

# Bradley Expansion Project

## Aquatic Resources Meeting

March 5, 2026



# Meeting Agenda

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- **Project Overview**
- **FERC Process Update**
  - Bradley Lake Shoreline Erosion
  - Martin River Hydrology
  - Bedload Transport
  - Water Quality
  - Fish Distribution
  - Habitat Connectivity
- **Proposed Operations & Potential Future Conditions**
- **Proposed Monitoring**
- **Discussion**



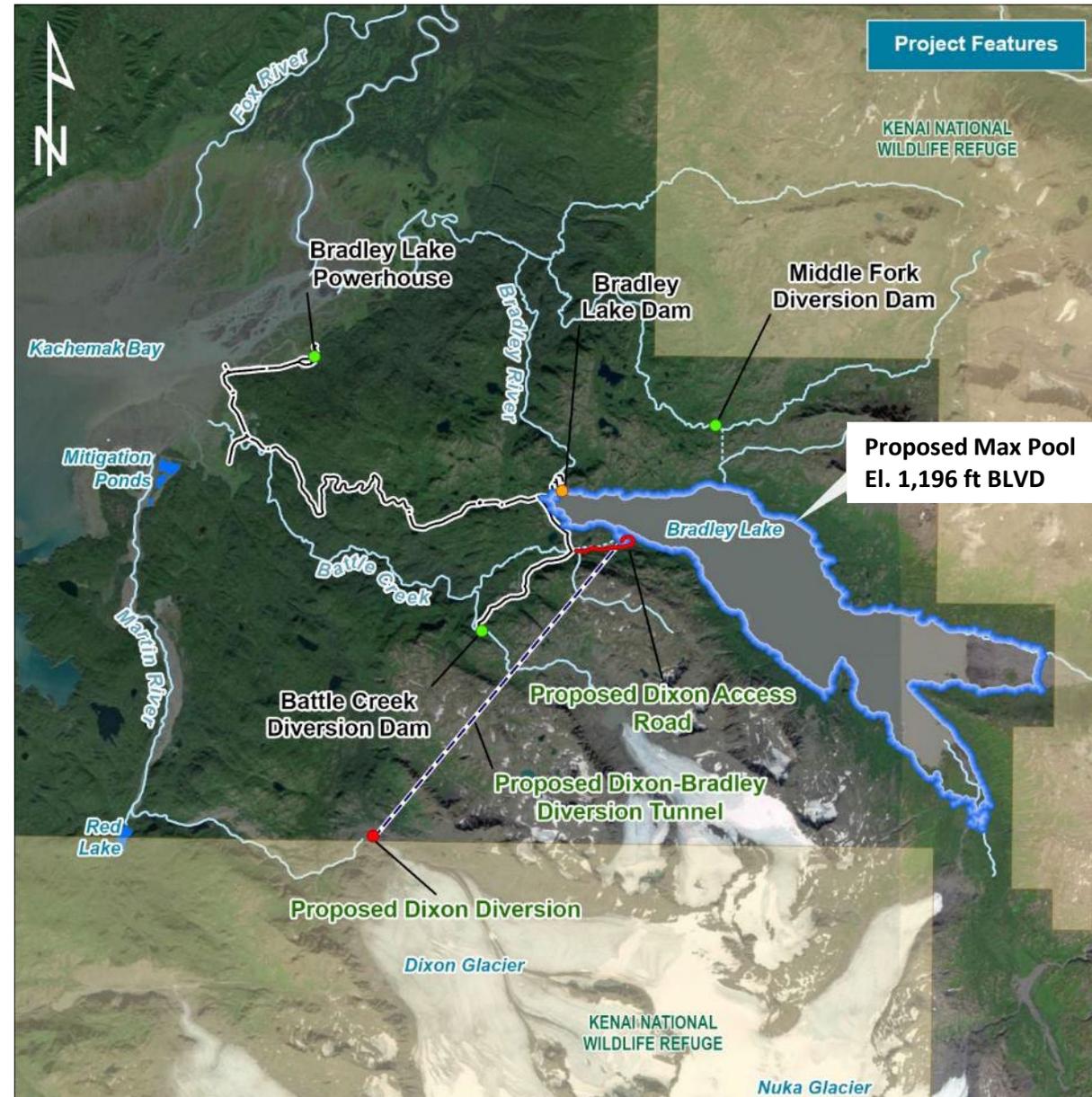
# Proposed Project Overview

Divert water from Dixon Glacier to Bradley Lake **May - November** to increase energy output at Bradley Lake Project by about 40%.

## All on State-owned Land

### Project Elements:

- Modify Bradley dam to **raise pool by 16 ft**
- New diversion dam at Dixon Glacier
- 4.6-mile-long tunnel to Bradley Lake with a **maximum capacity of 1,650 cfs**
- New tunnel outlet discharge channel
- New 1-mile-long access road from existing Battle Creek Diversion road to tunnel outlet



# FERC License Amendment Process Status



Responsible Party	Activity	Dates
AEA/Stakeholders	Initial Agency Consultation	Jan - Mar 2022
AEA	Conduct 2022 Preliminary Studies	Summer 2022
<b>Stage 1: Initial Consultation Document (ICD)</b>		
AEA	File ICD, Request for Non-federal Representative, & Newspaper Notice	Apr 2022
FERC	FERC Issues Notice of Amendment Accepted	May 2022
AEA	Provide Stakeholders with Notification of Joint Meeting	May 2022
AEA/Stakeholders	Hold Joint Agency/Public Meeting and Site Visit	Jun 14-15, 2022
FERC/Stakeholders	Comments on ICD/ Proposed Studies Due	Aug 14, 2022
<b>Stage 2: Study Planning and Implementation</b>		
AEA	Distribute Draft Study Plans	Nov 2022
Stakeholders	Comments on Draft Study Plans	Dec 2022
AEA	Paused Amendment Process and Refined Project Design	Mar 2023 – Feb 2024
AEA/Stakeholders	Project Update and Study Plan Meetings	Mar - Apr 2024
AEA/Stakeholders	Implement Year 1 Studies	2024
AEA/Stakeholders	Study Reports & NHPA Section 106 Consultation Meetings	Jan - Feb 2025
AEA	Implement Year 2 Studies	2025
AEA/Stakeholders	Consultation with agencies, Tribes, stakeholders	2025

# FERC License Amendment Process Status



We  
are  
here

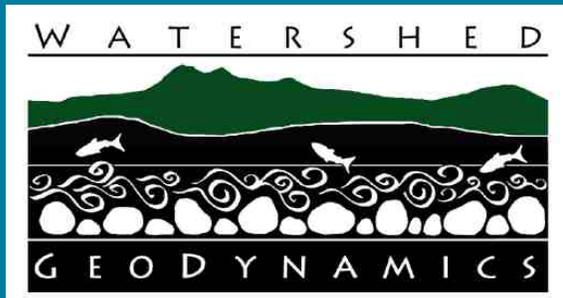


Responsible Party	Activity	Dates
AEA	Posted Draft 2025 Study Reports (45-day review)	Feb 2-6, 2026
AEA	Filed Draft Amendment Application (AEA requests 60-day review)	Feb 13, 2026
<b>Stage 3 Consultation</b>		
<b>AEA/Stakeholders</b>	<b>Draft 2025 Study Report Meetings</b>	<b>Mar 4-5, 2025</b>
AEA/Stakeholders	Consultation with agencies, Tribes, stakeholders	Mar – Apr 2026
AEA	NHPA Section 106 Consultation Meetings	Apr 2026
<b>Stakeholders</b>	<b>Comments due on Draft 2025 Study Reports</b>	<b>Mar 20, 2026</b>
<b>Stakeholders</b>	<b>DAA comments</b>	<b>Apr 14, 2026*</b>
AEA/Stakeholders	Consultation with agencies, Tribes, stakeholders – if needed	May 2026
AEA	File Final Amendment Application and Final Study Reports	Early June 2026
FERC	Review FAA; issue AIR; issue REA; license order	2026-2027
AEA	Implement proposed pre-diversion monitoring studies	2026-2028
AEA	Other permitting (e.g., USACE Section 404)	2027-2028
Construction		2028-2030/2031
Operations begin		2031

# Geology – Bradley Lake Shoreline Erosion

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- Watershed GeoDynamics:  
Kathy Vanderwal Dubé



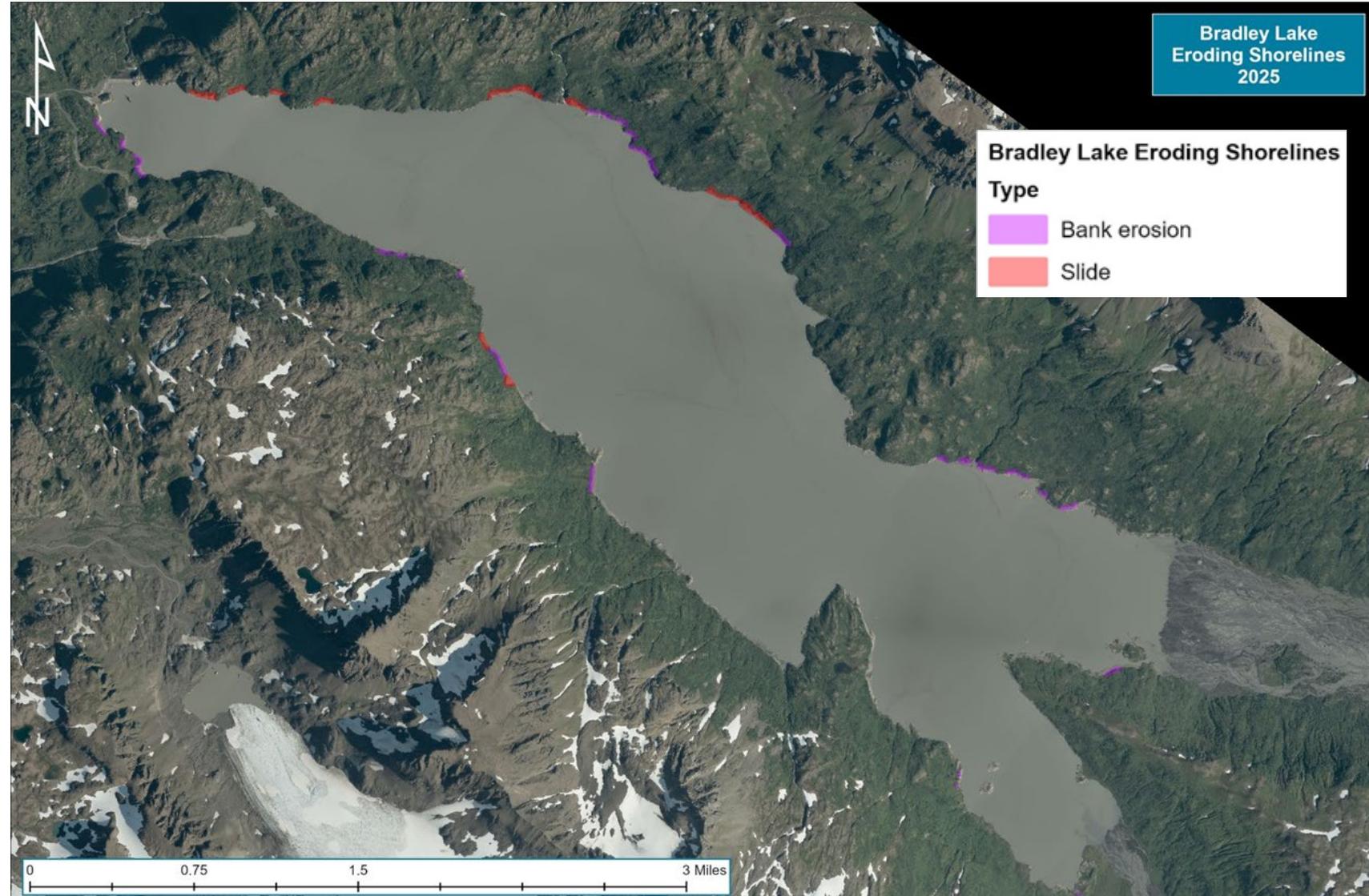
# Geology – Bradley Lake Shoreline Erosion

## Aerial/Remote sensing inventory of shoreline

- About 10 percent (1.7 miles) of shoreline eroding
- Wave action on unconsolidated material

## Proposed 16 ft Pool Raise

- Would move location of wave action upslope
- Continued upslope erosion of existing areas

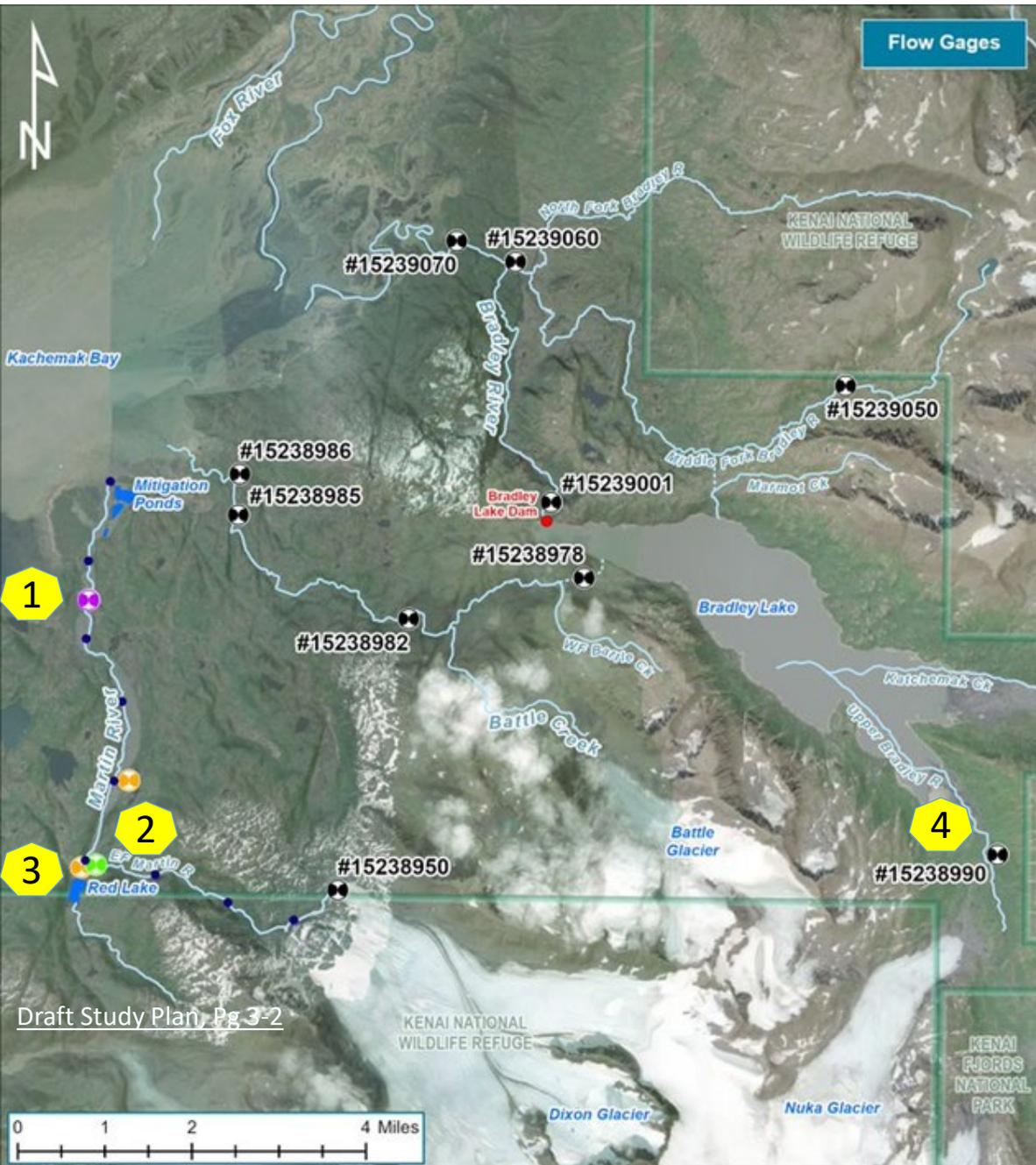


# Hydrology

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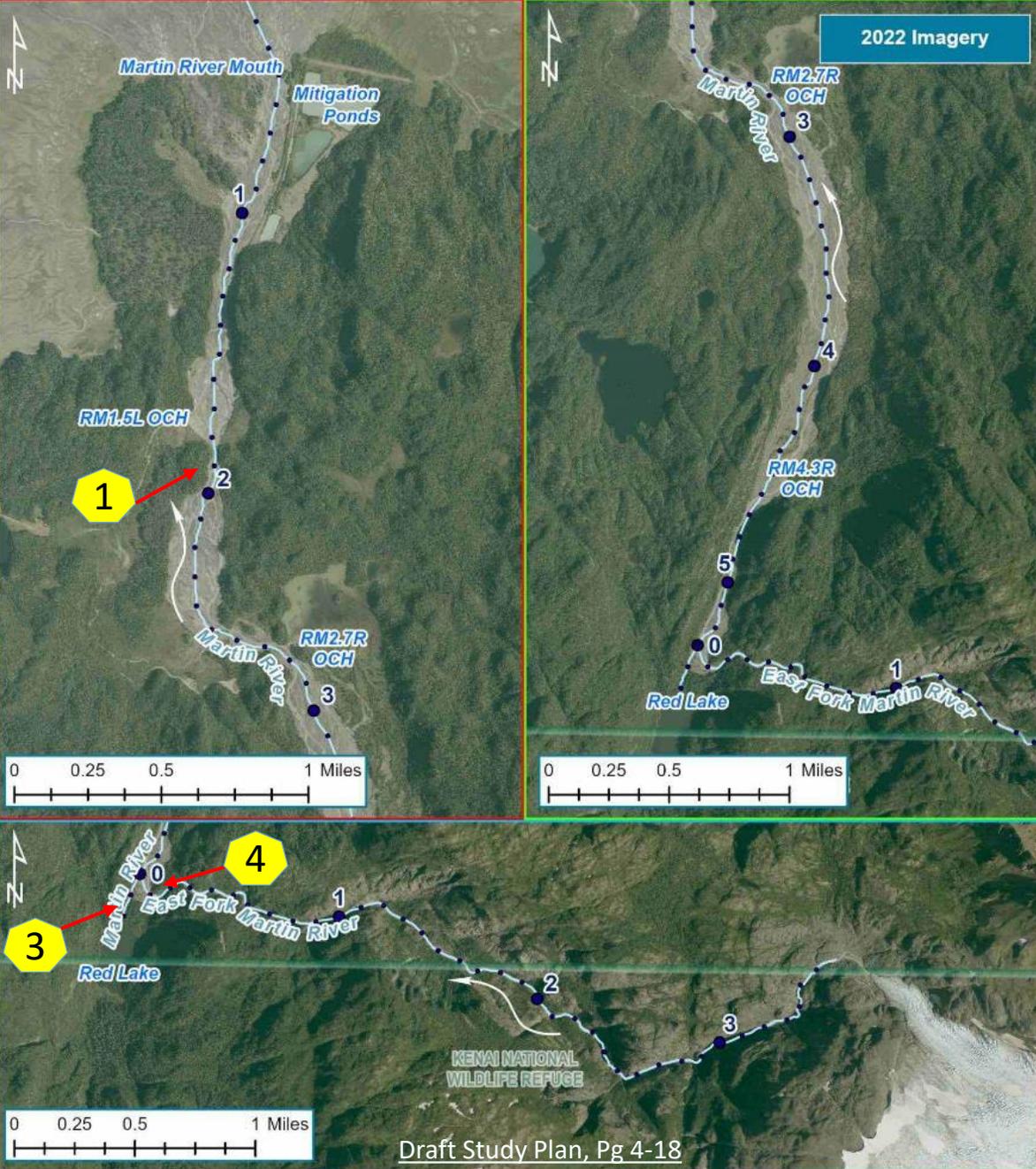
- DOWL:
  - Andrew Johnson





