **Canyon Creek Culvert Design and Construction Project** – Tracy Bowerman indicated the sponsor (CF) is working to gather follow-up comments from the Forest Service. The sponsor will set up a meeting with the Forest Service to make sure they have adequately addressed Forest Service needs before progressing to a 60% design. The sponsor plans to implement the project in 2026.
- **Eagle Rocks Habitat Enhancement Project** – Tracy Bowerman said the sponsor (Methow Salmon Recovery Foundation; MSRF) continues to work on maintenance of plantings, including weed management, irrigation, and protection. They are also reaching out to landowners on final site restoration and project acceptance.
- **Kedrowski Acquisition Project** – Tracy Bowerman indicated that the sponsor (MSRF) received the appraisal and have presented it to the landowner. Dave Duvall said the sponsor signed the purchase agreement. The purchase only includes 8.67 acres of riparian/floodplain habitat. It does not include the entire 13.67 acres, which includes 5 acres on which there is a house. The sponsor was pleased the landowner agreed to sell only the 8.67 acres, because the sponsor did not want to buy the house. *The PRCC HabSC approved the purchase of the 8.67 acres of riparian/floodplain habitat ($134,000) and would like the sponsor to proceed with the survey and land permits that are required to segregate the floodplain area from the larger property*.

- **Bartsch Acquisition – Lower Twisp River – Reach 2A Project** – Dave Duvall said the sponsor (MSRF) closed the property on 18 March 2025. This project is complete and can be closed once the sponsor submits the final invoice. Dave added that the sponsor continues to investigate the potential removal of the existing home on the property. The project team is also looking into level removal or modification, which includes initial 2D modeling and permit review. No issues or challenges were reported at this time.
- **Skyline Screen and Fish Return Upgrades Project** – Tracy Bowerman reported that the fish screen was installed successfully and is operating as intended (i.e., delivering design flows). The sponsor (MSRF) is working through the remaining punch-list items and sent the final draft of the O&M Manual to the Skyline Board for their review. For the Fisheries Restoration and Irrigation Mitigation Act (FRIMA) component of this project, the sponsor's archaeology subcontractor finalized the cultural survey report and uploaded it to the DAHP database. The project engineer conducted site visits in preparation for pipe fusion, which will begin in early September with construction planned for the end of September. The sponsor is coordinating with Okanogan County on permits for road access and crossing and coordinating with landowners and the Skyline Board on staging and construction.
- **Penticton Dam Fish Passage Construction** – Chris Fisher reported that work on the fishway will be completed this month. The sponsor (ONA) is currently completing work on the operational area/monitoring station, electrical and communication conduits and hook ups, pedestrian and vehicle bridge installs, fencing and site reclamation, and stop-log installs (see photos in Attachment 1). The sponsor will hold a celebration when they open Okanagan Lake to fish passage on 18 August at 10:00 a.m. (see Attachment 2). Members are encouraged to attend the celebration.
- **ORRI Okanagan Falls** – Dave Duvall said there is no update on this project.
- **White River Ohme Acquisition** – Dave Duvall said the sponsor (Chelan Douglas Land Trust; CDLT) reported that the landowner is agreeable to the $300,000 appraisal for the 60-acre White River property, which is well within the budget for the project. The sponsor is preparing a Purchase and Sale Agreement. The landowner would like to close the sale by the end of December 2025. The sponsor asked the PRCC HabSC whether the PRCC HabSC approves $300,000 for the acquisition of the property. *The PRCC HabSC approved the purchase of the White River Ohme Acquisition for $300,000.*
- **Enloe Dam Sediment Analysis and 30% Design** – Chris Fisher reported that the sponsor (TU) continues to make progress on this project. The project team is preparing for a multi-agency meeting involving representatives from the Dredge Materials Management Office, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, Washington Department of Ecology, and the Department of Natural Resources. The discussion will focus on the sediment evaluation report including the volume of sediment behind the dam, the projected downstream distribution of sediment, and potential human health implications. A range of important topics is expected to be addressed during the meeting. The preferred alternative is to remove the dam with full sediment release. The sediment evaluation report has been sent out for review and the final report will be released in October 2025.
- **Methow River Riparian Stewardship** – Dave Duvall reported that there is no update for this project. Project contracts were recently signed, and work is expected to proceed accordingly.

- **M2@3R Habitat Construction** – Dave Duvall indicated that there is no update for this project. Project contracts were recently signed, and work is expected to proceed accordingly.
- **Libby Creek Fish-Passage Barrier Dam Removal** – Tracy Bowerman reported that the sponsor (CF) is working to fill out and submit permitting applications with WDFW and the Army Corps of Engineers, and they will be sending out a request for qualifications for a cultural resources survey. The USFWS engineer will work to develop a final design this fall, and the sponsor is planning to implement the project this fall.
- **Methow River – Integrated CMZ Project** – Dave Duvall reported that the sponsor (MSRF) received word from Ecology that they are only able to fund a portion of the anticipated application due to a reduction in the allocated state budget funding. The sponsor is considering whether to re-apply during the next funding cycle (2026). Okanogan County has indicated that they would support that. The Flood Control Assistance Account Program (FCAAP) program requires evidence of a secured match for these grant applications. The sponsor would like to know whether the PRCC HabSC would be willing to keep the awarded funds allocated for this project for an extended period to support the next state application. *The PRCC HabSC agreed to retain the awarded funds for the project until 30 September 2027.*

VI. Restoration/Protection Projects

Wenatchee-Okanogan Comprehensive Thermal IR Surveys for Cold Water Species

Mark Ingman with Cascadia Conservation District joined the meeting to discuss the Wenatchee-Okanogan Comprehensive Thermal IR Surveys for Cold Water Species project with the PRCC HabSC. Mark gave a presentation titled "Wenatchee and Okanogan Comprehensive Thermal IR Surveys for Cold Water Species" (see Attachment 3). Mark began by noting that he will talk about benefits to fish, project longevity, project scope, benefits to future projects, partnerships, and economics.

Mark indicated that fish face several challenges including warmer winters, reduced snowpack, and longer summer droughts. In the Upper Columbia, for example, summer Chinook Salmon face variable temperature regimes on an annual basis that can affect their growth rates, susceptibility to disease, and stress. Fish in the Okanogan River often experience temperatures greater than 20˚C. Mark shared a study conducted in Bear Creek, Alaska, where fish move among different temperature patches within streams. In that study[2], Coho Salmon fed in warmer patches and then relocated to colder patches to digest their food. Marked referred to this as "Dash and Dine."

Mark noted that the Upper Columbia Regional Technical Team (RTT) has identified temperature as an important data gap and filling the data gap will support ongoing long-range temperature monitoring. He said the RTT identified the need for granular/fine data (granular = 18 inches; 0.1˚C) for reach-level habitat evaluations. The Upper Columbia Salmon Recovery Board can make the data readily available in a beta format for project implementers. Mark showed an example of the quality of the thermal data that were collected in the Entiat River basin. He said the same thermal data are needed for the Wenatchee and Okanogan basins. He added that 68% of cold-water patches in the Entiat were unknown until they were mapped using thermal IR surveys in 2023. Based on research, these cold patches last for about 15-20 years. Along with reach assessments, thermal IR assessments provide sponsors with future restoration opportunities. These data are currently missing from the Wenatchee and Okanogan basins.