# Goals and Objectives

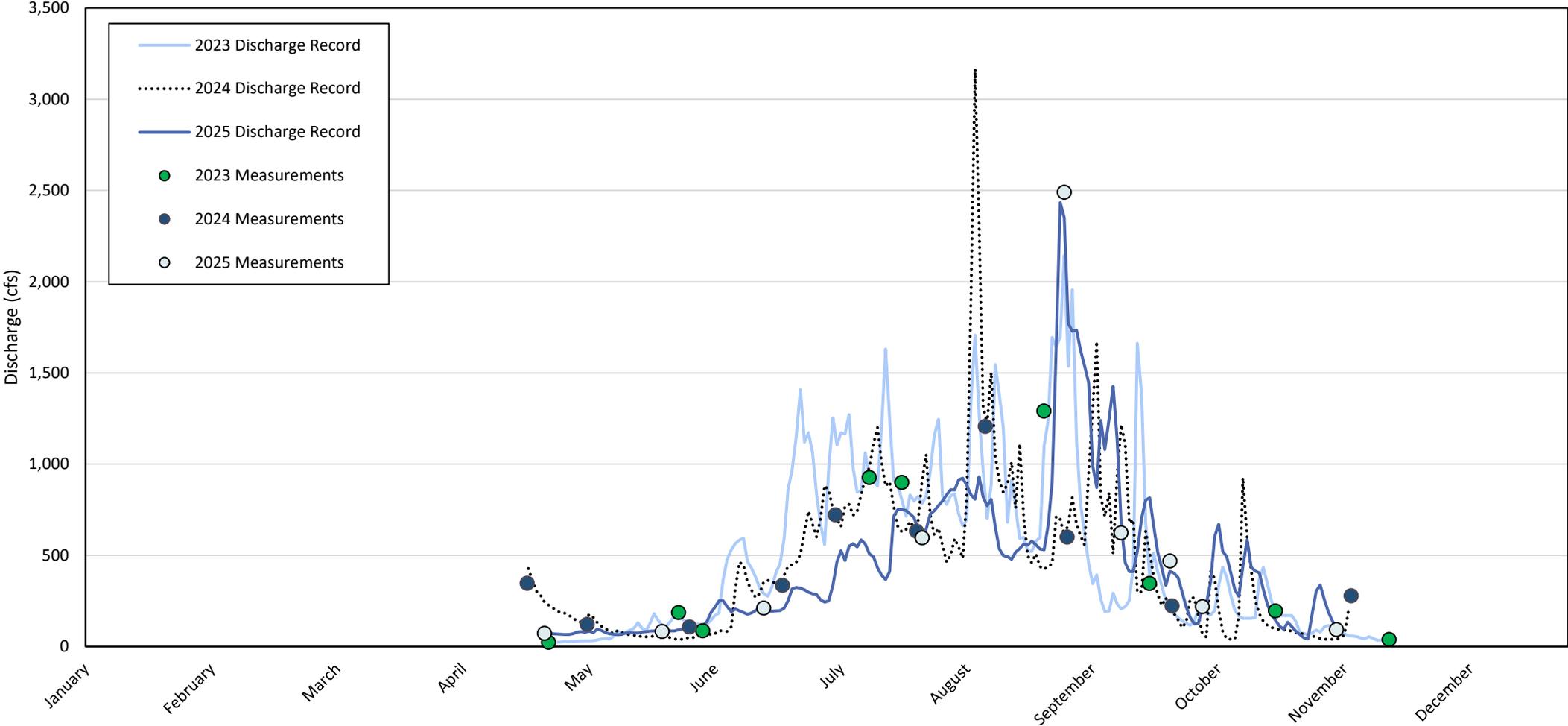
- Goal
  - Characterize flow regime of the Martin River and select tributaries
  
- Objectives
  - Use the past three years of stream gaging on the Martin River to establish a record
  - Use data from nearby Upper Bradley Basin to extend the record
  - Perform flood-frequency and flow-exceedance analyses on hydrographs at:
    - EFMR at the Mouth 2
    - MR at the Constriction (RM 1.9) 1



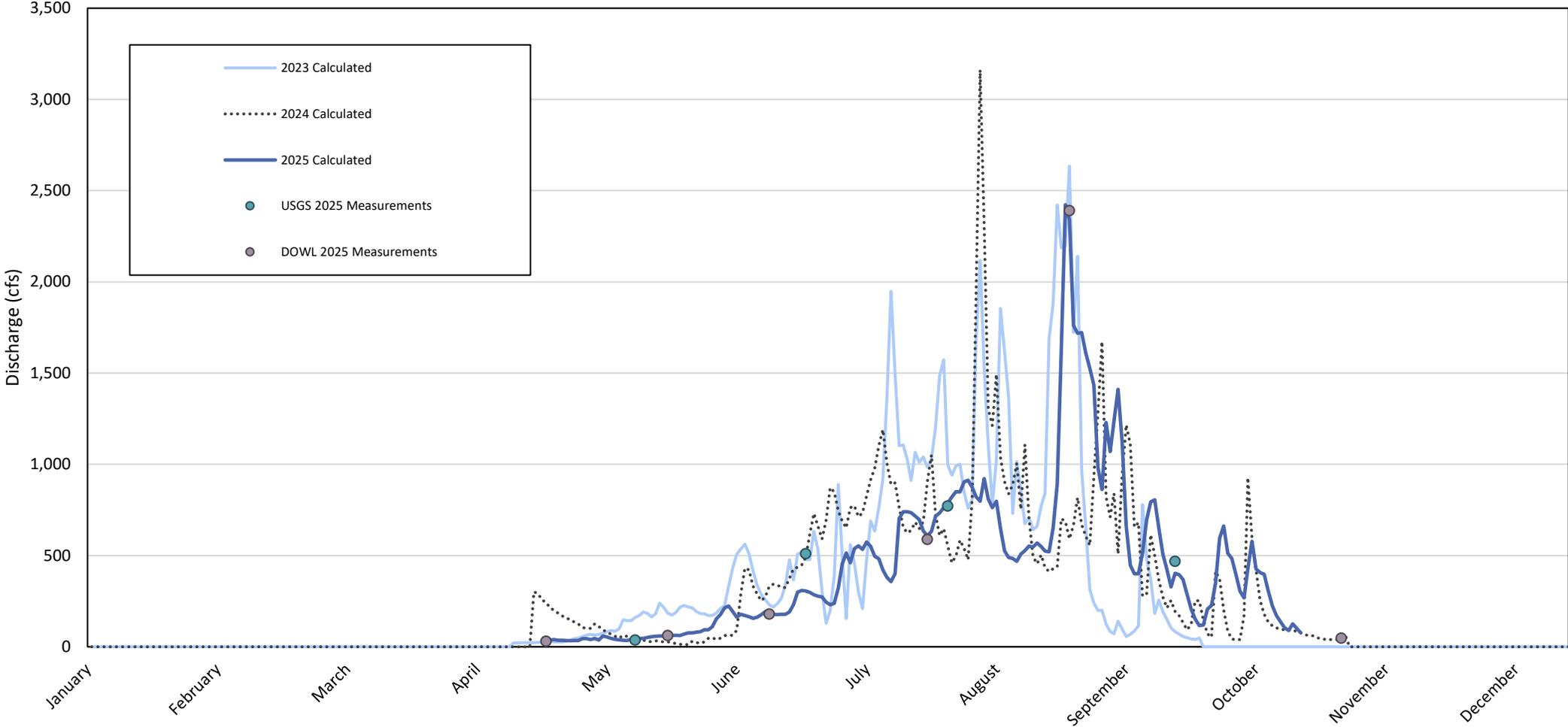
# Stream Gaging Summary

- 2023
  - Field Season: April – November
  - 9 Site visits
- 2024
  - Field Season: April – November
  - 10 Site Visits
  - 10-year event (8/7/24)
- 2025
  - Field Season: April – November
  - 9 Site visits

# Measured Hydrograph at the Martin River Constriction (RM 1.9)

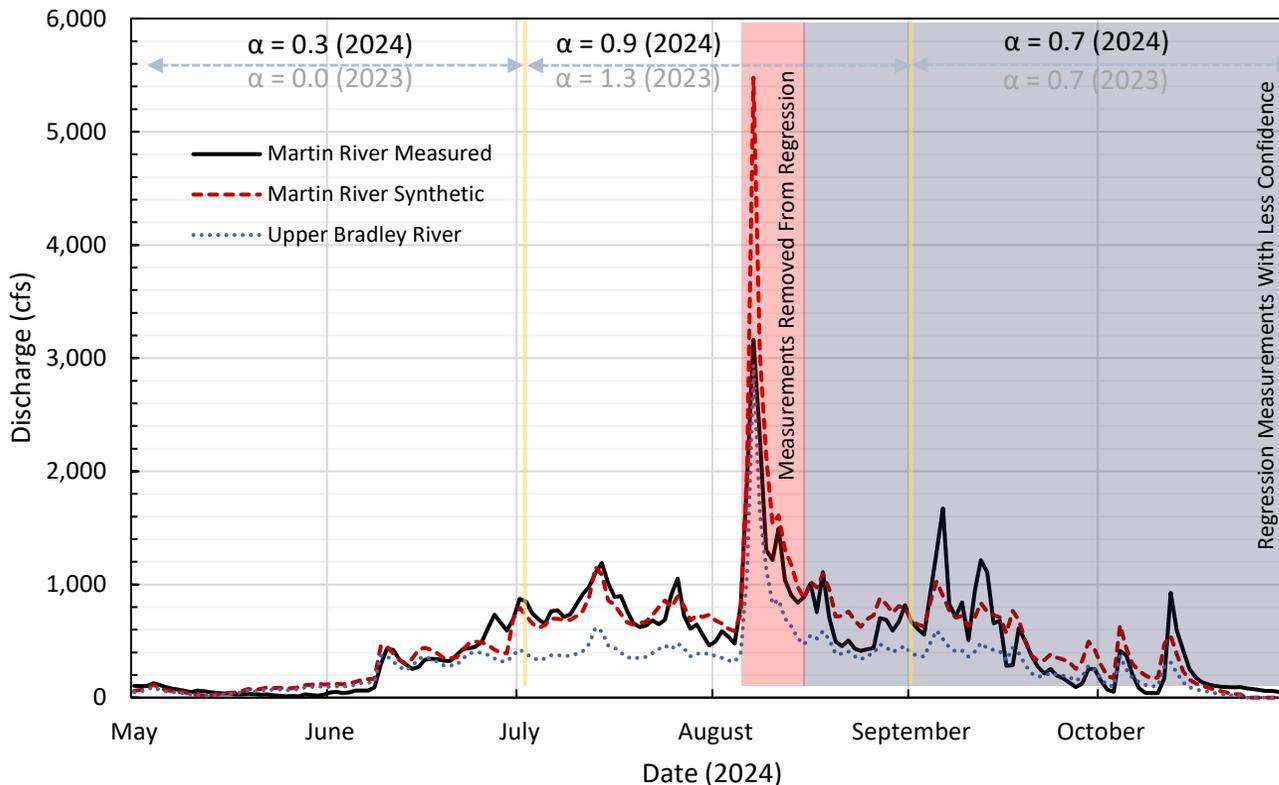


# Calculated Hydrograph at the EFMR Mouth



# Synthetic Hydrograph at EFMR

Period	Area Exponent (Factor)		
	2023	2024	Best Estimate (Average)
May 1 through June 30	0.0 (1.0)	0.3 (1.2)	0.1 (1.1)
July 1 through August 31	1.3 (2.5)	0.9 (1.9) <sup>1</sup>	1.1 (2.1)
September 1 through October 31	0.7 (1.6)	0.8 (1.7) <sup>2</sup>	0.7 (1.6)

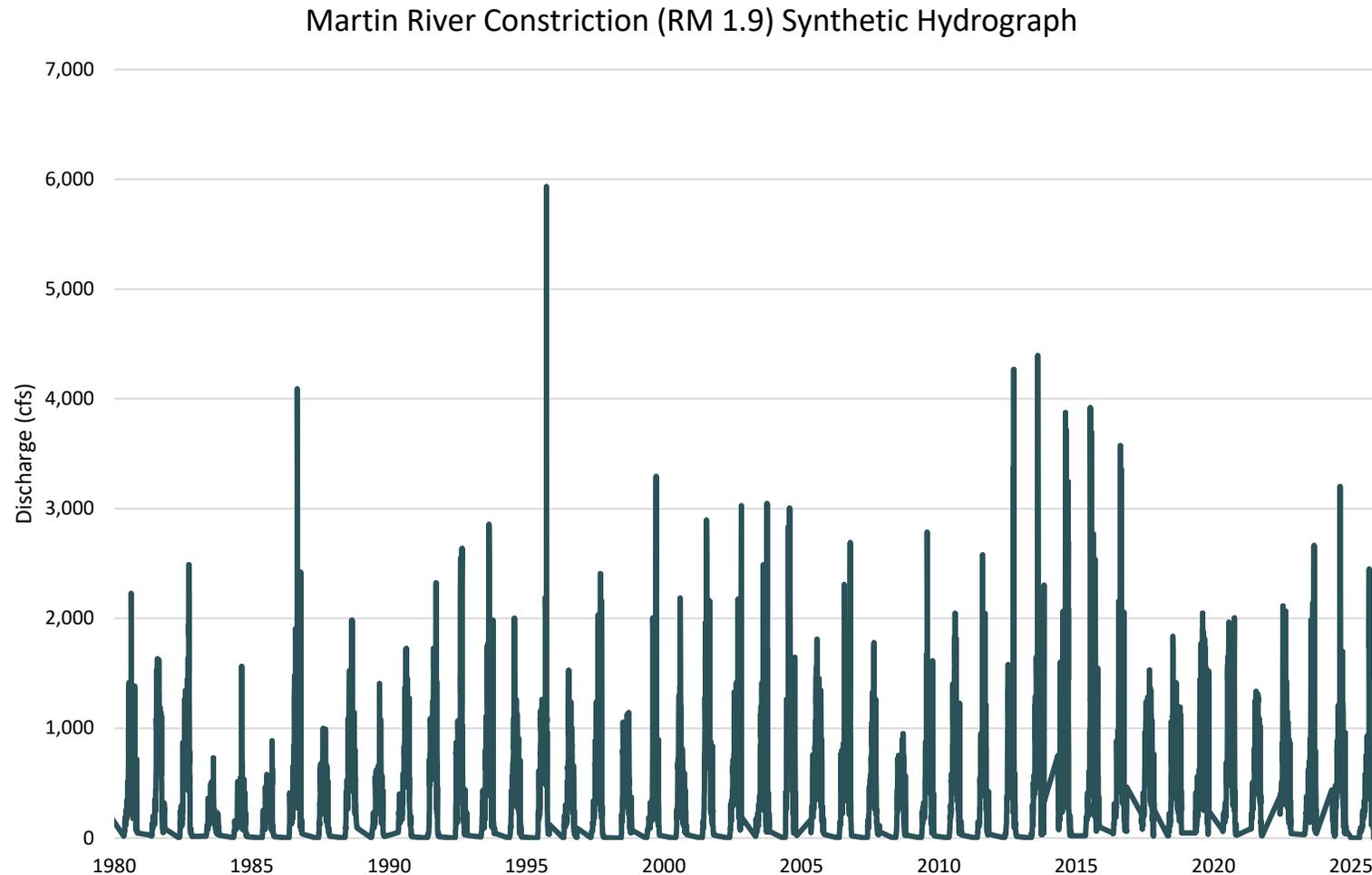


- USGS Stream Gage 15238990
  - Measurements since 1979
  - Tributary area = 11.2 mi<sup>2</sup>
- EFMR at the Mouth
  - Measurements since 2023
  - Tributary area = 22.3 mi<sup>2</sup>

$$Q_{EFMR} = Q_{Bradley} \left( \frac{A_{EFMR}}{A_{Bradley}} \right)^\alpha = Q_{Bradley} \times Factor$$