[2] Armstrong, J.B. and D.E. Schindler. 2013. Going with the flow: spatial distributions of juvenile Coho Salmon track an annually shifting mosaic of water temperature. Ecosystems, DOI: 10.1007/s10021-013-9693-9.

Mark indicated that thermal IR surveys co-collect high-resolution RGB (Red, Green, Blue color scale) data. He stated that a common question is, what stream is too small or may have canopy precluding IR data capture? He indicated that if vegetation obstructs the IR signal, survey's RGB data shows status of riparian condition in high resolution. He then pointed out that the location of these cold-water patches can be expanded with the appropriate restoration action. The goal would be to expand the patch without diluting it. First, however, it is important to identify and map these cold-water patches.

Mark described the scope of the proposed project. It would expand the coverage in the Wenatchee River basin to 227 river/stream miles, which is a 30% increase over legacy datasets. In the Okanogan River basin, the surveys would cover 196 river/stream miles, a 29% increase over legacy datasets. The surveys will sample the thermal IR mosaic at 0.1-mile intervals along the centerline and provide 10 sampling points within a 20-foot buffer. Descriptive statistics will be used to summarize the data (min, max, mean, median, and standard deviation). In addition to maps showing locations and extent of thermal anomalies, figures will be generated that show the temperatures along the length of the river/stream and will identify cold-water anomalies.

Mark said this work has a lot of partners and community support. Several sponsors, including tribes, have provided direct input into the process. Mark said the surveys are inexpensive when compared to the cost of implementing restoration projects, and the data can be used to determine whether a proposed restoration site includes a cold-water patch. If so, then the sponsor can design the project to do no harm (no mixing of cold water) or do the most good (enhance/extend site-specific cold water). Importantly, watershed-scale thermal IR data provide maps for project sponsors seeking sites with greatest benefit while providing reviewers with important information and data they need to evaluate and fund projects.

Mark provided a case study where thermal IR data were used to help design a restoration project at the mouth of Chiwaukum Creek in the Wenatchee River basin. He showed how the original design was modified once they had thermal IR data. The current design will expand the extent of the cold-water plume; the former design would have resulted in thermal mixing. Mark also showed thermal maps generated from thermal IR surveys conducted in Oregon and Idaho. The point is "Seeing is Believing."

Mark said the total cost of the proposed work is $458,000. He has a potential match of $200,000 from the Salmon Recovery Funding Board. He is requesting $258,000 from the PRCC HabSC. Mark ended by stating that recovery of cold-water species in a warming climate requires temperature day. This project will cover more than 400 river/stream miles and will provide project sponsors with information to design appropriate restoration actions. The proposed project has several partners and wide community support and is cost effective.

Jeremy Cram asked whether the surveys capture surface waters only, or can they measure temperatures at depth. Mark responded that thermal IR gathers temperatures down to about 10 feet into the water column. Jeremy asked whether the temperatures measured at depth will be checked with ground sensors. Mark said yes, and they have already conducted some of these checks in the Entiat basin. Chris Fisher asked how small a temperature difference can be detected with thermal IR. Mark said they can detect 0.1˚C differences; temperatures are measured within an 18-inch pixel. Both Jeremy and Chris asked about conducting the thermal IR surveys during winter when leaves are off the trees/shrubs and the less dense groundwater rises to the water surface, making it easier to detect thermal anomalies. Mark said they can conduct the surveys during winter; however, they prefer to conduct them during the summer low-flow period when it is easier and safer to conduct the flights. He said winter flights are more difficult to complete because of weather uncertainties.

Members thanked Mark for the presentation. After Mark left the meeting, members discussed the specification sheet titled, "Wenatchee and Okanogan Comprehensive Thermal IR Surveys for Cold Water Species." Chris Fisher, the liaison, said the purpose of the proposed project is to collect thermal IR data over 400 river/stream miles within the Wenatchee and Okanogan basins. The sponsor (Cascadia Conservation District) is requesting $258,000 from the PRCC HabSC. The total cost of the project is $458,000.

Following discussion, members realized that they needed more information before they could vote on funding the proposed project. Therefore, they agreed to compile additional questions to share with the sponsor. They would like the sponsor to join the September PRCC HabSC meeting to discuss the questions and provide additional information. Members will provide their questions to Tracy Hillman by Friday, 22 August. Tracy will compile the questions and pass them to the sponsor.

After the meeting, the PRCC HabSC provided the following questions, which were shared with the sponsor.

- Is there an advantage of flying during the late fall/early winter to conduct thermal IR surveys? Surface flows during the fall/winter period are near the annual low discharge; thus, groundwater input (particularly smaller inputs) would be more detectable (less mixing with low surface discharge) and location of the point sources would be more definitive.
- Although it was mentioned that water temperature could be detected to a depth of 10 feet, the HabSC questions whether the sensitivity to detect groundwater inputs would be greater during the fall/winter period. During the fall/early winter, surface water temperatures are in the upper 30s-low 40s and groundwater temperature is ~ 50˚F. Because of the warmer groundwater temperature and colder surrounding surface water, groundwater is anticipated to rise to the surface with less mixing and therefore should be easier to detect than during the summer when groundwater would be colder than surface water and would remain near the riverbed and become diluted by surrounding warmer surface water. The signature of this groundwater input may be obscure during the summer and would more likely be detected during the winter.
- During the late fall/early winter, there would be less foliage on riparian trees and bushes. The HabSC is not certain how, if at all, leaves would affect the results of the thermal IR surveys, but undoubtedly there would be a less obstructed view of the water surface during the fall/winter than during the summer, particularly for small streams (< 10 m).
- Is there a possibility the surveys could be extended into Canada on the Okanagan and Similkameen rivers? There are likely several issues with conducting surveys in Canada, but it may be worth exploring.
- What are the tradeoffs between summer and winter flights in terms of identifying thermal anomalies?
- When the data are collected, we end up with a snapshot of thermal anomalies. How do these thermal anomalies change across the hydrograph and relative to water withdrawals?
- How can summer surveys account for irrigation practices?

VII. Administration and Information Updates

Signage on Acquisition and Restoration Properties

Dave Duvall reported that Signs Now produced 12 signs for the PRCC HabSC. Previously, the PRCC HabSC agreed to add signage on projects on a project-by-project basis. Members identified the Okanagan Dam fishway, McIntyre Dam, and the COIC projects as worthy of signage.

Upper Columbia Science Conference

Tracy Hillman reported that the Upper Columbia Salmon Recovery Board (Board) will hold the Upper Columbia Science Conference on 21-22 January 2026 in Leavenworth, Washington. Tracy noted that the Board will ask the PRCC HabSC to help support the conference.

Okanagan Habitat Tour in Canada

Tracy Hillman indicated that the habitat tour in Canada is scheduled for 8-9 October. He asked who plans to attend the tour. Dave Duvall, Chris Fisher, Brandon Rogers, and Tracy Hillman indicated that they plan to attend the tour. Tracy Bowerman, Scott Carlon, and Jeremy Cram indicated that it is unlikely they can attend. Tracy Hillman will send an email to both the PRCC HabSC and HCP Tributary Committees asking whether members or others from their agencies plan to attend the tour.

VIII. Adjourn

Tracy Hillman adjourned the meeting at 2:45 pm.

IX. Next Meeting

The next meeting of the PRCC HabSC will be on 11 September 2025.

Attachment 1

Photos of Construction on the Okanagan Lake Dam East Salmon Passage Project (from Zoe Eyjolfson, ONA)

South end of fishway with high and low flow fish entrance channels

Pedestrian bridge, grating and fencing

Grating, fencing (in progress) and mulch (in progress)

Stop log guides installed at north end

Large wood and top soil placed along Okanagan Lake shoreline

Mulch added to protect soil for fall planting. Electrical pedestal in place.

Attachment 2

Okanagan Nation Alliance Celebration Invitation: Opening Fish Passage into Okanagan Lake

Okanagan Nation Alliance

MEDIA ADVISORY | August 13, 2025

SALMON PASSAGE AT OKANAGAN LAKE TO OPEN AUGUST 18, 2025

snpintktn (Penticton): After years of hard work, advocacy, planning, and now successful implementation while overcoming challenges, the new Okanagan Dam Fish Passage is about to open! The water will be released and permanently flowing, providing salmon unimpeded access from Okanagan River into their Okanagan Lake historical spawning habitat. The Okanagan Nation Alliance (ONA) invites you to join us and celebrate the opening of the fish passage:

Date: August 18, 2025 **Time:** 10 am
Location: East side of Okanagan Lake Dam, Riverside Drive Penticton, BC

For close to 100 years, salmon, a keystone species inextricably linked to the health of Okanagan Lake and its ecosystem, have had no or limited access to the lake and its tributaries.

This innovative project led by the Syilx Nation, has extremely important cultural significance. The unique design and complex build in addition to the extensive collaboration and partnerships has been a huge accomplishment. The fish passage bypasses Okanagan Lake dam, allowing Steelhead, Rainbow Trout, Sockeye, Chinook, and Kokanee to ascend into 350 square kilometres of Okanagan Lake, and access 13 tributaries, through differing migration times and during drought conditions, while invasive species are deterred by an adjustable barrier.

For the Syilx Okanagan people, this project is much more than infrastructure; it is a cultural reconnection of siwɬkʷ, water and the tmixʷ all living things. To have salmon be able to freely make their way into kʰusxnitkʷ a reflection of deep responsibilities and relationships. Salmon, or ntytyix, are sacred to the Syilx people. They are considered relatives, not resources, and their return marks a powerful act of environmental and cultural healing.

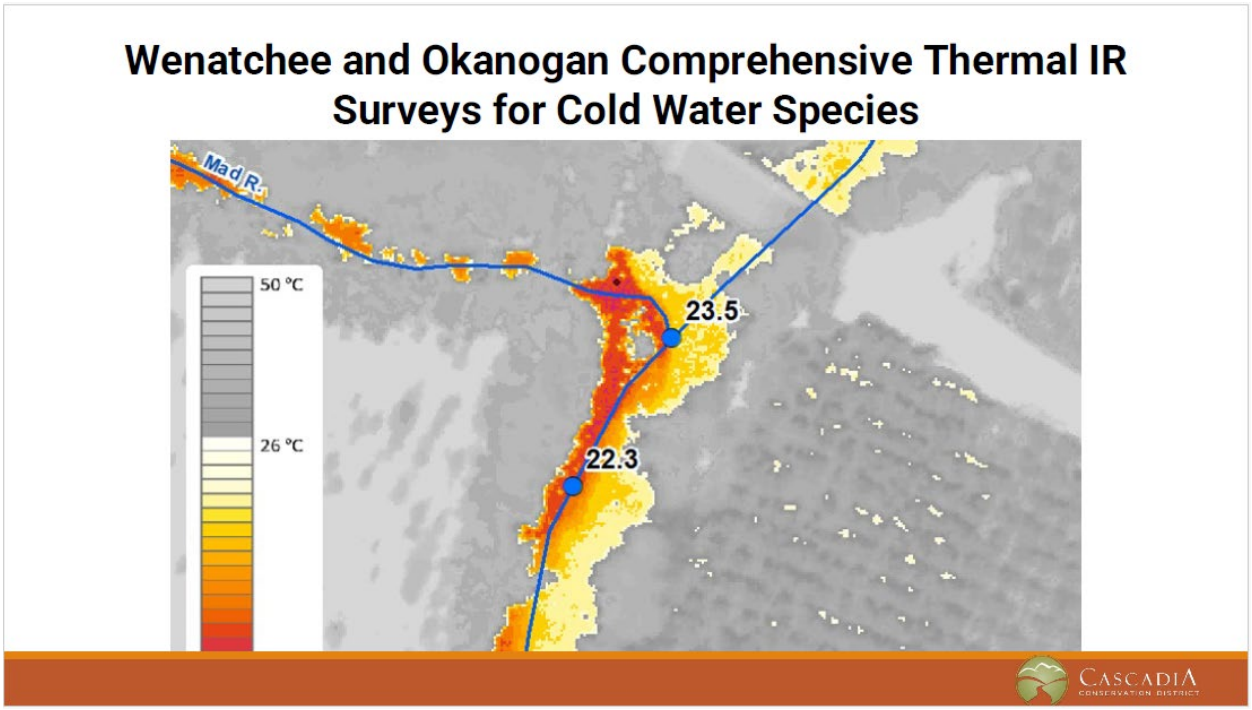
ONA expresses immense gratitude and appreciation to everyone involved. Years of advocacy, partnership development, public education and a tremendous amount of hard work have led to one of the greatest success stories in history – the salmon are back! Project partners include the Penticton Indian Band, City of Penticton, Province of BC and Fisheries and Oceans Canada. Okanagan Dam Fish Passage construction was funded by the Habitat Conservation Plan and the Habitat Subcommittee of the Priest Rapids Coordinating Committee, and a fall planting of indigenous species is funded by the TD Friends of the Environment Foundation. Educational signage and planting will be completed this fall.

kɬ cp̓əlk̓ stim̓, cause to come back is an initiative to return salmon back to their waters, that were near the brink of extirpation. This has required tremendous effort. During 1996 ONA, with foresight, determination and resiliency, began years of advocacy, gathering partners and finding support, the end goal being to return the salmon to their historical territory. Over the last 20 + years, ONA has completed a 12-year Sockeye reintroduction program into Skaha Lake, which saw little impact on other species and completed about 50 habitat restoration and fish passage projects including building spawning beds, reconnecting the river with oxbows and side channels, modifications to McIntyre Dam (Oliver) and Skaha Dam (Okanagan Falls), increasing river bed diversity, and reconnecting former floodplains, all mitigating habitat lost during river channelization. To further assist rebuilding Okanagan salmonid populations, the ONA built a sockeye salmon conservation hatchery, kɬ cp̓əlk̓ stim̓, for release of fry into historical spawning areas.