# Synthetic Hydrograph at the Martin River Constriction (RM 1.9)

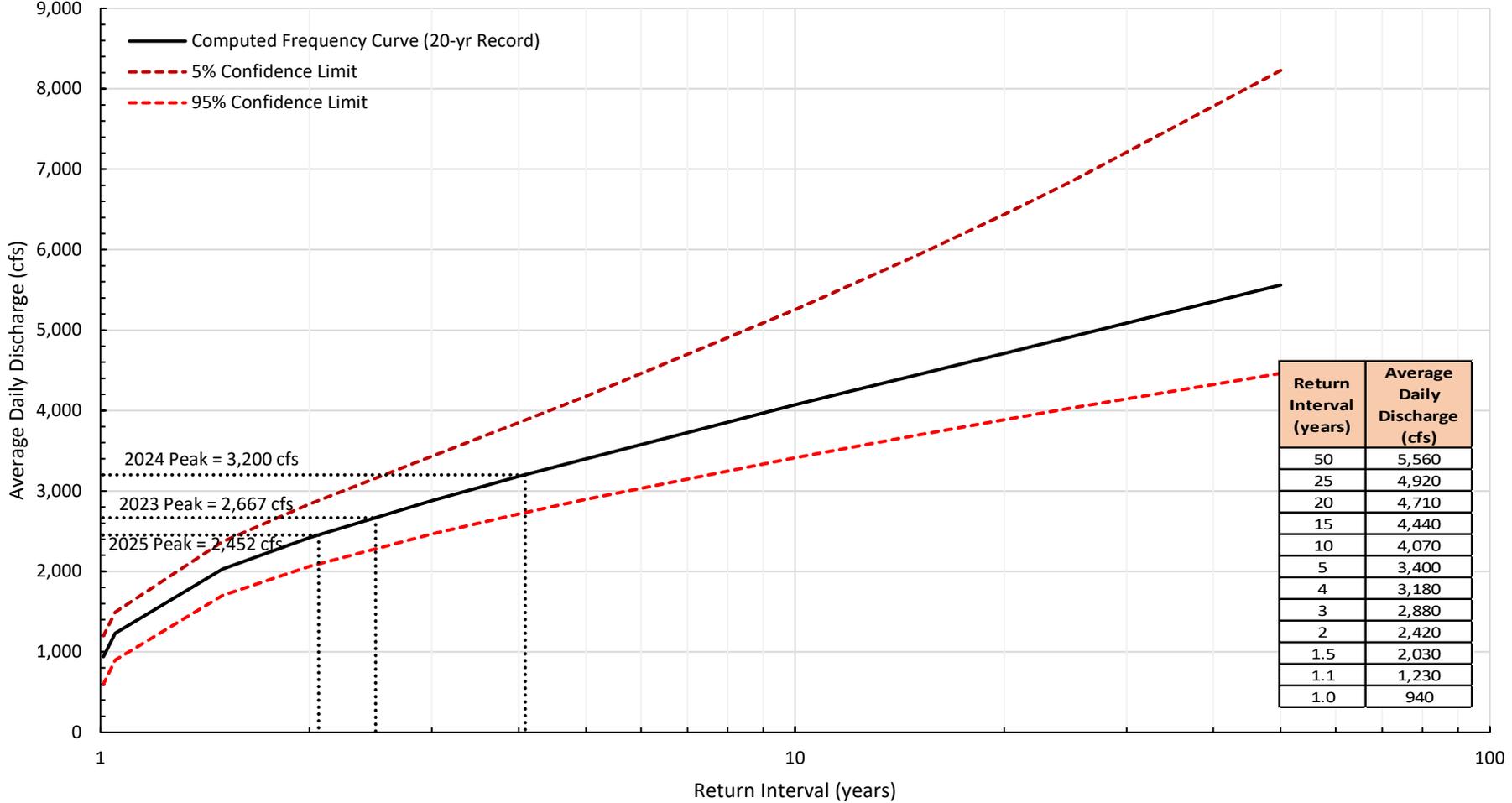
- Measurements 2023-2025



Month	EFMR to MR @ RM 1.9 Factor
January	1.00
February	1.00
March	1.00
April	1.45
May	1.56
June	1.11
July	1.02
August	1.01
September	1.02
October	1.04
November	1.00
December	1.00

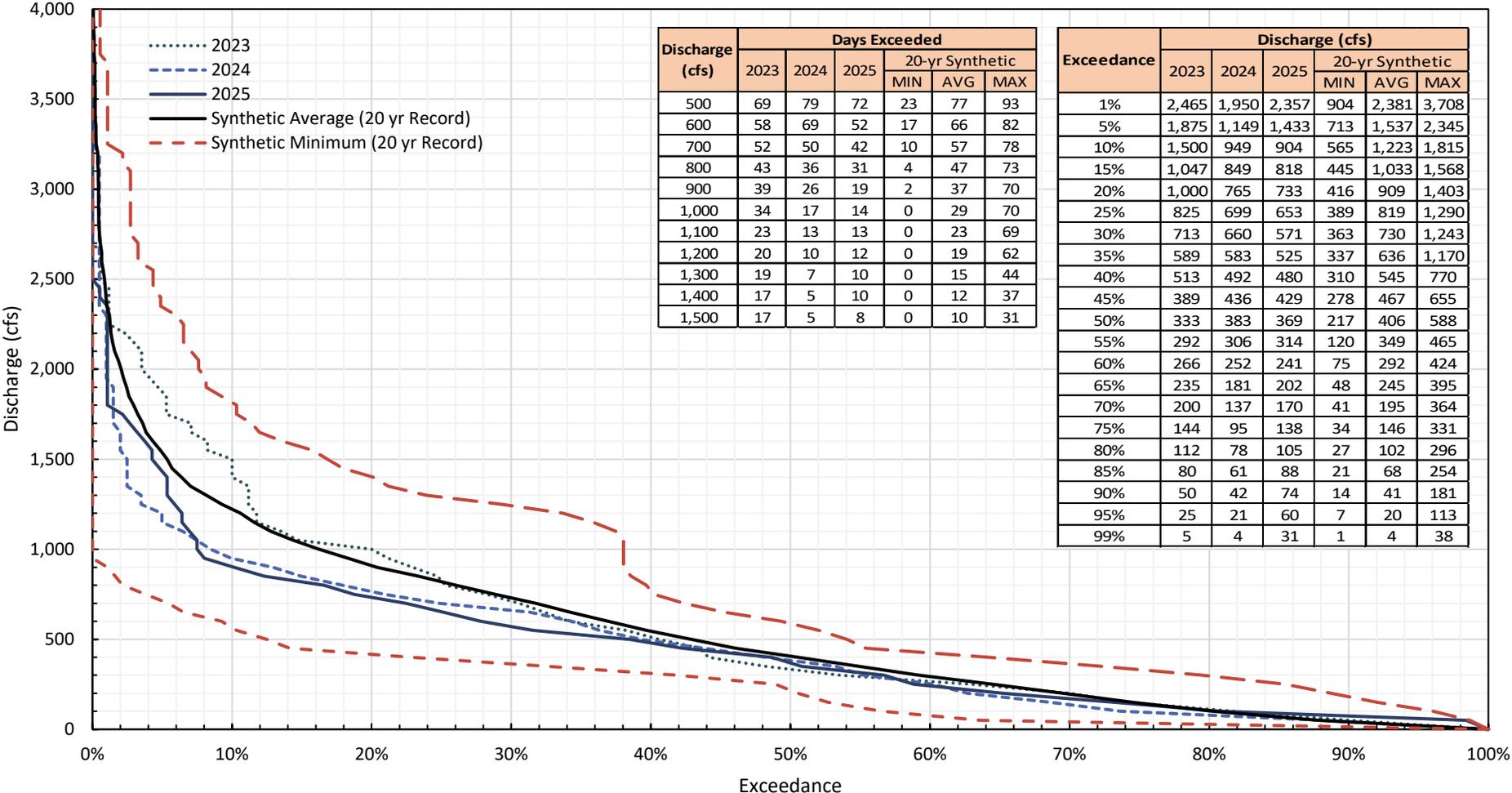
# Daily Flood Frequency at the Martin River Constriction (RM 1.9)

Martin River at the Constriction (RM 1.9) Flood-Frequency Using Daily Average Peaks



# Constriction Flow Exceedance

Yearly - Daily Flow Exceedance of the Martin River at the Constriction (RM 1.9)





# Continued Stream Gaging

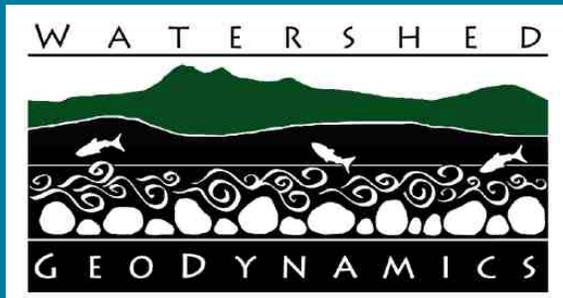
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- 2026-2028
  - Data collection during open-water season
  - Three sites
    - MR at the Constriction (RM 1.9)
    - WFMR at Red Lake Outlet
    - EFMR at the Mouth

# Geomorphology and Sediment Transport Study

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- Watershed GeoDynamics:  
Kathy Vanderwal Dubé



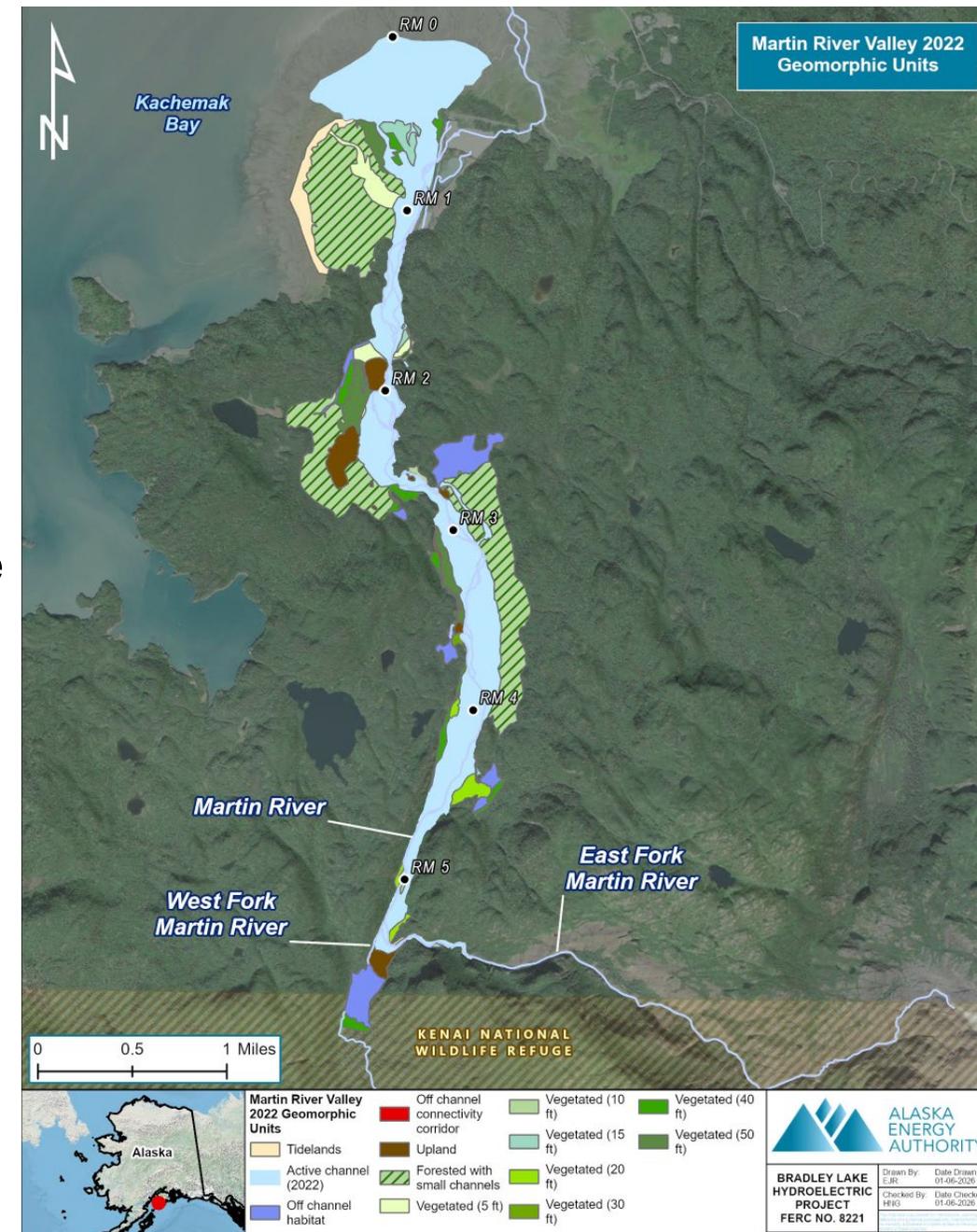
# Geomorphology and Bedload Transport Study

- Over-arching question:
  - How will diversion of water from EFMR affect bedload transport and geomorphic change; and therefore riparian/aquatic habitat, connectivity?
- Geomorphology study included:
  - 3 years of field studies (timelapse cameras, grain size data)
  - Historic aerial photograph/LiDAR analysis
  - Hydraulic modeling/initiation of bedload transport
  - Literature review
  - Coordination with aquatic and riparian teams (synthesis)



# Martin River Characteristics

- Mainstem Martin River is extremely active braided river
  - Wide active channel area with multiple bedrock constrictions
  - Channel changes/bedload transport occur multiple times/year
- Mainstem has occupied much of valley bottom through time
  - Off-channel/tributary connectivity changes frequently
  - Some off-channel areas get turbid mainstem flow during summer high flows
- Gradient
  - EFMR canyon/confined 6.7%
  - Mainstem 1.5 - 0.7%
- Substrate
  - boulders near EF/WF confluence
  - primarily gravel/cobble elsewhere



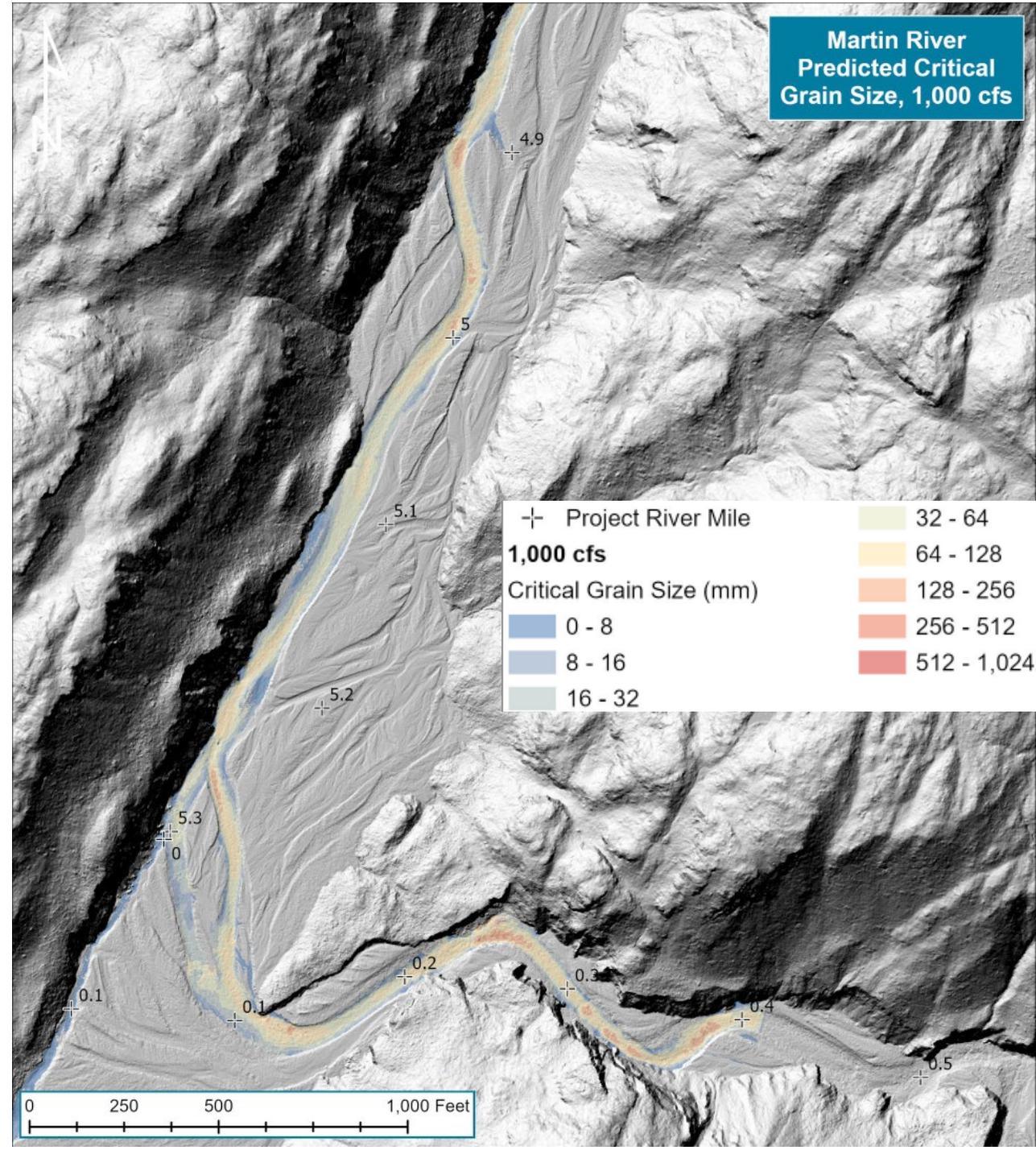
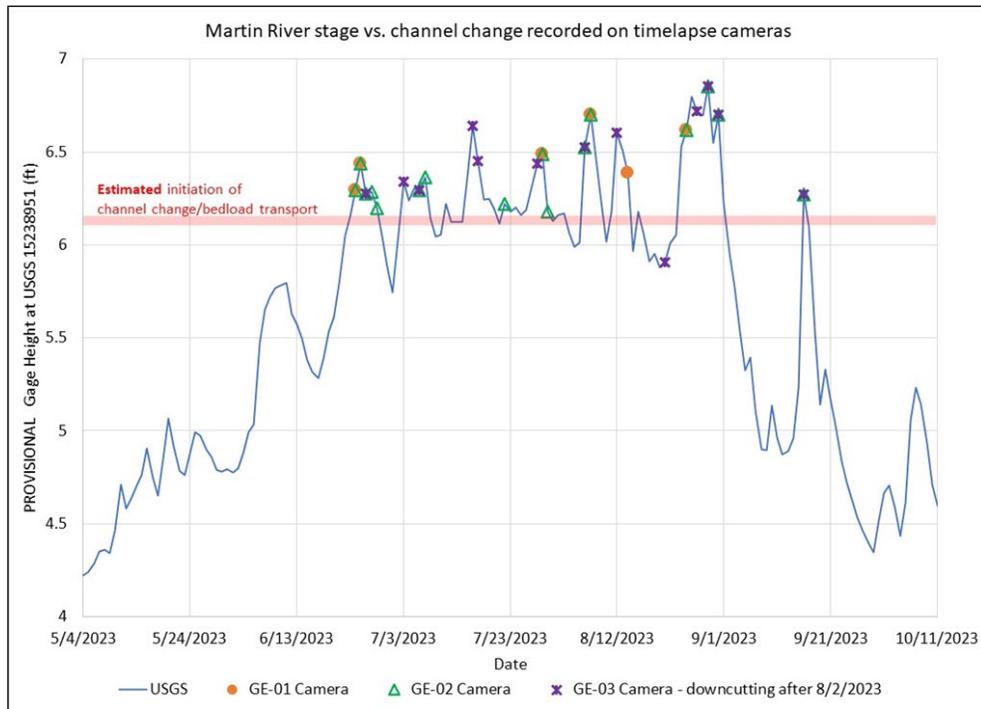
# Sediment Supply and History

- Dixon Glacier supplies most of the sediment to the Martin River
  - Estimated ~30,000 cu yd/yr of coarse sediment
  - Small tributaries/bedrock valley = other inputs of sediment minor
- Large historic influx of sediment following retreat of glacier from Little Ice Age Maximum (late 1800s) resulted in 5-10 feet of aggradation along entire river
  - Sediment “slug” moved downstream, progressive aggradation/valley widening
  - Right bank levee breach in 2023 due to aggradation – delta building in former mitigation ponds
- Evidence of downcutting in upper mainstem area (PRM 4-5) since “slug” has moved downstream
- Levee breach has lowered base level at mouth, downcutting progressing upstream (PRM 0-1.5)

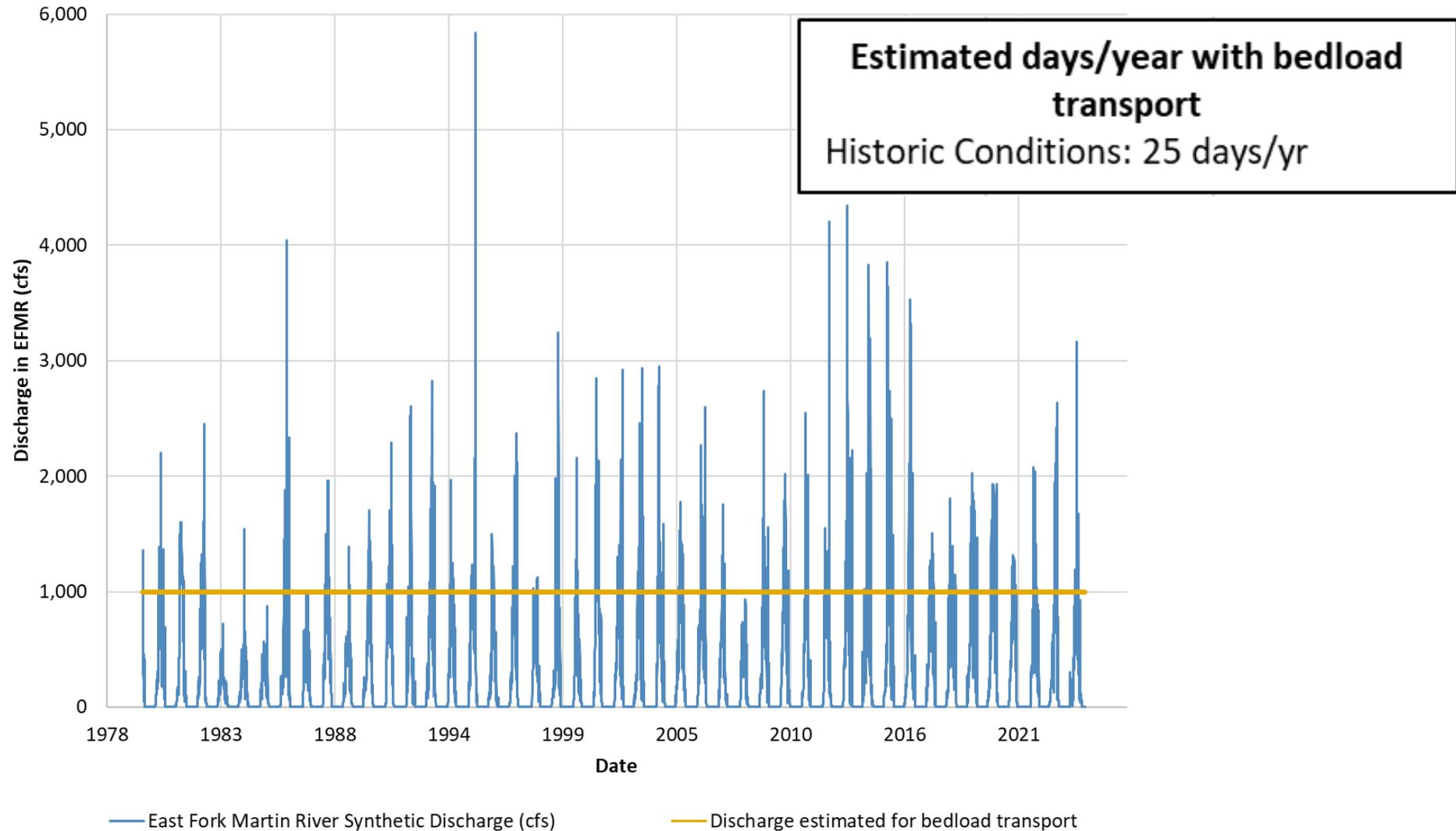


# Bedload Transport

- Based on timelapse camera data and hydraulic model results, **bedload transport in Martin River occurs at flows > ~1,000 cfs**
  - Higher initiation flow at EF/WF confluence due to large substrate
  - Lower initiation flow near MR mouth due to lower base level following levee breach



# Bedload Transport – Current Conditions



# Project-Related Changes to Sediment Supply & Transport

## Effects of Project Operations

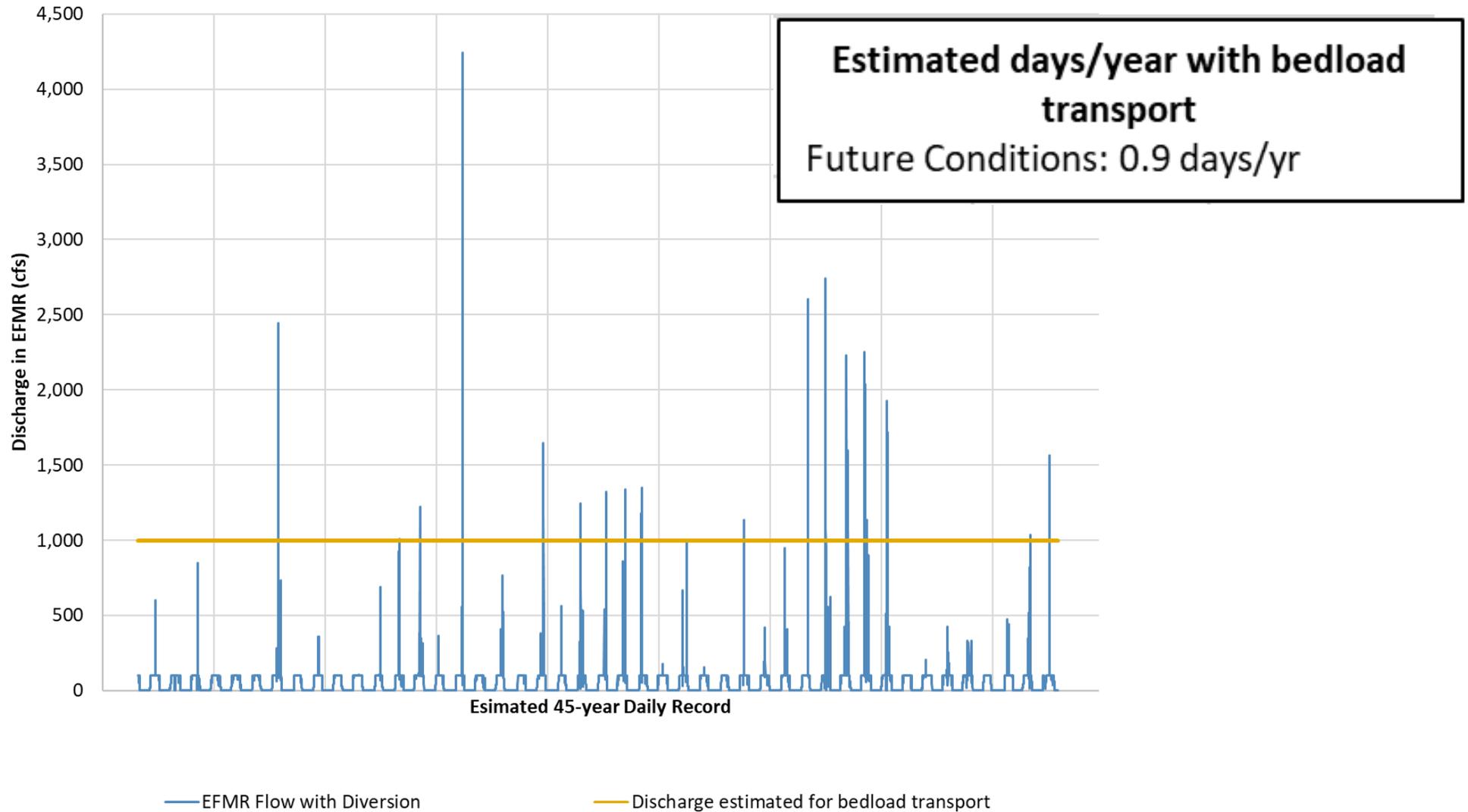
- Fine sediment – diverted with water to Bradley Lake
- Coarse sediment – accumulate behind diversion until flushed
- Reduced flows in Martin River

## Changes to Sediment Transport in Martin River

- Reduced input of flow and fine sediment (silt, clay, fine sand)
- Similar input of coarse sediment (coarse sand to boulder size)
- Coarse sediment input more episodic - flushing of diversion pool
- Reduced bedload transport potential
  - Sediment management flow during flushing events
  - Channel maintenance flows
  - High flows > diversion tunnel capacity (1,650 cfs)



# Bedload Transport – with Diversion



# Geomorphology and Bedload Transport – Potential Future Conditions

- Most likely scenario – evolution from braided to primarily single thread river channel
- Possible multiple/braided areas following extreme flood events
- Riparian vegetation growth along streambanks will enhance channel stability
- Connectivity to off-channel/tributary areas will stabilize
- Possible areas of aggradation or fine sediment deposition in slow water areas

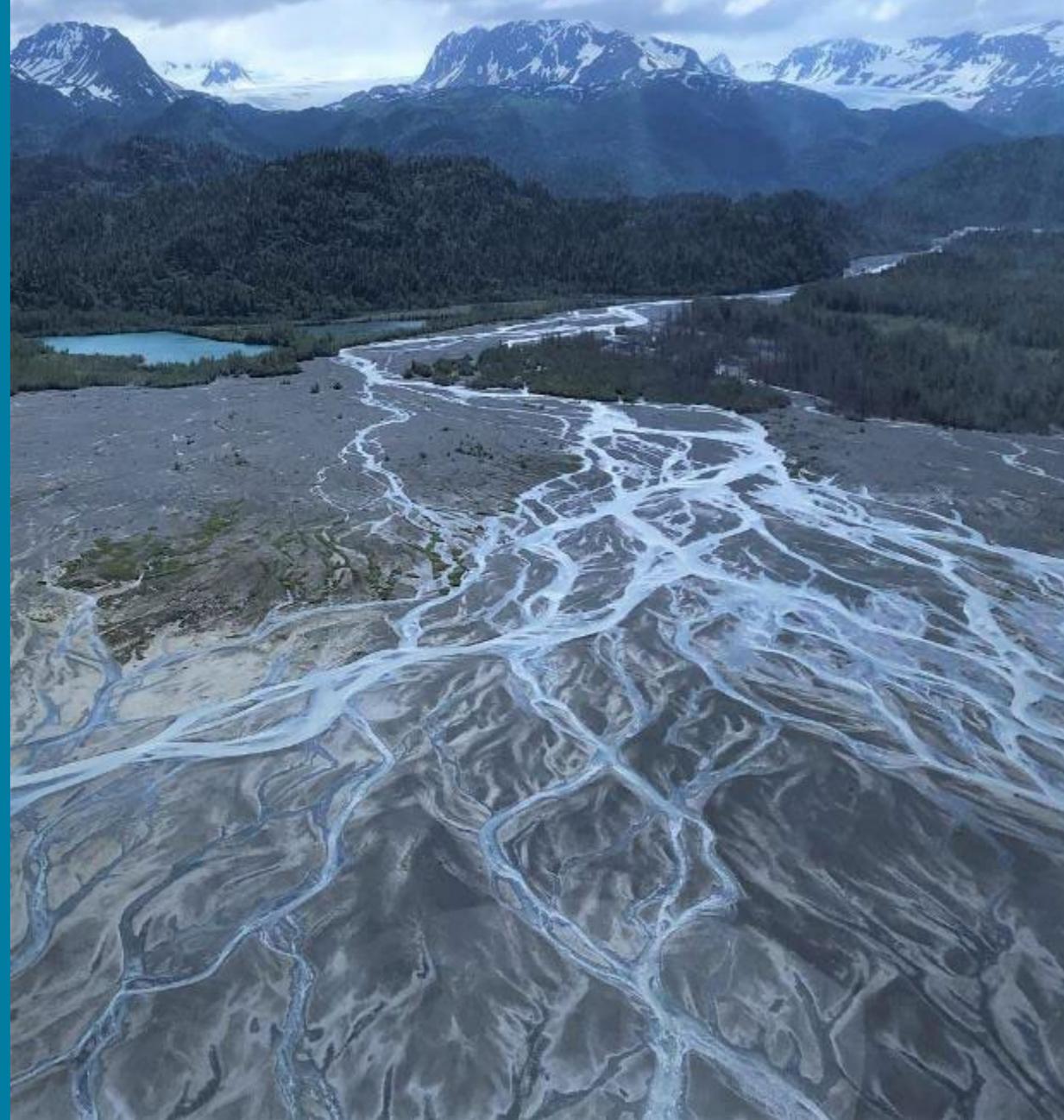


# Water Quality Monitoring

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Kleinschmidt Associates:  
Blake Hamilton

***Kleinschmidt***



# Water Quality Monitoring

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- 2023-2025
- Measured temperature and turbidity
  - EF Martin River
  - WFMR and other OCH/Tribs
  - Martin River at RM 1.9

***Kleinschmidt***



# Results: Mainstem Turbidity

Spring (5/22/25) – 68 cfs  
< 5 NTUs



Summer (7/31/25) – 820 cfs  
60 NTUs



# Results: Mainstem Turbidity

Fall (9/29/25) – 150 cfs  
13 NTUs



Fall (10/6/25) – 690 cfs  
>240 NTUs



# Results: OCH Turbidity

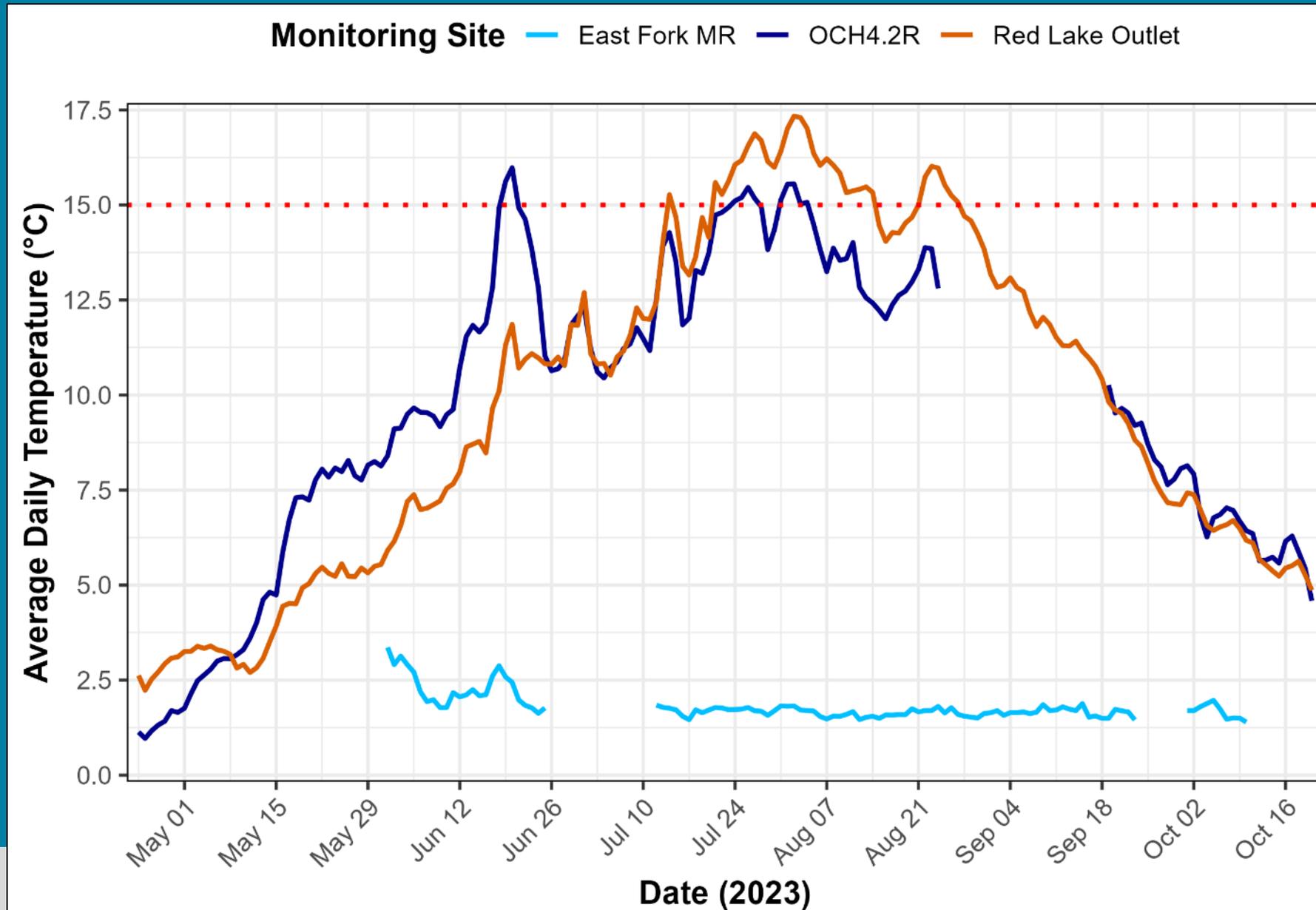
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- 2023 – 2025 data consistent:
  - < 5 NTU unless inundated
- High flow events
  - August 8 – 6, 2024 (4,206 cfs)
  - August 26 – 28, 2025 (2,635 cfs)
- Rainfall event – October 2025
  - Some OCHs partially or fully inundated