For More Information Contact:
Tara Montgomery, ONA Communication Lead
Email: tmontgomery@syilx.org Phone: 250-862-6866

Attachment 3

Presentation by Cascadia Conservation District on Wenatchee-Okanogan Comprehensive Thermal IR Surveys for Cold Water Species



Outline

Benefits to Fish – evidence of thermal infrared data's direct connection to fish and their habitat
CASE STUDY: Bear Creek Alaska, J. Armstrong and D. Schindler, 2013 [Coho]

Project longevity – long term value of datasets for salmon recovery

Project Scope – comprehensive scale of habitat being assessed

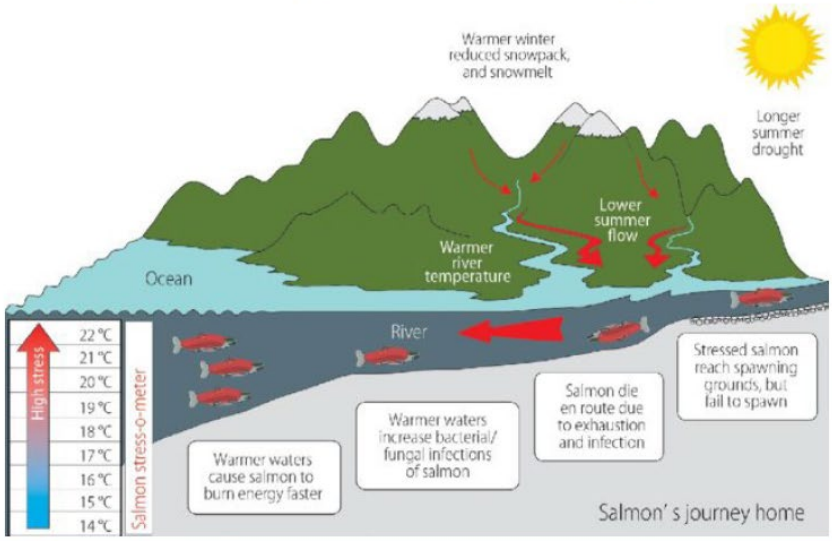
Benefits to future projects – Case Study of Lower Chiwaukum Restoration project

Partnerships – how this assessment project has been building partnerships in the region

Economics – how this foundational assessment generates fish-centric projects with the greatest impact, *and* cost-effectiveness

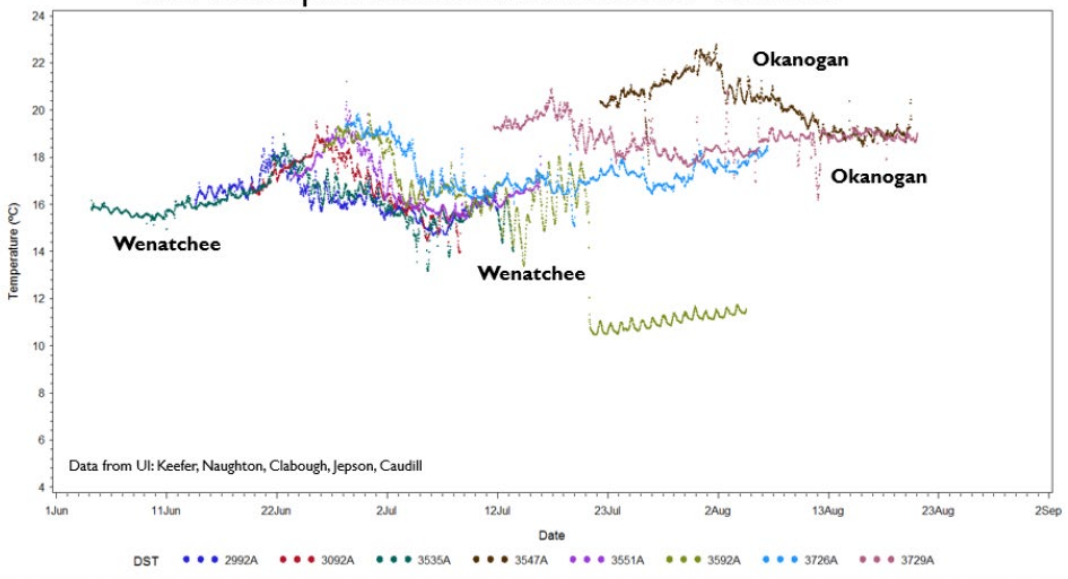
CASCADIA CONSERVATION DISTRICT

Challenges Facing Fish



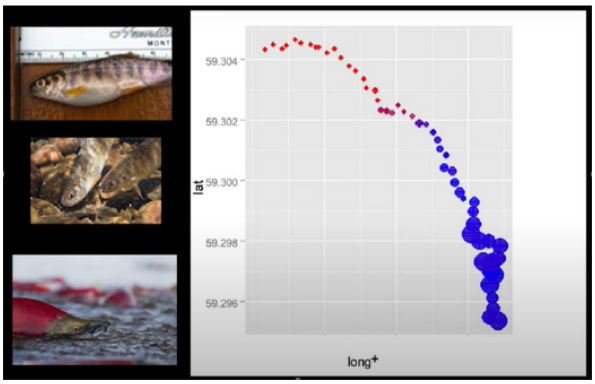
CASCADIA CONSERVATION DISTRICT

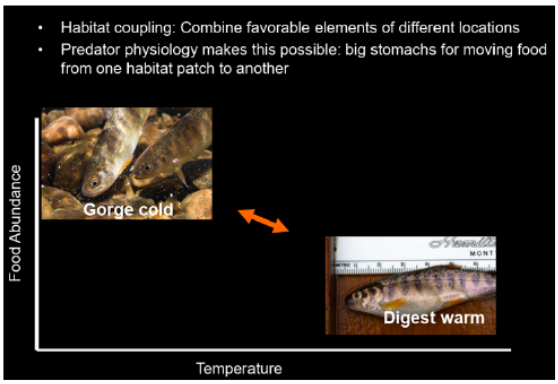
Thermal experience: individual Summer Chinook