# 2023 Results: Temperature

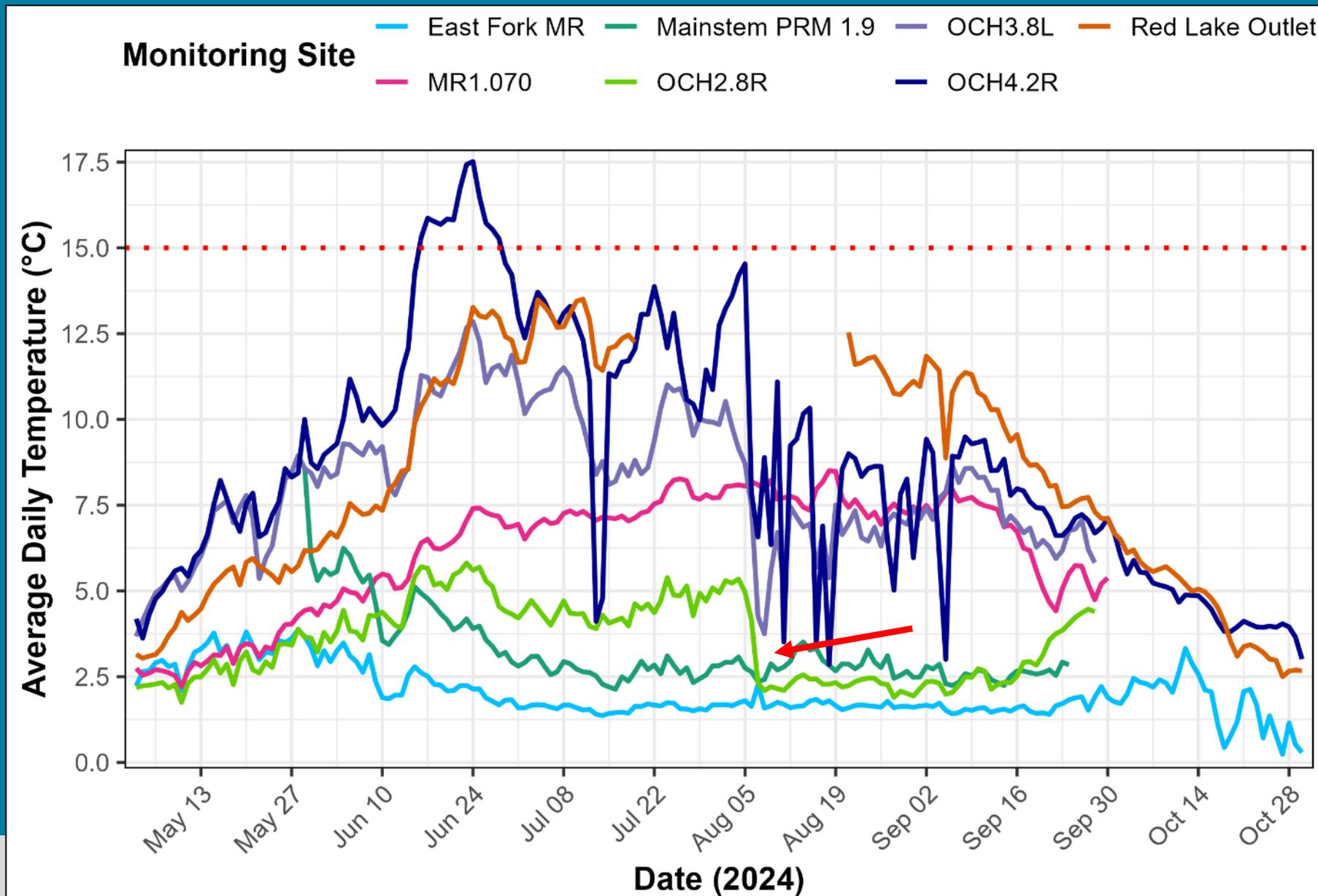
- EFMR temp – USGS gage



# 2024 Results: Temperature

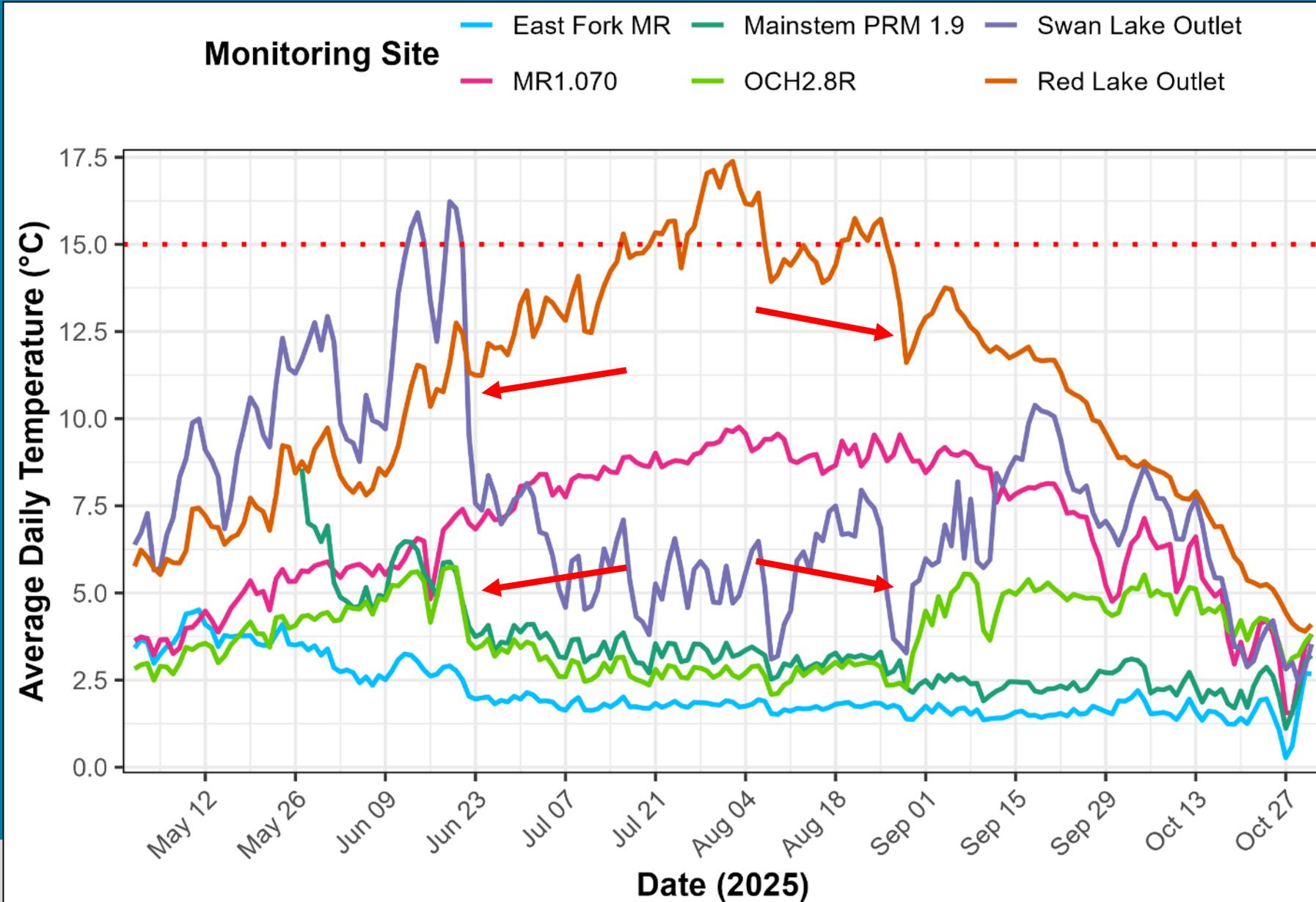


- OCH4.2R – multiple inundation events
- August 6 high flow event (4,209 cfs)



# 2025 Results: Temperature

- SLO & OCH2.8R inundation (~300 cfs)
- August 28 high flow event (2,635 cfs)



# Martin River Temperature Impact Assessment

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Kleinschmidt Associates:  
Clair Yoder

***Kleinschmidt***



# Martin River Temperature Impact Assessment

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- 2025 Study Report
- Years analyzed:
  - 2024 (limited)
  - 2025
- Mass balance analysis
- Calculations assume a worst-case condition

***Kleinschmidt***

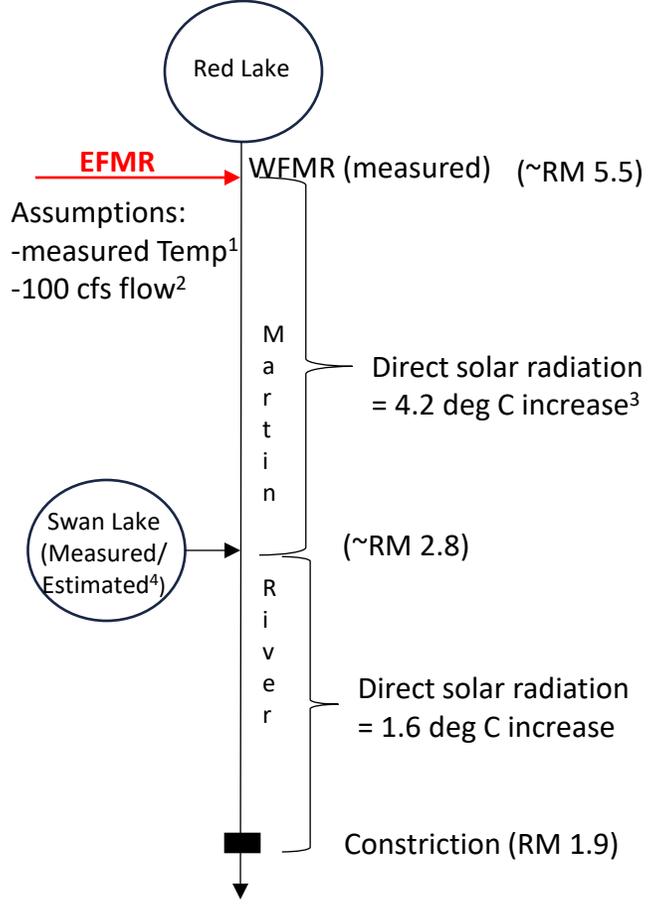


# Methods

Calculate water temperature with project under worst case conditions



	<b>AEA Gages</b> 2025 Water Temperature 2025 Water Temperature & Flow 2024 & 2025 Water Temperature & Flow	USGS Gage No. 15238951 Project River Mile Hydrography Study Target Hydrography	 <b>BRADLEY LAKE EXPANSION HYDROELECTRIC PROJECT FERC NO. 8221</b> <small>Drawn By: E.R. Date Drawn: 01-07-2026 Checked By: mll Date Checked: 01-07-2026</small>
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**EFMR**  
 Assumptions:  
 -measured Temp<sup>1</sup>  
 -100 cfs flow<sup>2</sup>

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Constriction (RM 1.9)

Direct solar radiation = 4.2 deg C increase<sup>3</sup>

(~RM 2.8)

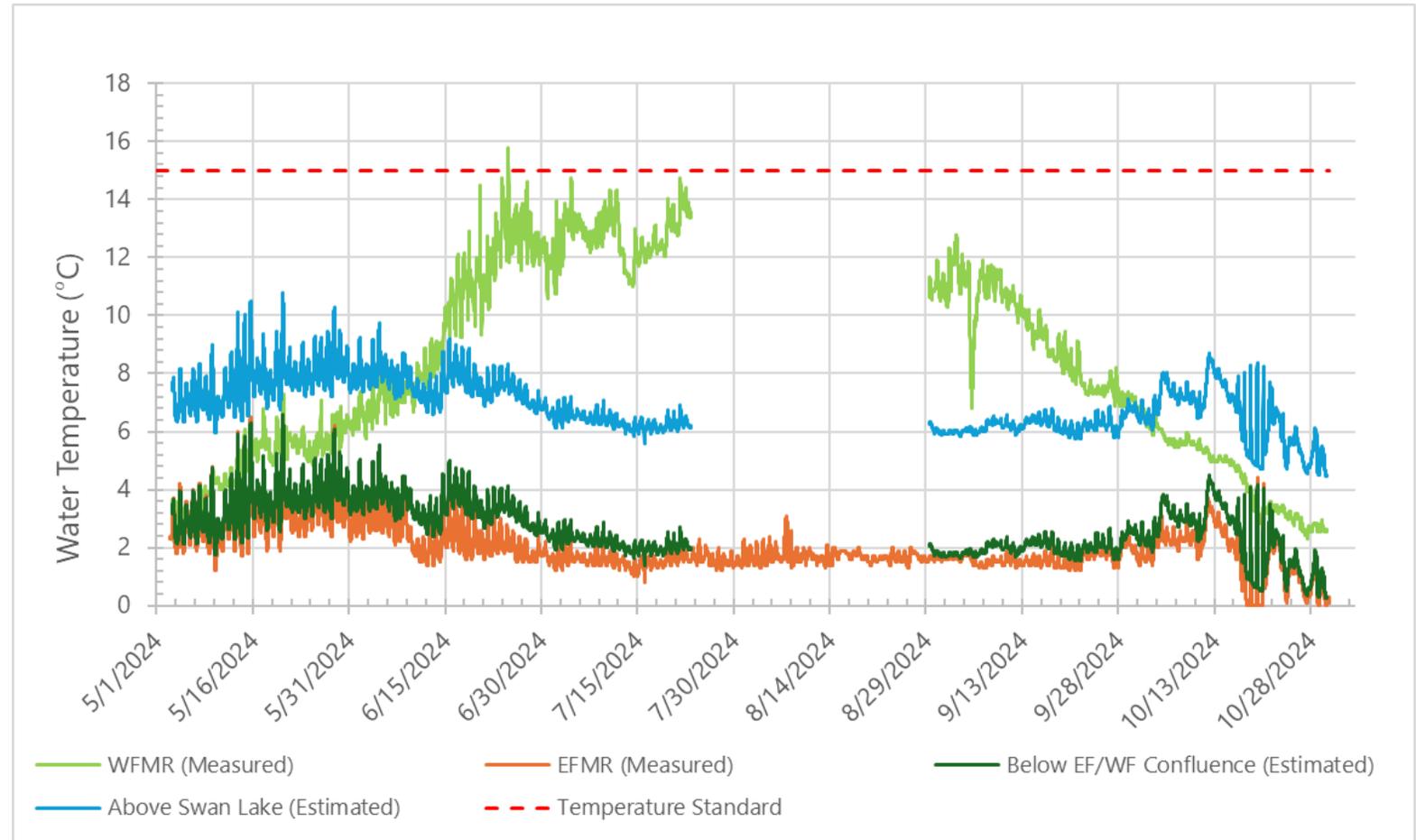
Direct solar radiation = 1.6 deg C increase

**Assumptions:**

- 1: No temperature changes at reduced flow due to one hour travel time in steep canyon terrain
- 2: 100 cfs at all times is worst case condition (i.e., lowest amount of cold water flow)
- 3: No tributary inflow – tributaries contribute less than 5% of the total flow in the Martin River
- 4: Excluded Swan Lake temperature data estimated using relationship with Red Lake (Red Lake + 4.5 degrees)

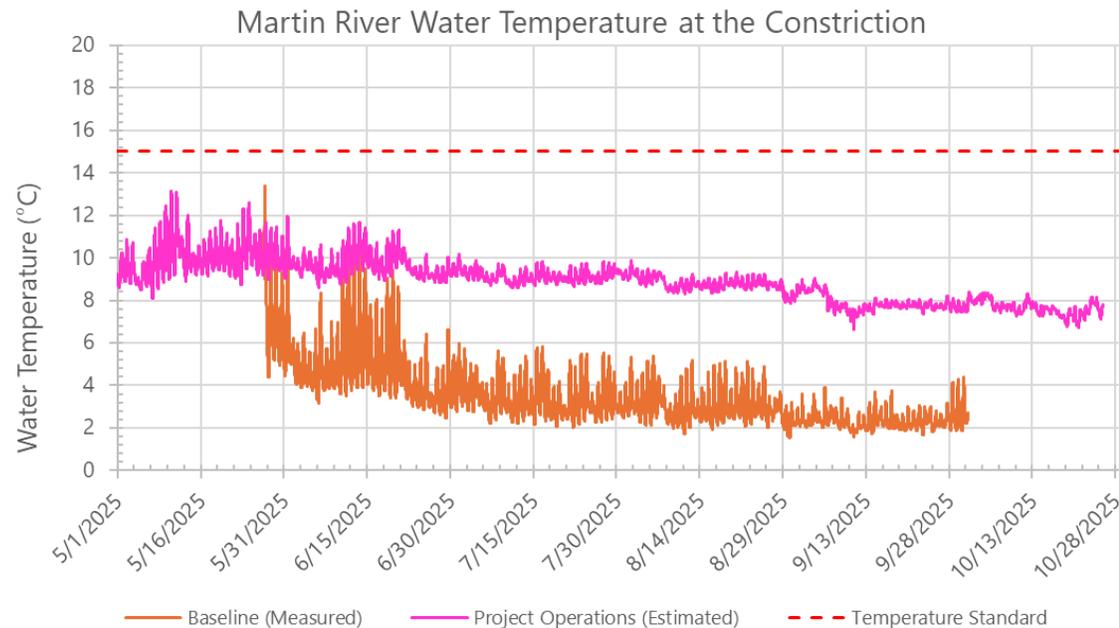
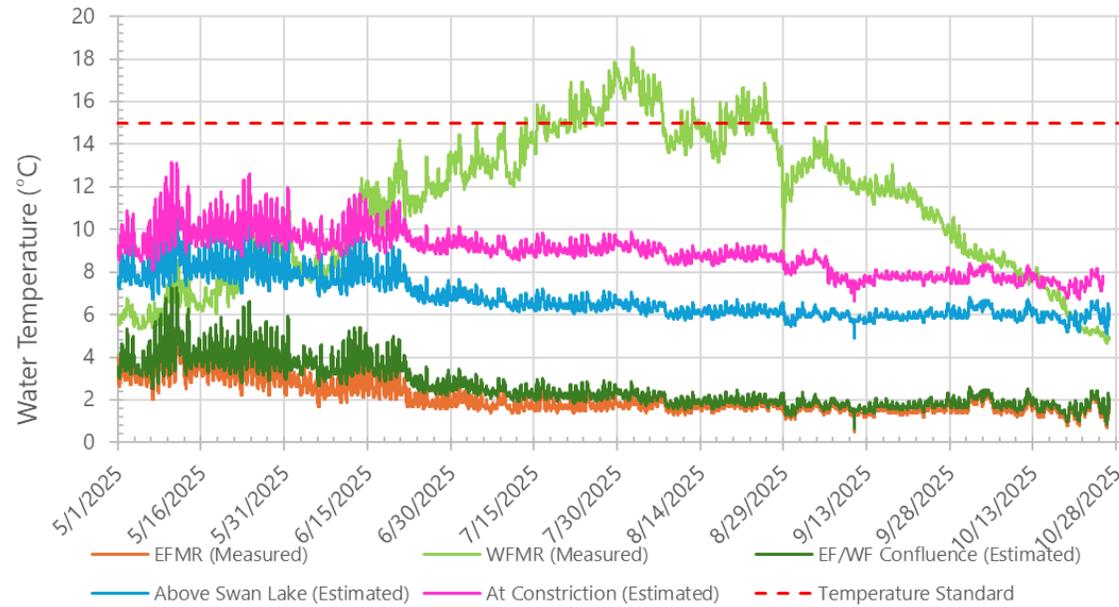
# 2024 Results

- No Swan Lake data (T or Q) collected in 2024. Calculations only available for Martin River above Swan lake



# 2025 Results

- Water Temperatures in the Martin River at the constriction with the project are below the standard



# Questions?

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# Martin River Fish Use Study

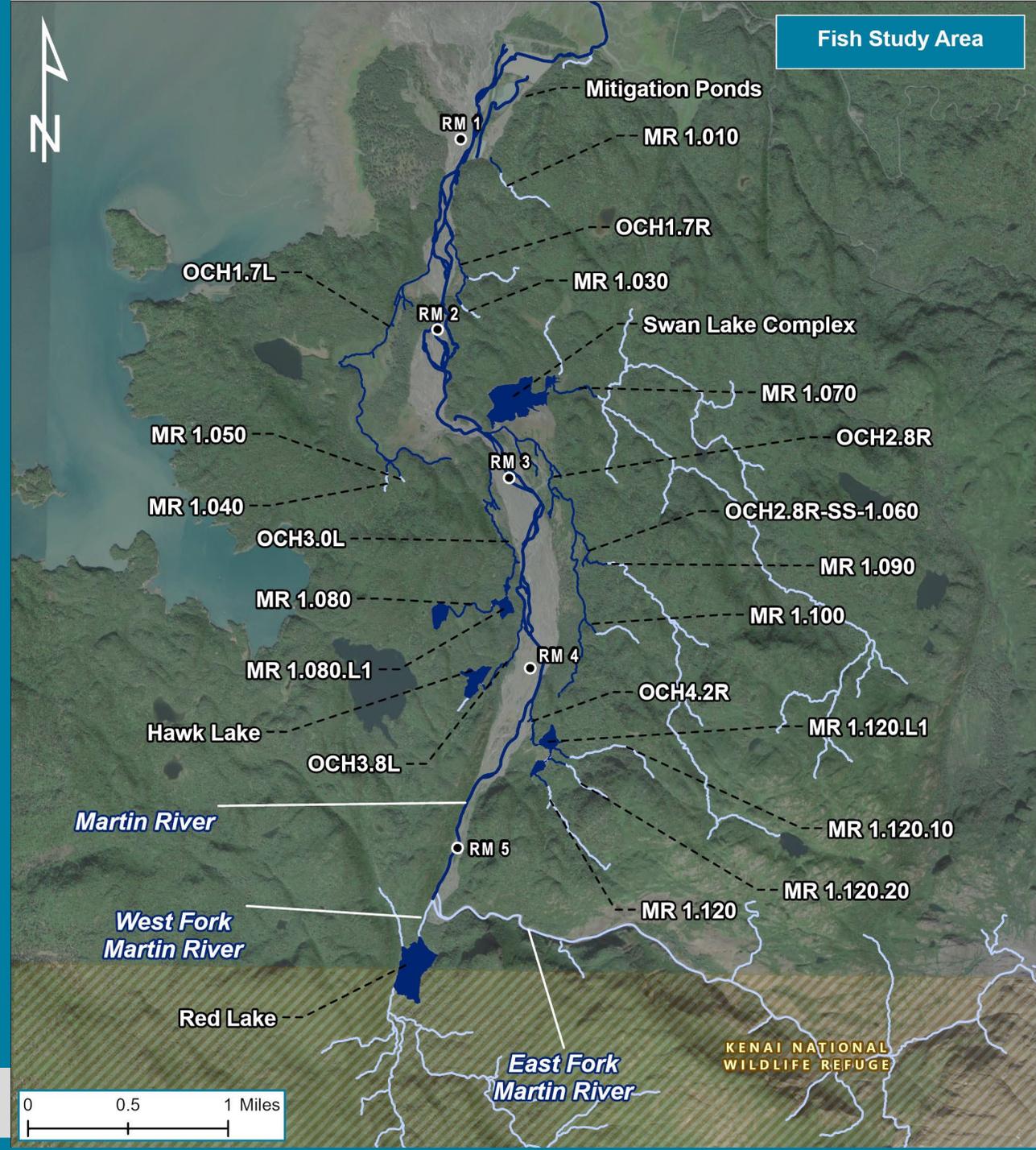
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- Kleinschmidt Associates:  
Blake Hamilton



# Martin River Fish Study

- Presence/Absence
- Document salmon spawning in suitable habitats
- 2024
  - April 28<sup>th</sup> – May 10<sup>th</sup>
  - September 23<sup>rd</sup> – October 3<sup>rd</sup>
- 2025
  - May 21<sup>st</sup> – May 27<sup>th</sup>
  - July 28<sup>th</sup> – August 3<sup>rd</sup>
  - September 29<sup>th</sup> – October 5<sup>th</sup>

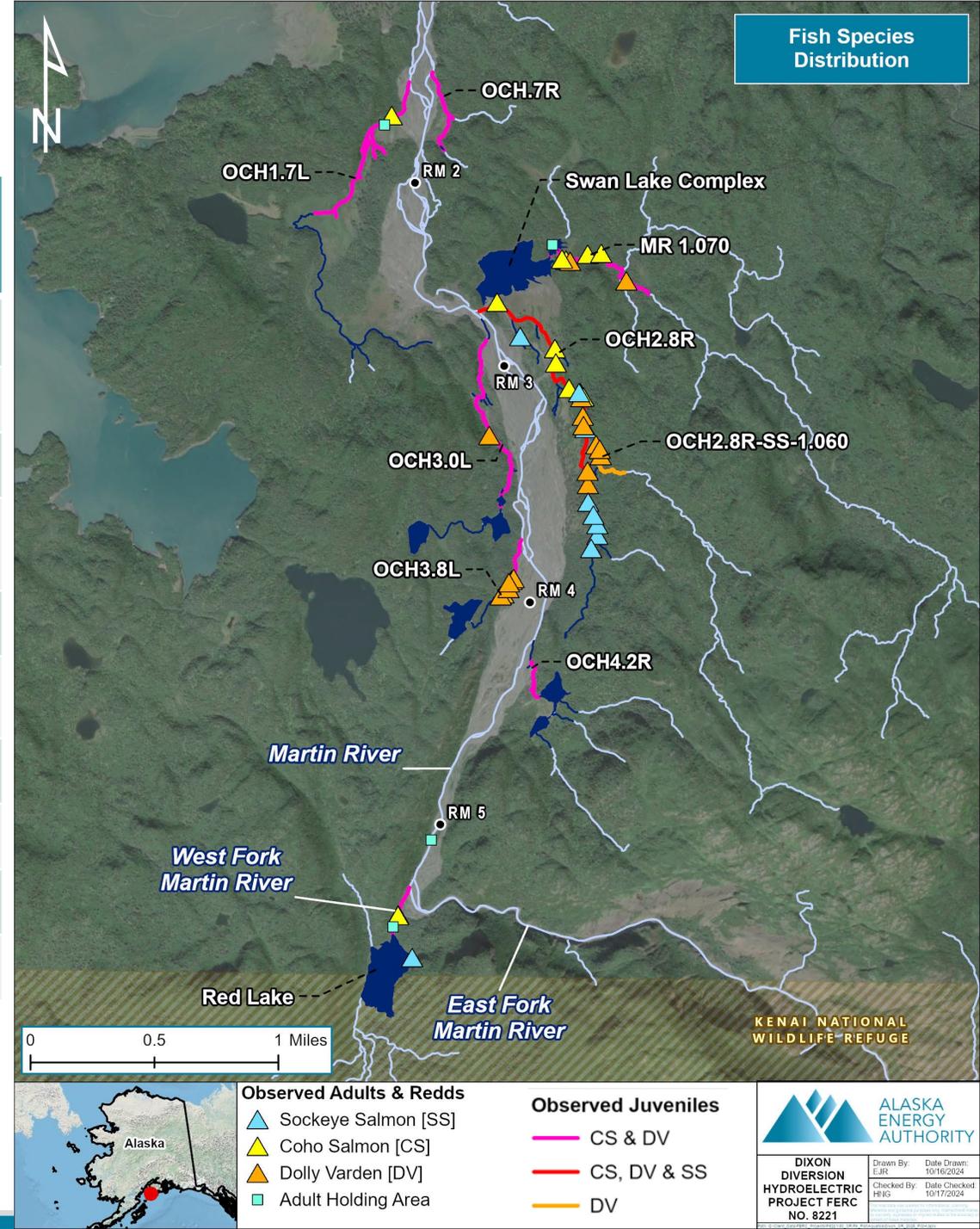


# Martin River – Fish Species Distribution

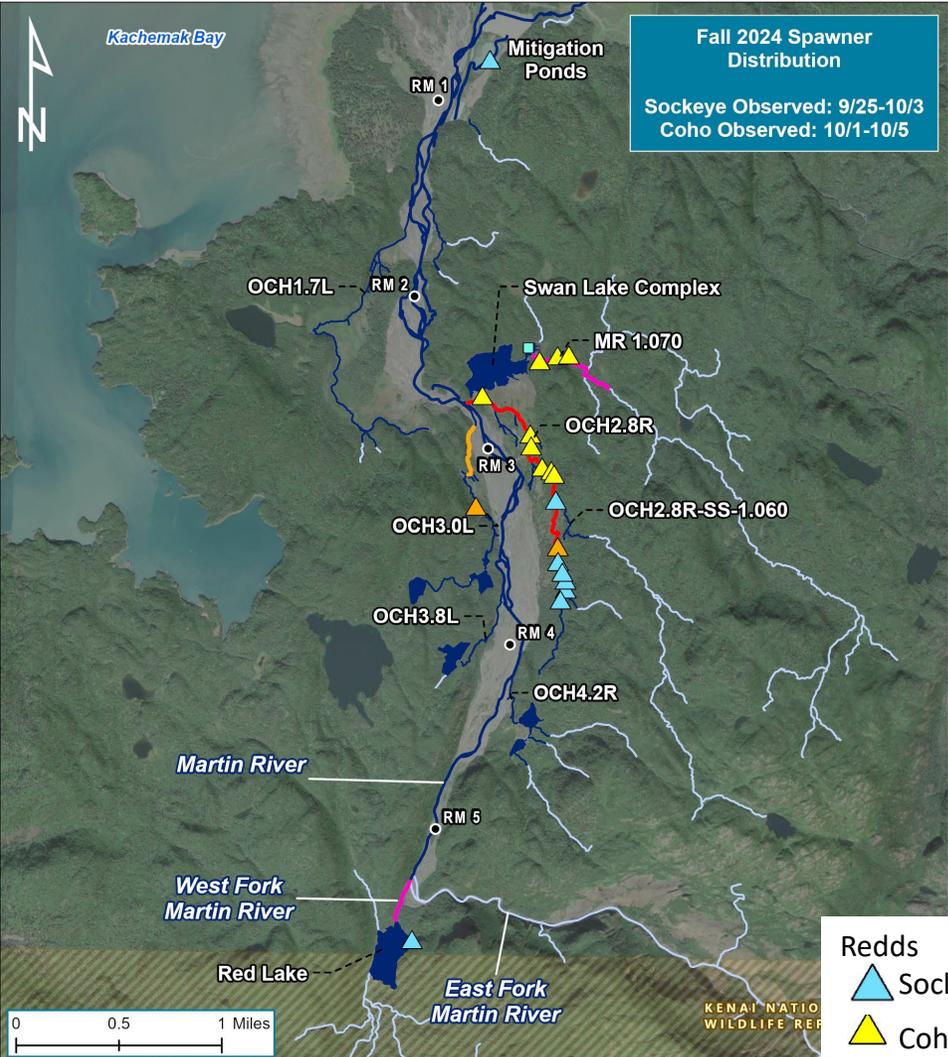
OCH-Tributary Complex	Sockeye Salmon		Coho Salmon		Dolly Varden	
	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult
OCH1.7R			1+, 2+		Juv	
OCH1.7L			1+, 2+	✓ <sup>2025</sup>	Juv	
Swan Lake/ Trib MR1.070			YOY, 1+, 2+	✓	YOY, Juv	✓
OCH2.8R	YOY	✓	YOY, 1+, 2+	✓	YOY, Juv	✓
Trib MR1.090			1+		Juv	
OCH3.0L*			YOY, 1+, 2+		YOY, Juv	✓
OCH3.8L*			1+, 2+	✓ <sup>2025</sup>	YOY, Juv	✓
OCH4.2R*			YOY, 1+, 2+		Juv	
Red Lake	YOY, 1+, 2+	✓	YOY, 1+, 2+	✓	Juv	✓

\* May only be accessible to adults in some years or at higher flows. In 2024 tributaries were very shallow at mouth, potential adult passage barrier; hydraulic modeling at connection found depths <0.7 ft (OCH3.0L) and <0.3 ft (OCH3.8L, OCH4.2R)

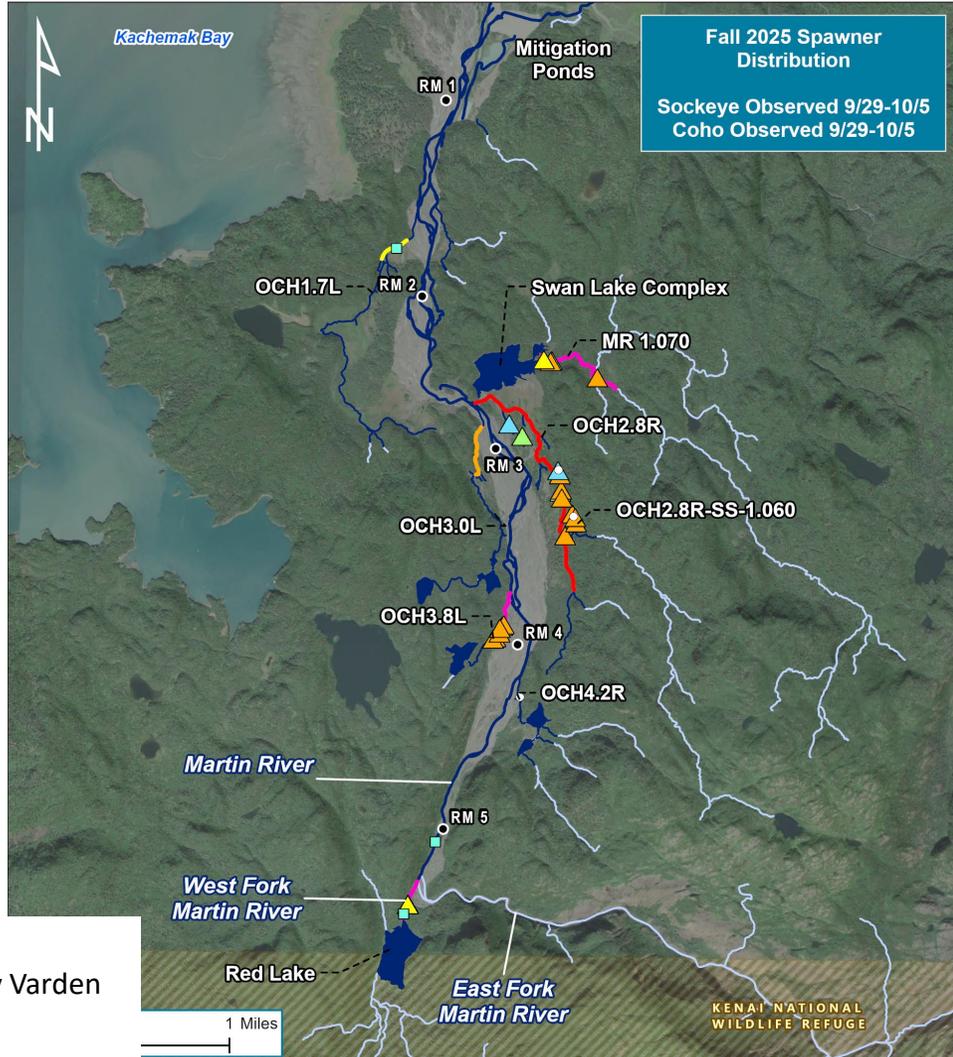
2025 – adults only documented in fall 2025



# Martin River – Sockeye and Coho Salmon Spawning Distribution



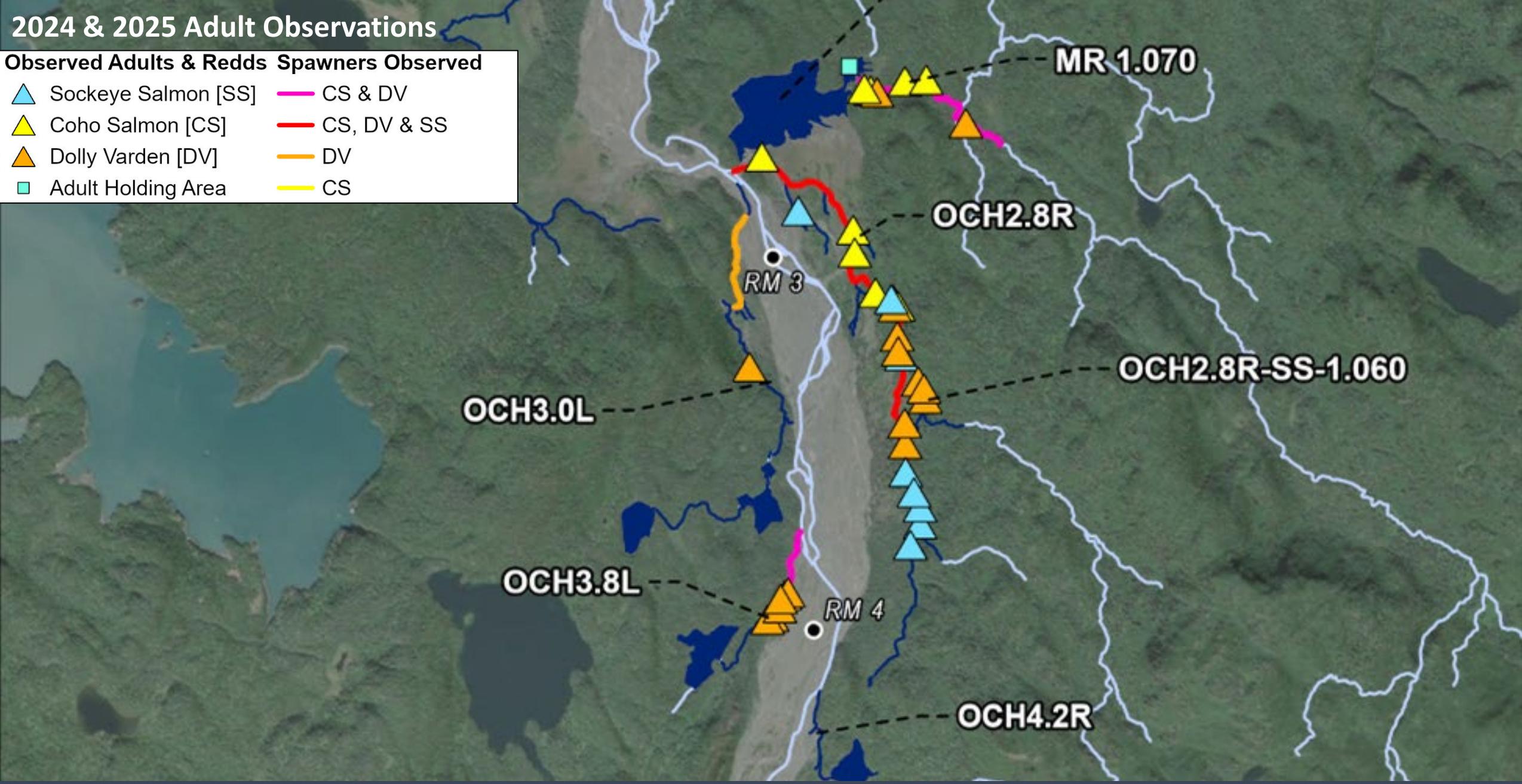
- No spawning in mainstem Martin River
- Significant salmon spawning (2024 and 2025)
  - Red Lake
  - OCH2.8R
  - MR1.070 (Coho only)
- Adult Coho observed in 2025 only
  - OCH1.7L
  - OCH3.8L