CASCADIA CONSERVATION DISTRICT

"Dash and Dine" Study, Bear Creek AK

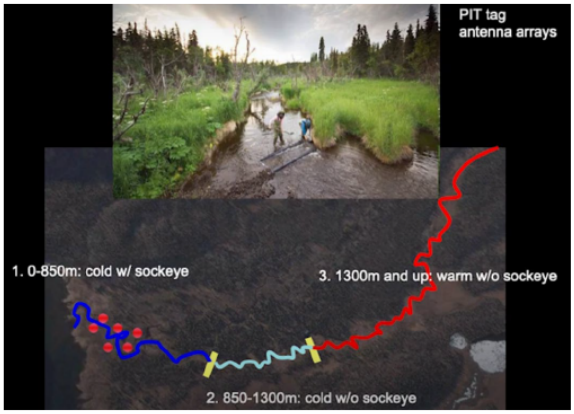


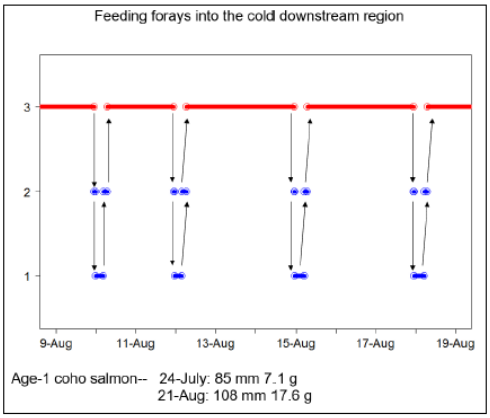


J. Armstrong & D. Schindler, 2013

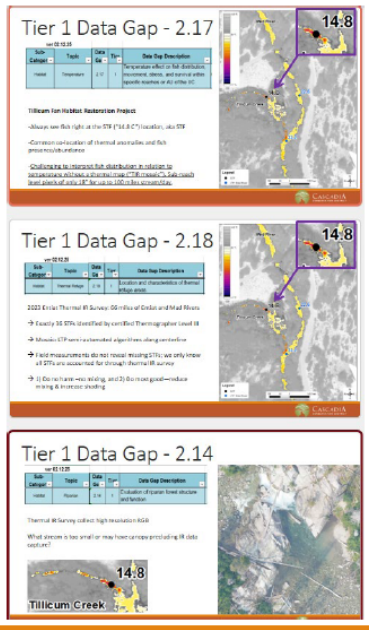
CASCADIA CONSERVATION DISTRICT

"Dash and Dine" - Continued





J. Armstrong & D. Schindler, 2013



UC Salmon Recovery Plan

Directly supports filling multiple Tier 1 data gaps

Directly supports the ongoing Long Range Temperature monitoring for the region, led by USFWS

The RTT have discussed these granular/fine data allowing for reach level habitat evaluations (granular = 18" pixels, 0.1C !)

UCSRB is already making the UC Thermal data available in a beta format for project implementers.

Tier 1 Data Gap - 2.17

ver 02.12.25

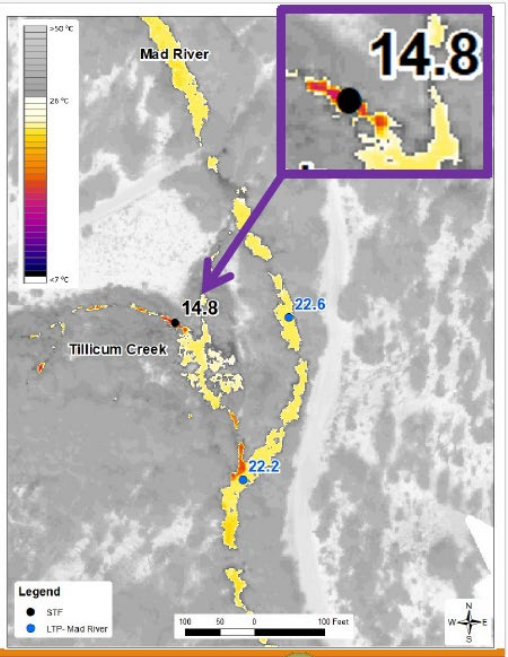
Sub-Categor	Topic	Data Ga	Tier	Data Gap Description
Habitat	Temperature	2.17	1	Temperature effect on fish distribution, movement, stress, and survival within specific reaches or AU of the UC

Tillicum Fan Habitat Restoration Project

-Always see fish right at the STF ("14.8 C") location, aka STF

-Common co-location of thermal anomalies and fish presence/abundance

-**We need a map** for Wen & Ok watersheds to understand where fish are exploiting temperature heterogeneity



CASCADIA CONSERVATION DISTRICT

Tier 1 Data Gap - 2.18

ver 02.12.25

Sub-Categor	Topic	Data Ga	Tier	Data Gap Description
Habitat	Thermal Refuge	2.18	1	Location and characteristics of thermal refuge areas.

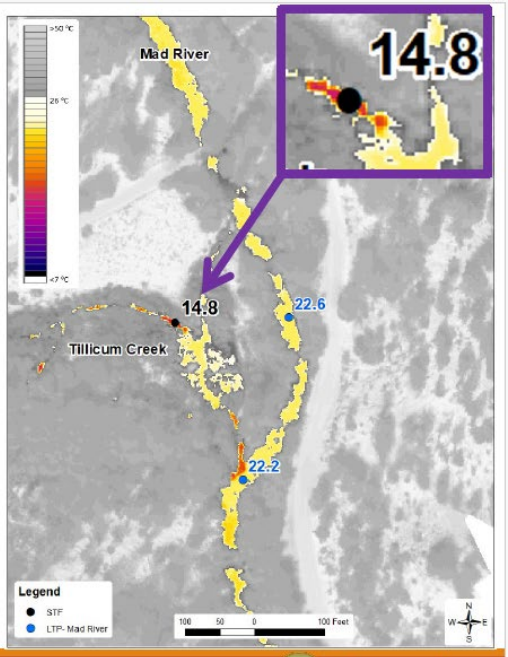
2023 Entiat Thermal IR Survey: 66 miles of Entiat and Mad Rivers

→ STFs identified by certified Thermographer Level III

→ Mosaic: LTP semi-automated algorithms along centerline

→ Field measurements do not reveal missing STFs; we only know all STFs are accounted for through thermal IR survey

→ 1) Do no harm –no mixing, and 2) Do most good—reduce mixing & increase shading



CASCADIA CONSERVATION DISTRICT

Longevity & New Projects

Cold patches remain consistent for roughly 15-20 years, they don't move around, foundational data

Cold patches cannot be intuited in most cases, 68%, or 18 of 26 cold patches were discovered because of the Entiat and Mad River Assessment (2023)

Along with reach assessments, thermal IR assessments lead project sponsors towards future project opportunities.

Big opportunity for the Wenatchee and Okanogan!