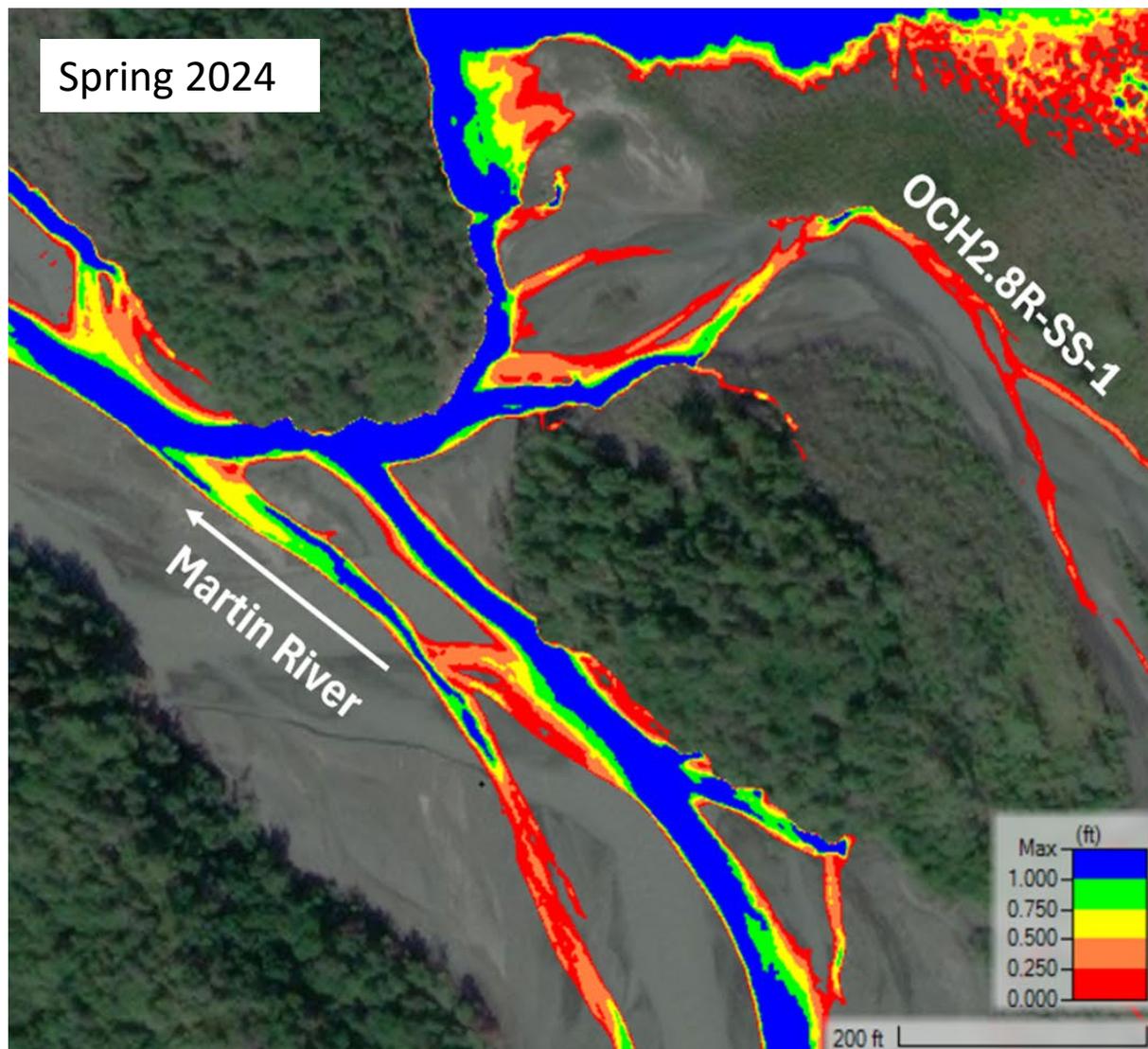
# 2024 & 2025 Adult Observations

**Observed Adults & Redds Spawners Observed**

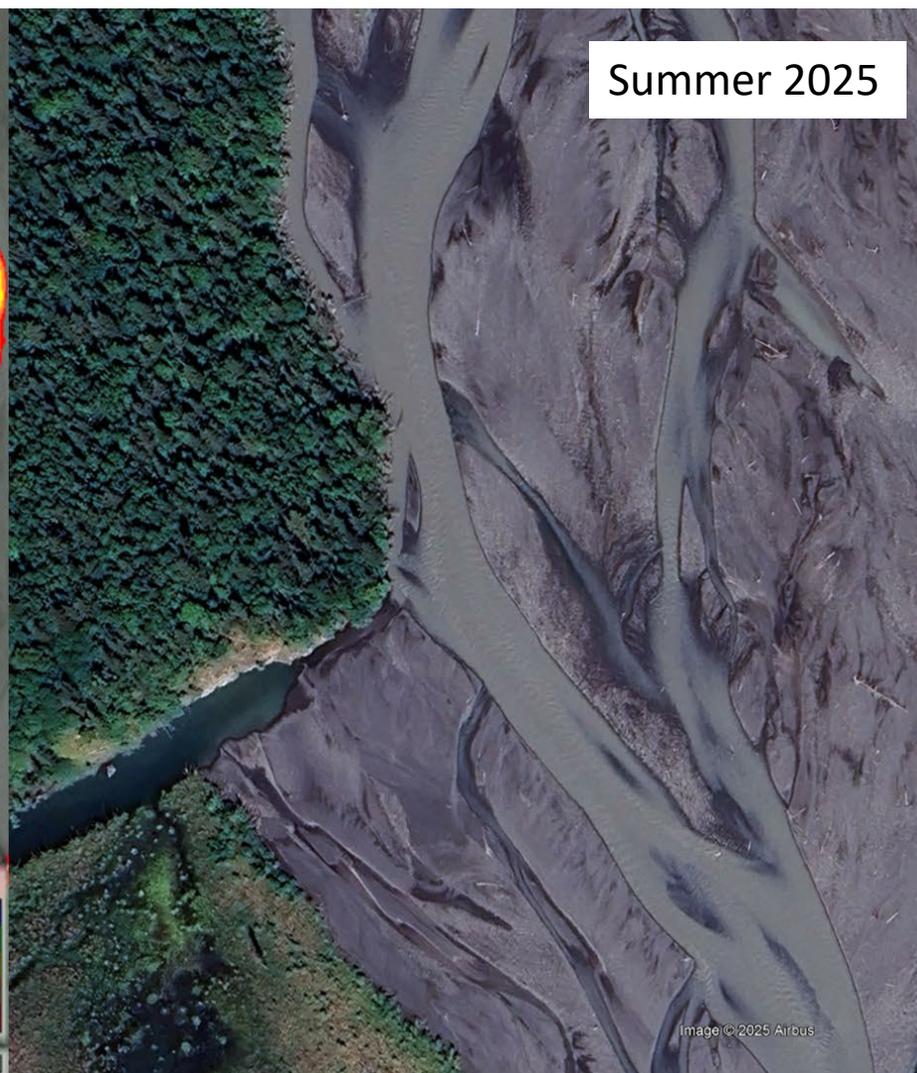
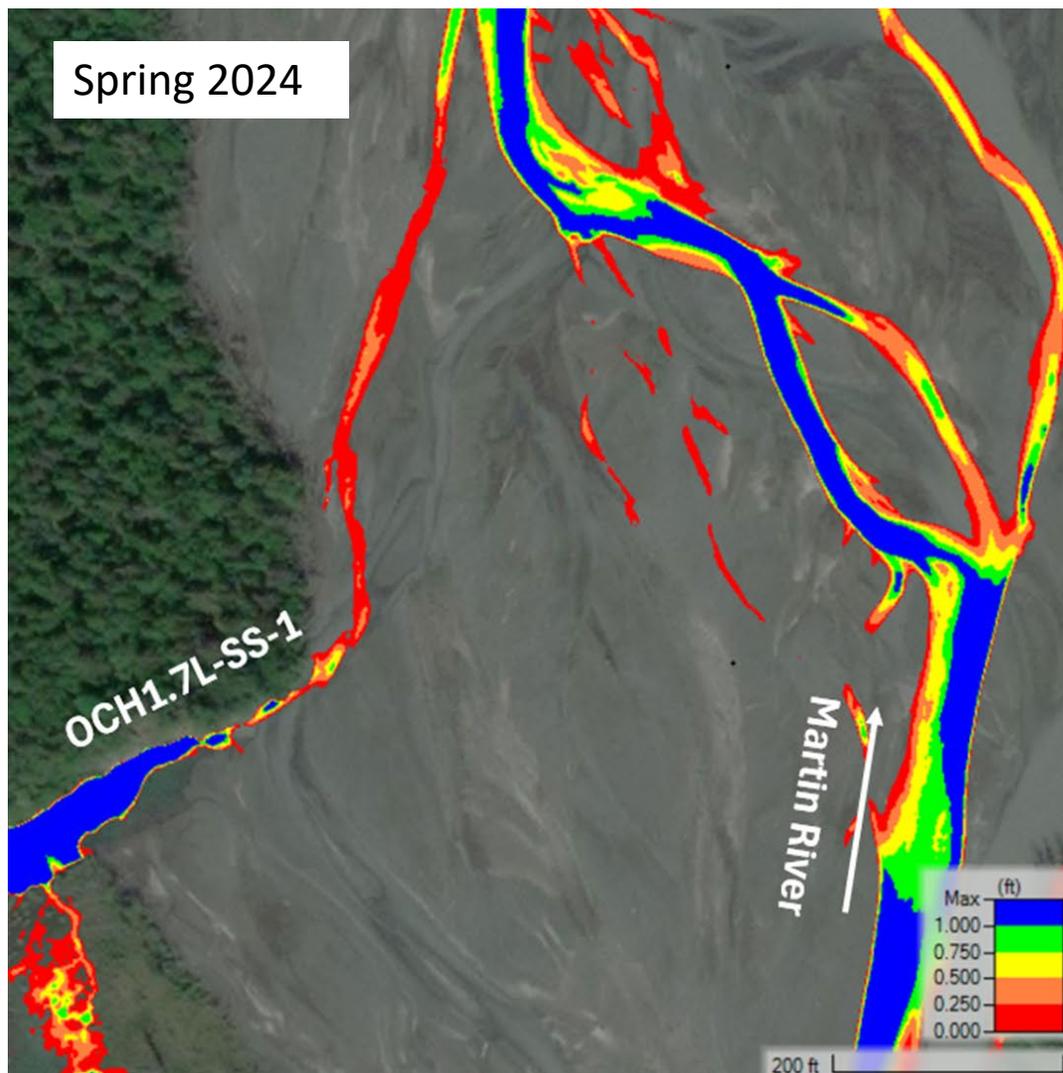
Sockeye Salmon [SS]	CS & DV
Coho Salmon [CS]	CS, DV & SS
Dolly Varden [DV]	DV
Adult Holding Area	CS