	note	Strm_Name	L_R_Bar	M_Off_str	Rvr_mi	Mean	Median	Min	Max	Std_Dev	
2	Entiat River STF										
3	spring/seep/ag bac	Entiat R.	R	400.57	0.65	17.7	17.6	##	18.1	0.220	STF_0818
4	side channel/hypor	Entiat R.	L	-167.86	0.71	20.6	20.5	##	####	0.281	STF_0818
5	seep/hyporheic	Entiat R.	R	47.81	2.25	20.8	20.7	##	####	0.387	STF_0818
6	seep/hyporheic	Entiat R.	R	28.15	2.57	20.6	20.2	##	####	1.984	STF_0818
7	seep/hyporheic	Entiat R.	R	21.61	2.61	21.0	21.1	19.1	####	0.669	STF_0818
8	seep/hyporheic	Entiat R.	R	25.51	2.93	20.1	19.6	19.1	####	0.960	STF_0818
9	seep/hyporheic									0.665	STF_0818
10	seep/hyporheic									0.504	STF_0818
11	seep/hyporheic									1.308	STF_0818
12	side channel									0.100	STF_0817B
13	hyporheic									0.857	STF_0817B
14	hyporheic									2.056	STF_0817B
15	side channel									0.178	STF_0817B
16	side channel									0.945	STF_0817B
17	seep/hyporheic									0.269	STF_0817B
18	hyporheic/side cha									0.171	STF_0817B
19	hyporheic									1.089	STF_0817B
20	hyporheic									1.594	STF_0817B
21	hyporheic/side cha									0.654	STF_0817B
22	hyporheic									1.200	STF_0817B
23	hyporheic/side cha									0.440	STF_0817B
24											
25											
26	Entiat River Tributa										
27	Roaring Cr.									1.164	STF_0818
28	Mad R.									0.067	STF_0818
29	Mad R.									0.045	STF_0817B
30	Mott Cr.									0.096	STF_0817B
31	Burns Cr.									0.630	STF_0817B
32	Tommy Cr.									0.207	STF_0817B
33	Lake Cr.									0.267	STF_0817B
34	Silver Cr.									0.066	STF_0817B
35	Pope Cr.	Entiat R.	L	-102.01	38.37	16.9	16.6	##	####	0.565	STF_0817B
36	NF Entiat R.	Entiat R.	L	-80.63	37.50	15.8	15.6	##	####	0.116	STF_0817B
37											
38											
39	Mad River Tributaries										
40	Tillicum Cr.	Mad R.	L	-12.99	2.00	15.2	14.8	14.1	####	0.944	STF_0817A
41	Hornet Cr.	Mad R.	R	85.09	5.56	24.3	24.3	##	####	0.165	STF_0817A
42	Windy Cr.	Mad R.	L	-45.39	9.05	21.4	20.8	##	####	2.069	STF_0817A
43	Young Cr.	Mad R.	L	-79.35	12.67	20.7	20.3	##	####	2.399	STF_0817A
44	Cougar Cr.	Mad R.	R	6.39	15.50	12.8	12.6	##	####	0.629	STF_0817A

68% of Entiat cold patches were unknown! Now Are All Mapped!

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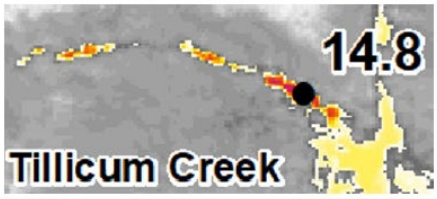
Tier 1 Data Gap - 2.14

ver 02.12.25

Sub-Categor	Topic	Data Ga	Tier	Data Gap Description
Habitat	Riparian	2.14	1	Evaluation of riparian forest structure and function

Thermal IR surveys co-collect high resolution RGB

What stream is too small or may have canopy precluding IR data capture? Answer: if vegetation obstructs IR signal, survey's RGB data shows status of riparian condition in high resolution



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Longevity – foundation datasets

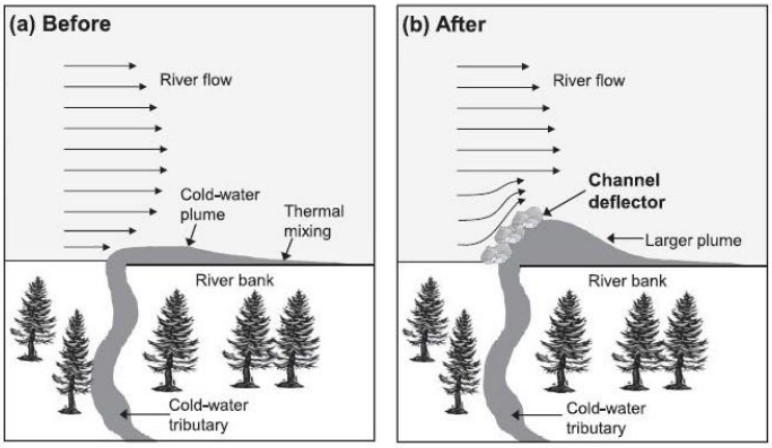


Figure 4. A cold-water plume at the mouth of a tributary before (a) and after (b) installation of a channel deflector to limit advective thermal mixing (adapted from Bilby, 1984).

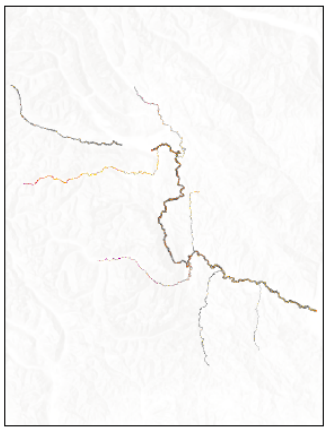
Scope: Comprehensive & Expanded Coverage

rKM	Existing Extent	rKM	Added Survey Extent
16	Lower Chiwawa Creek	42.1	Upper Chiwawa Creek
43.9	Nason Creek	3.8	Chikamin Creek
81	Wenatchee River	12.5	Big Meadow Creek
18.5	Chumstick Creek	25.8	White River
26.3	Peshastin Creek	1.7	Mill Creek
37.7	Mission Creek	1.6	Ingalls Creek
37.5	Little Wenatchee		
31.6	Icicle Creek		
292.5 Km Total		87.5 Km total	

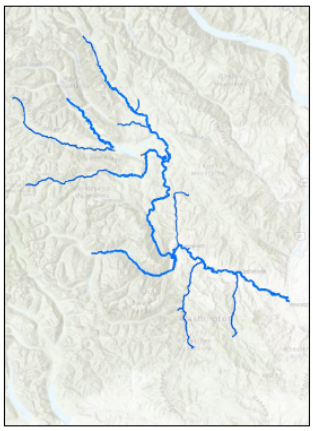
Wenatchee Watershed:
227 Total River and Stream Miles!

30% increase over legacy dataset

2001-2003 Legacy Dataset



Proposed Survey

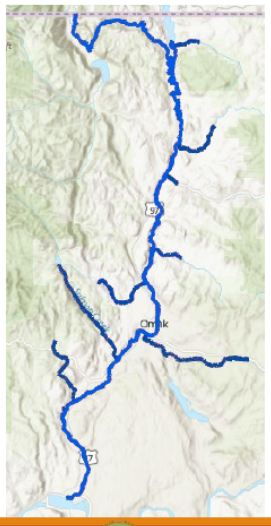


Scope: Comprehensive & Expanded Coverage

rKM	Existing Extent	rKM	Added Survey Extent
110	Okanogan River	0	Okanogan
8	Lower Silkamen	29	Silkamen to Canada
		32	Salmon Creek
		32	Omak Creek
		18	Loup Loup Creek
		16	Johnson Creek
		12	Antoine Creek
		6	Tonasket Creek
		3.7	Bonaparte Creek
		0.6	Aneas Creek
		1	Chiliwist Creek
		0.3	Mosquito Creek
		1.8	Wanacut Creek
		1	Whitestone Creek
118 Km Total		153.4 Km total	

2005 Legacy Dataset

Proposed Survey



Okanogan Watershed:
196 Total River and Stream Miles!

29% increase over legacy dataset

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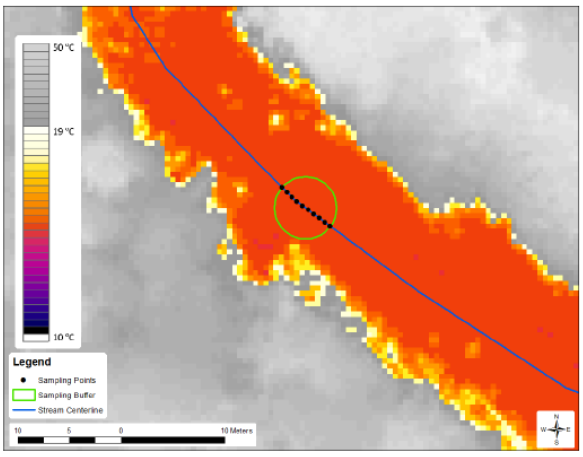
Deliverables: LTP Sampling

- Sampling the TIR mosaic at 0.1-mile intervals along the centerline
- 10 sampling points within 20-ft buffer
- Statistics: min, max, mean, median, stdev
- Automated, with manual quality control



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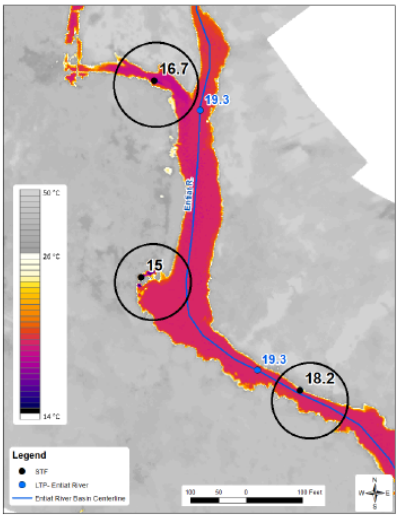
STF and Tributary Sampling

- Sampling the TIR mosaic at hand-picked sites
- Visually identifying thermal anomalies
- Mostly at river's edge, near gravel bars, and tributaries
- Statistics: (min, max, mean, median, stdev)



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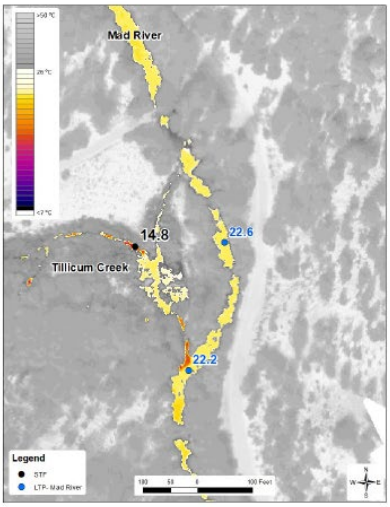
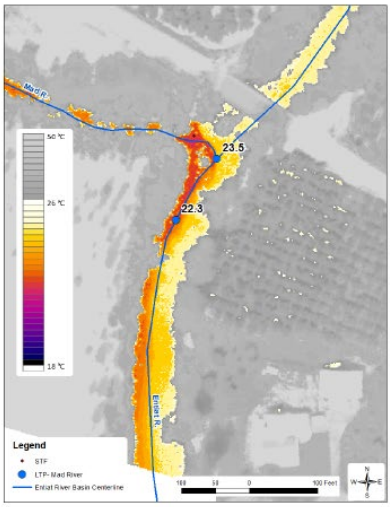
Cold Water Inflow and Tributaries





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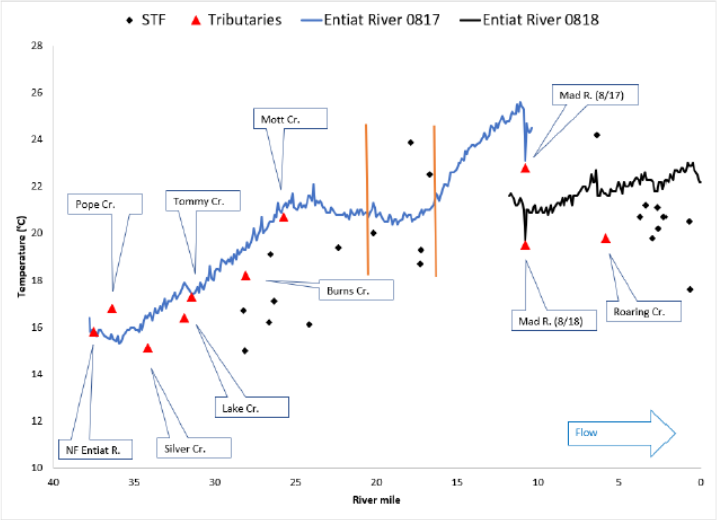
Methods to Deliverables



Partner and Community Support

Entiat Watershed Planning Unit, full presentation and multiple meeting updates in 2023 and 2024. Public familiarity with thermal infrared is growing.

First project in a long time to involve two Upper Columbia Watershed Action Teams (WATs). Includes coordination of geospatial presentations coordinated by NV5 in January and in February 2025 with Okanogan, Entiat, and Wenatchee WAT meetings.

List of sponsors with direct inputs for project scope and survey extent: Cascade Fisheries, Colville Confederated Tribes, Okanogan Conservation District, Methow-Okanogan Beaver Project (MSRF), Okanogan Highland Alliance; other project sponsors consulted.

Extremely collaborative and open process for developing project proposal!

Economics & Cost effectiveness: Example 530 ft Project Site

Engineered Project

ELJs, Side Channels, etc.

Cost: $500,000 to over $1,000,000

Thermal IR Survey

Same 530 ft project site thermal IR cost: **$100 or 0.01% of project cost**

Data lets us ask:

-Is this a temperature important or sensitive location?

-If yes, does the design ?

A) Do no harm (no mixing of cold water)

B) Do most good (enhance/extend site-specific cold water)

Watershed scale TIR provides the map for project sponsors seek sites with greatest benefit while allowing reviewers important information and data they need to fund a project!

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Case Study / Applied Thermal IR

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Case Study / Applied Thermal IR

COLD WATER REFUGE

PHOTOS/VIDE0: RUSS RICKETS 2015

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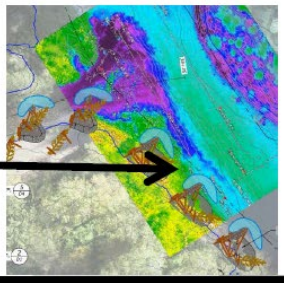
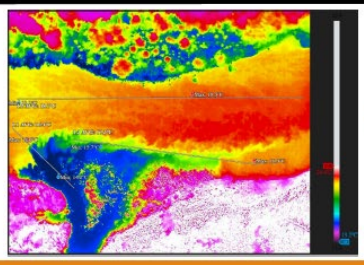
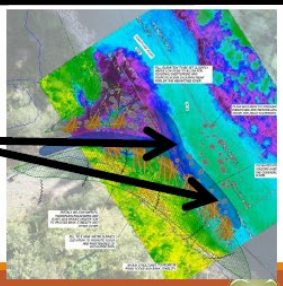
Case Study / Applied Thermal IR

Original design w/out TIR, ... mixing!





Re-design w/TIR = extended cold water!



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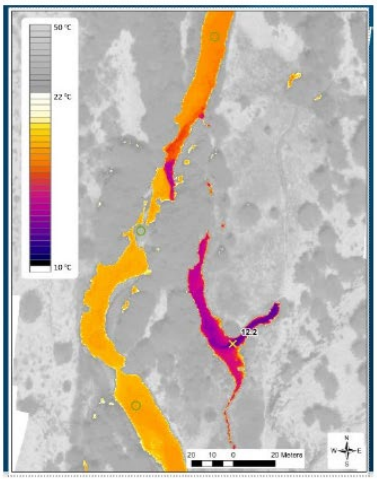
Thermal IR – Seeing is Believing



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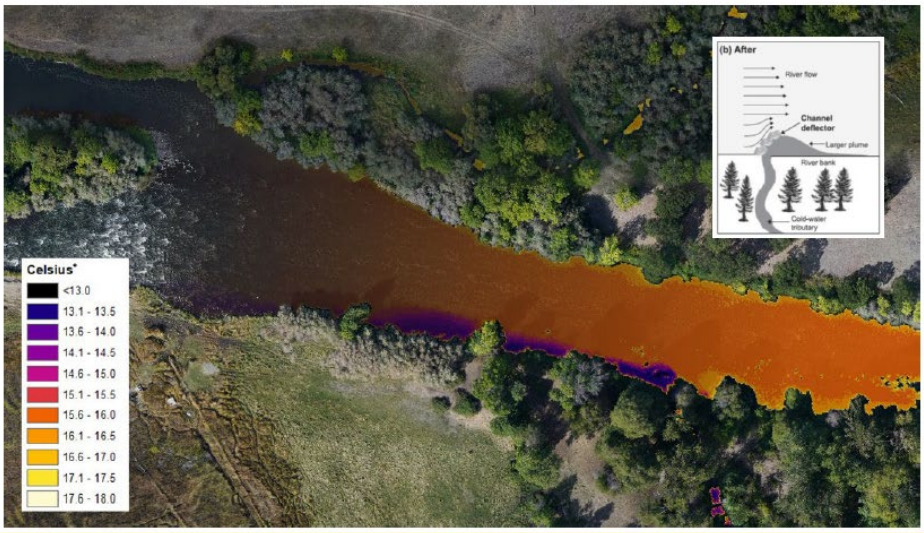
Thermal IR – Seeing is Believing



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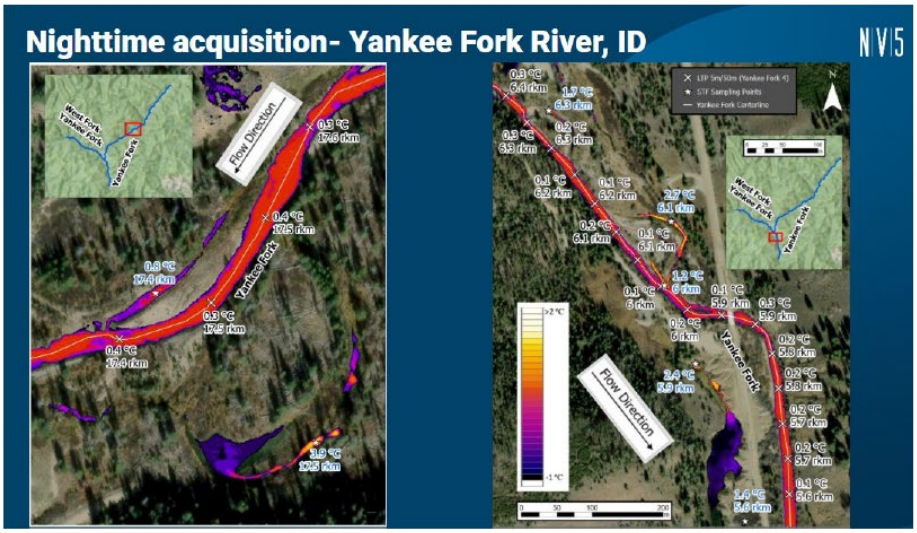
Thermal IR – Winter Flights for Warm Groundwater Inflows



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Other Factors Limiting Production

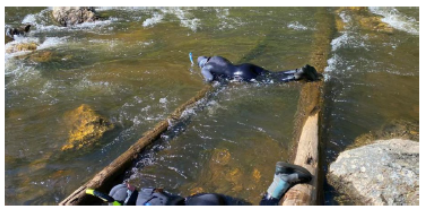
At the project site level, nuanced, and time series temperature data (drones and temp loggers useful)

Understanding of how fish move to take advantage of temperature and food resources

Understanding of juvenile rearing food sources, specifically in Stillwater/Floodplain/beaver pond habitat types (foodscapes and relates to nutrients)

Project site temp loggers & drones

Stillwater food resources



Fish movement for prey and metabolizing

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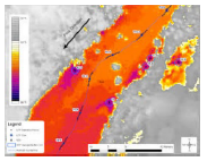
Project Cost for Okanogan & Wenatchee

All Wenatchee Thermal IR	$232,000
All Okanogan Thermal IR	$208,000
WA DNR Contracting	$9,500
CCD Staff	$8,300
Travel	$200
Cultural Resources	N/A
Total	$458,000
WA RCO Match Awarded	$200,000
PRCC Request	*$258,000*

Closing Thoughts



Benefits to Fish – recovery of cold water species in a warming climate requires temperature data. Growth and temperature interrelationship, example "Dine & Dash" case study in Alaska (coho).

Project longevity – comprehensive thermal infrared datasets are needed for the next 20 years of projects.

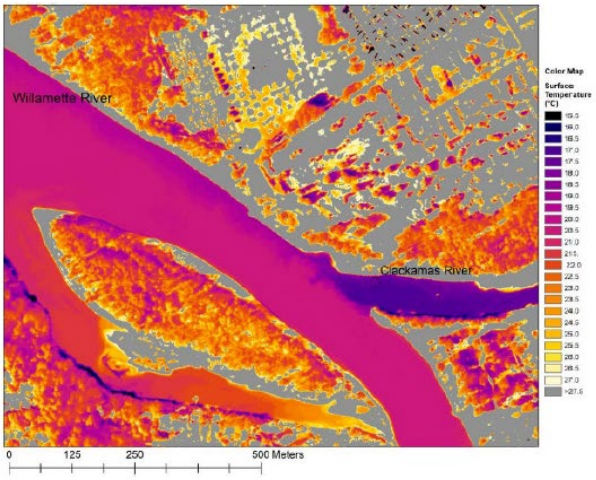
Project Scope – this project funds 404 river and stream miles for the final 2 of 4 UC watersheds needing TIR

Better future projects - Case Study of the re-design, Lower Chiwaukim project pre & post thermal IR data

Partner & Community Support – this assessment proposal spanning two watersheds involved an high level of partner engagement within the regional salmon recovery community

Economics – extremely cost effectiveness is a result of *aircraft remote sensed data*, large scale and high rate of collection using advanced technology and analytics

Questions/Comments?



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