# OCH2.8R / Swan Lake Complex



# OCH1.7L



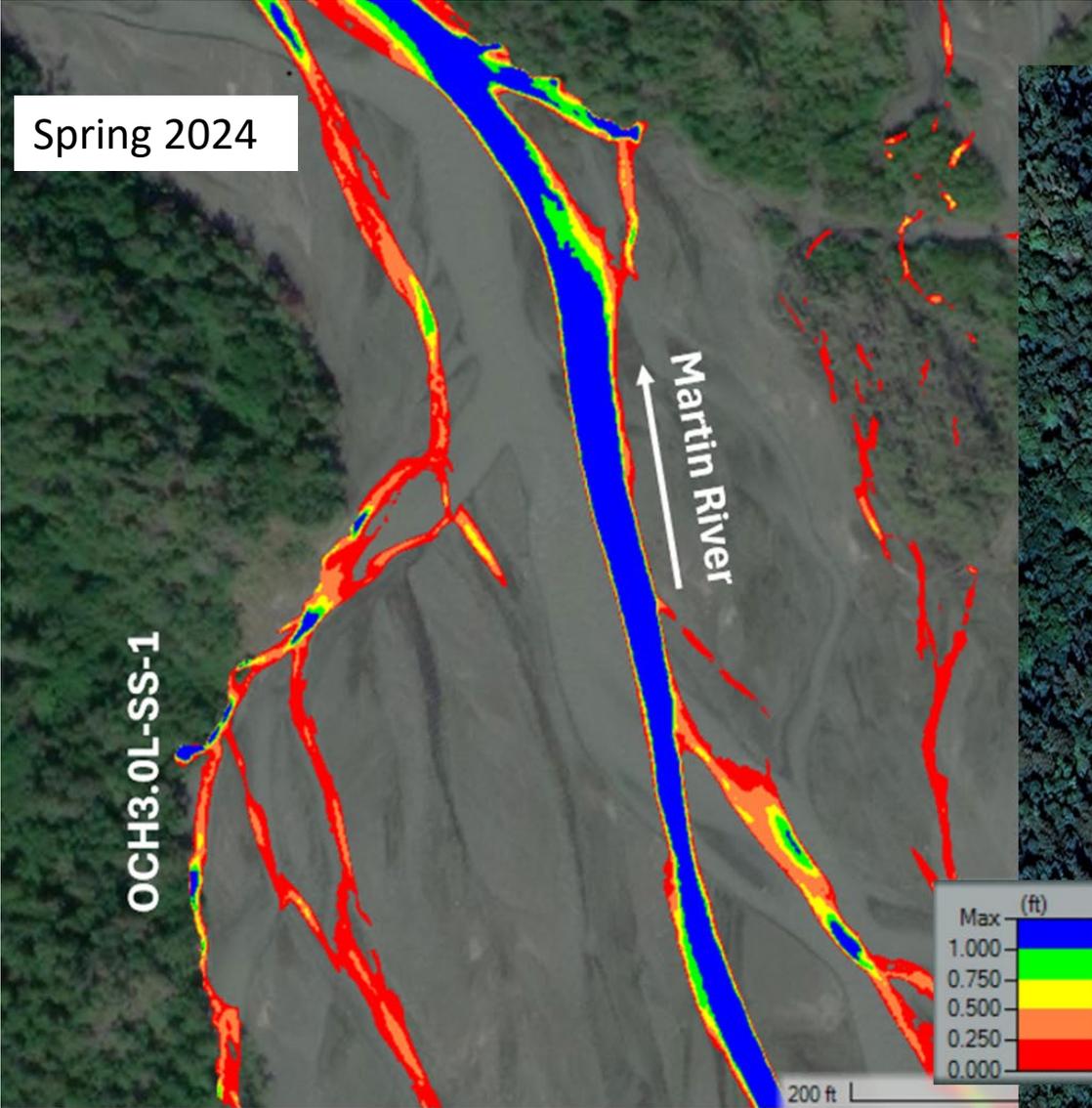
## 2024

- Coho
  - 1+, 2+

## 2025

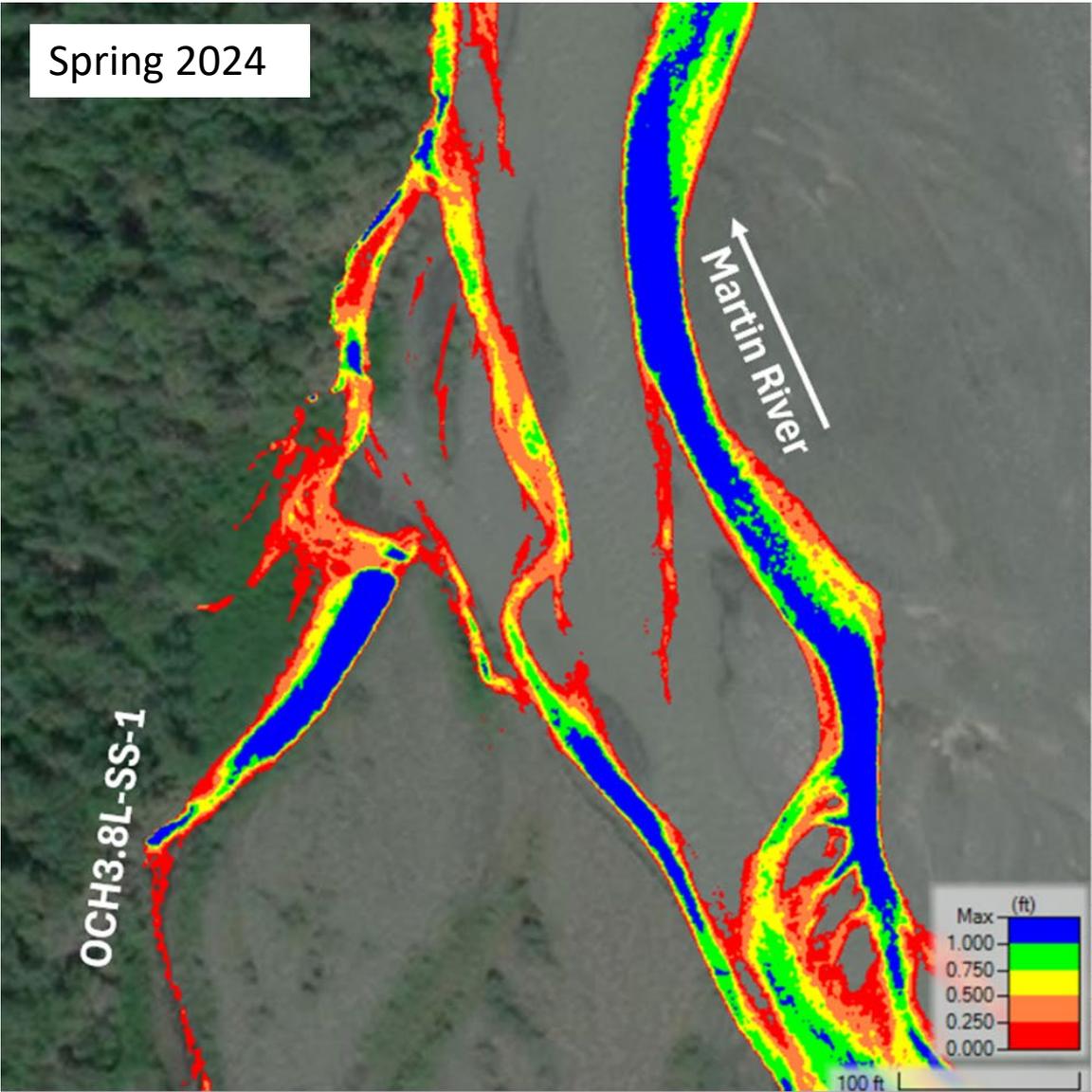
- Coho
  - Adults
  - 1+, 2+

# OCH3.0L



# OCH3.8L

Spring 2024

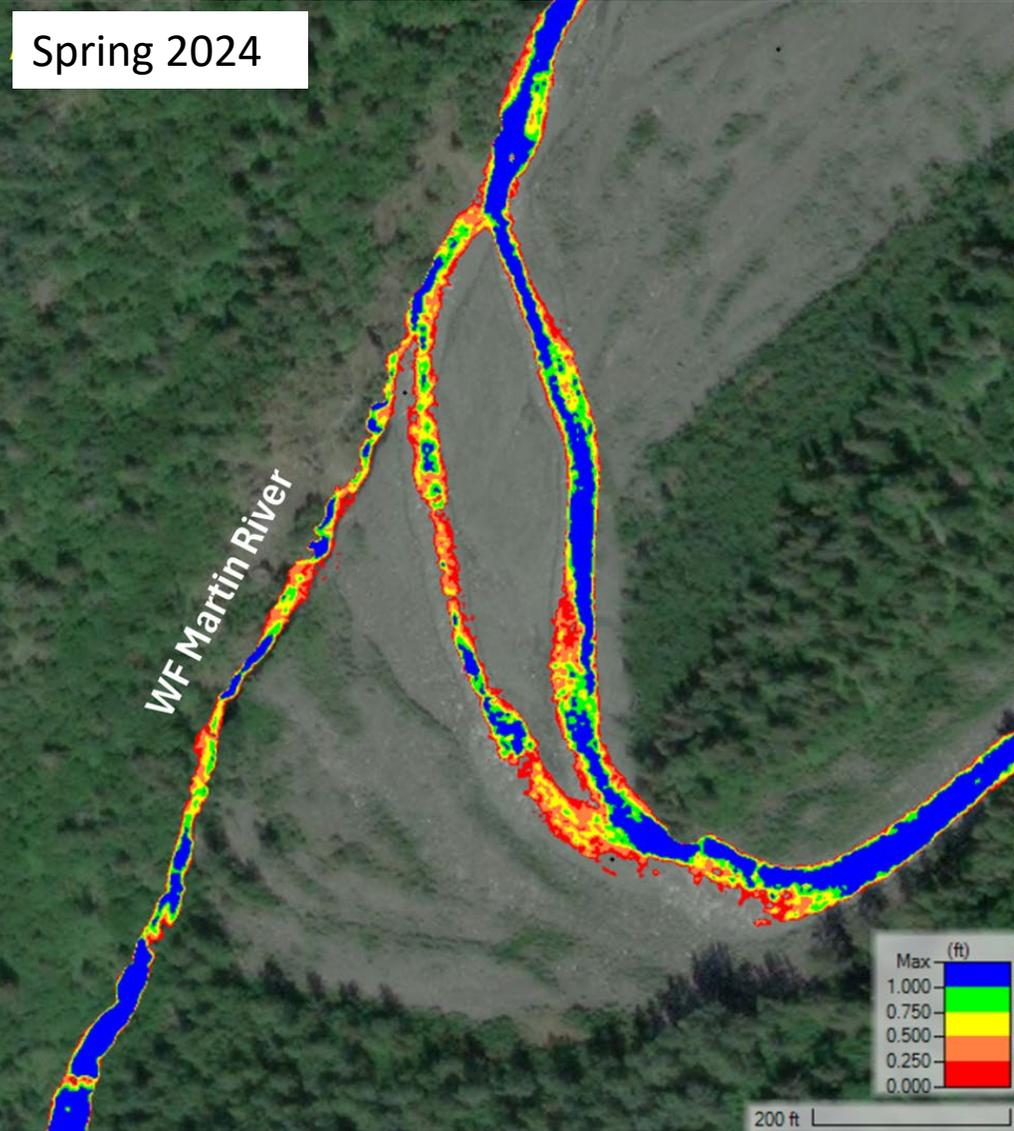


Summer 2025



- 2024
  - Coho
    - 1+, 2+
- 2025
  - Coho
    - Adults
    - 1+, 2+

# Red Lake Outlet

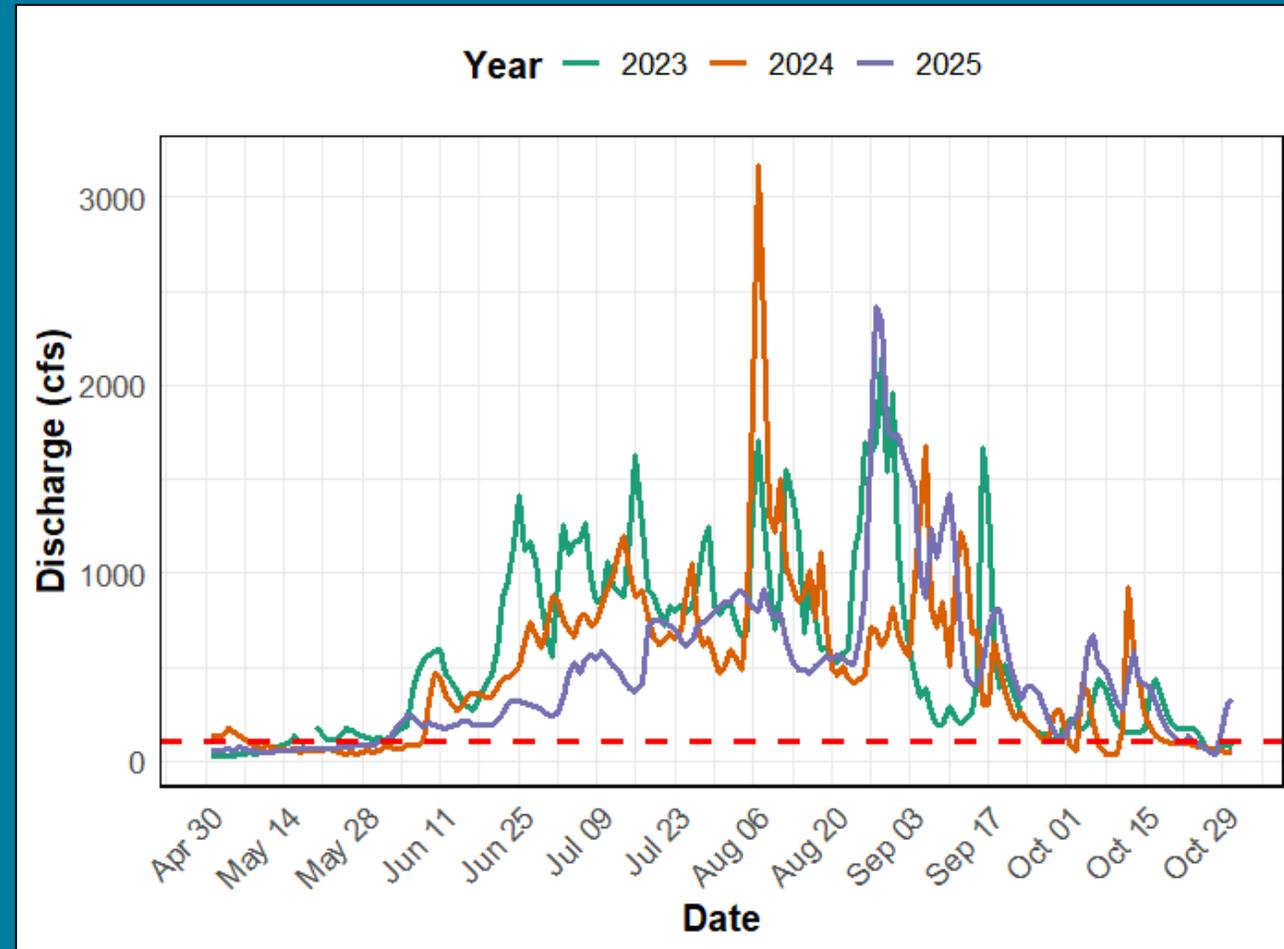


## 2024 and 2025

- **Sockeye**
  - Spawning
  - YOY, 1+, 2+
- **Coho**
  - Spawning
  - YOY, 1+, 2+

# Results – Summer 2025 (July 28 – August 3)

- No Pink or Chum salmon captured/observed in Martin River watershed
  - Estimated velocities @ PRM1.9 exceed sustained swimming capabilities when cfs > 108
- Pink Salmon were actively spawning in adjacent Battle Creek; had not been observed in pre-construction surveys



Line @ 108 cfs; PRM1.9

# Results – Non-salmonids

- No Eulachon observed (2024-2025)
  - May 2025 - Flows near mouth exceeded sustained swimming speeds (1.2 fps; Spangler 2020)
- Three-spined and Ninespine stickleback
  - Vegetated edges of lakes, flooded marsh grass and estuarine sloughs at mouth
- Few freshwater (*Cottus* spp.) and Staghorn sculpin



# Results – Red Lake Parasite (2025)

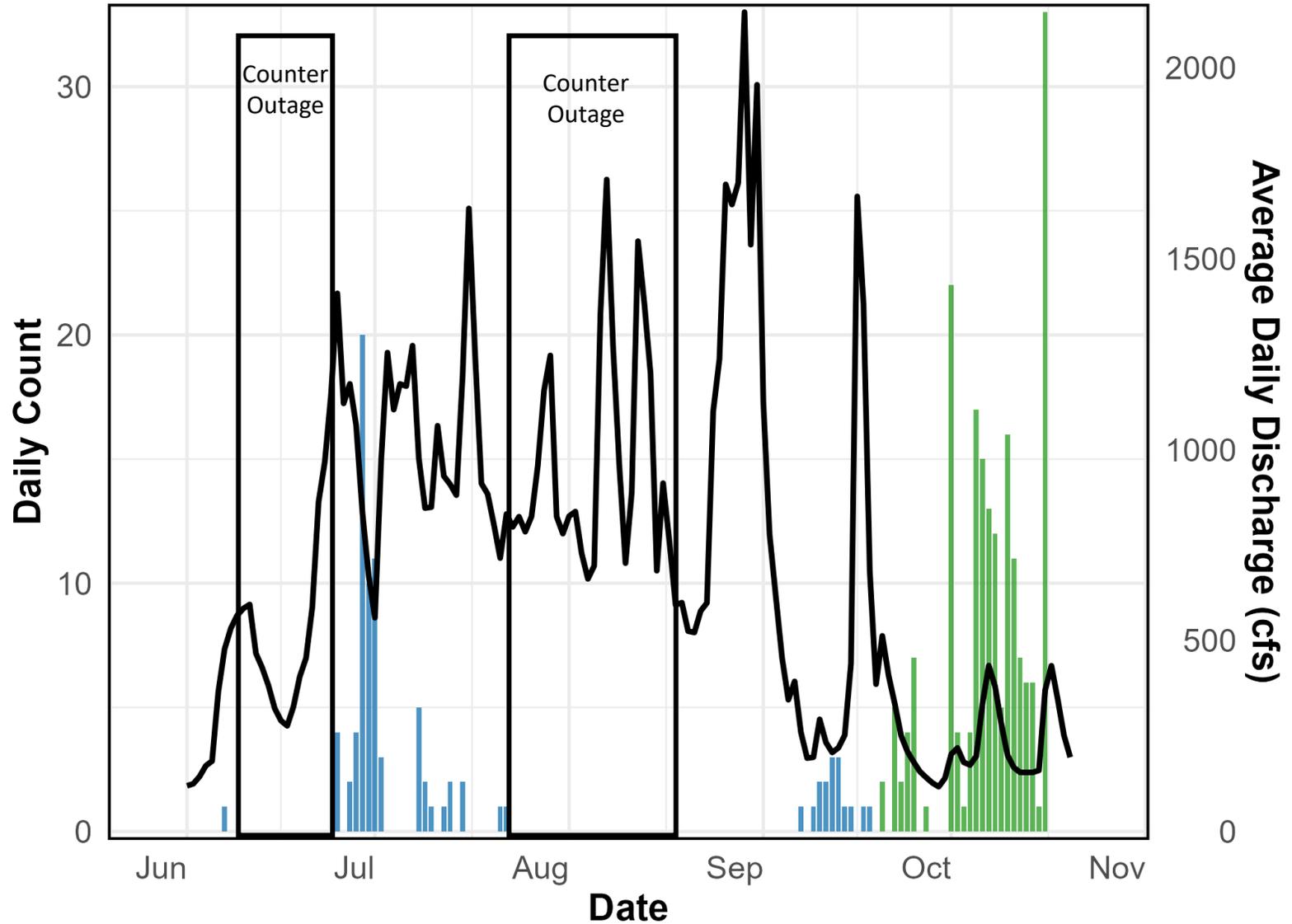
- 25+ affected fish observed on July 31 survey
  - Bloating, exophthalmia (pop eye), lethargy
  - Both Sockeye and Coho
  - 16.7°C; 13.52 mg/L DO
- ADF&G Pathology Lab examination of live fish
  - Larval digenean trematodes in musculature, cranial, gill tissues
  - Extensive tissue damage; high parasitic load
  - Bacterial, viral, BKD testing negative
- Complex parasitic lifecycle
  - Birds/mammals – snails – fish



# 2023 Red Lake AVCT Salmon Counts and Flow

**Total Count**

- 66 Sockeye
- 294 Coho



**80% of run:**

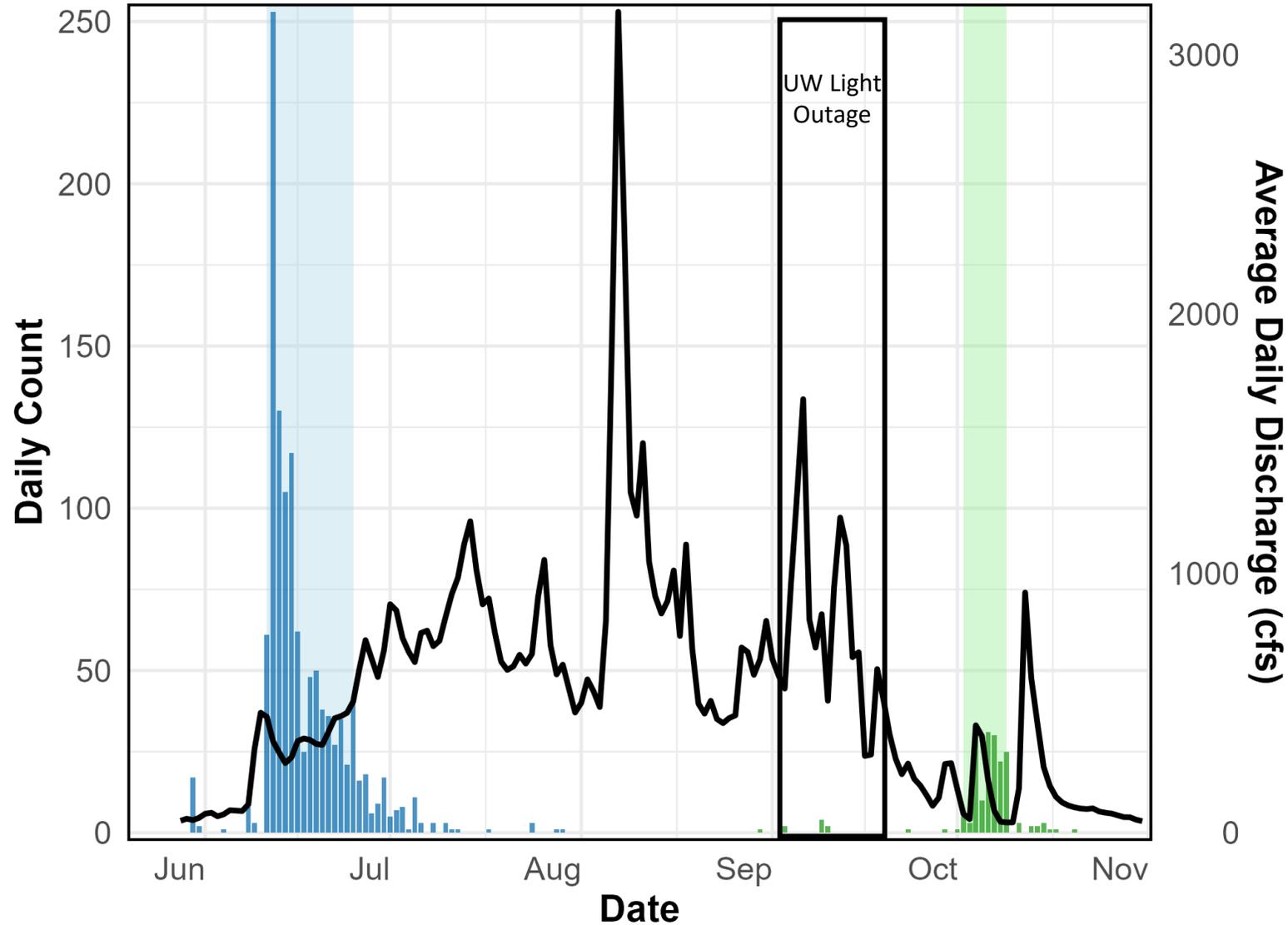
- Sockeye
  - N/A
- Coho
  - 10/1 – 10/16

\*outages

# 2024 Red Lake AVCT Salmon Counts and Flow

**Total Count**

- 1,197 Sockeye
- 182 Coho



**80% of run:**

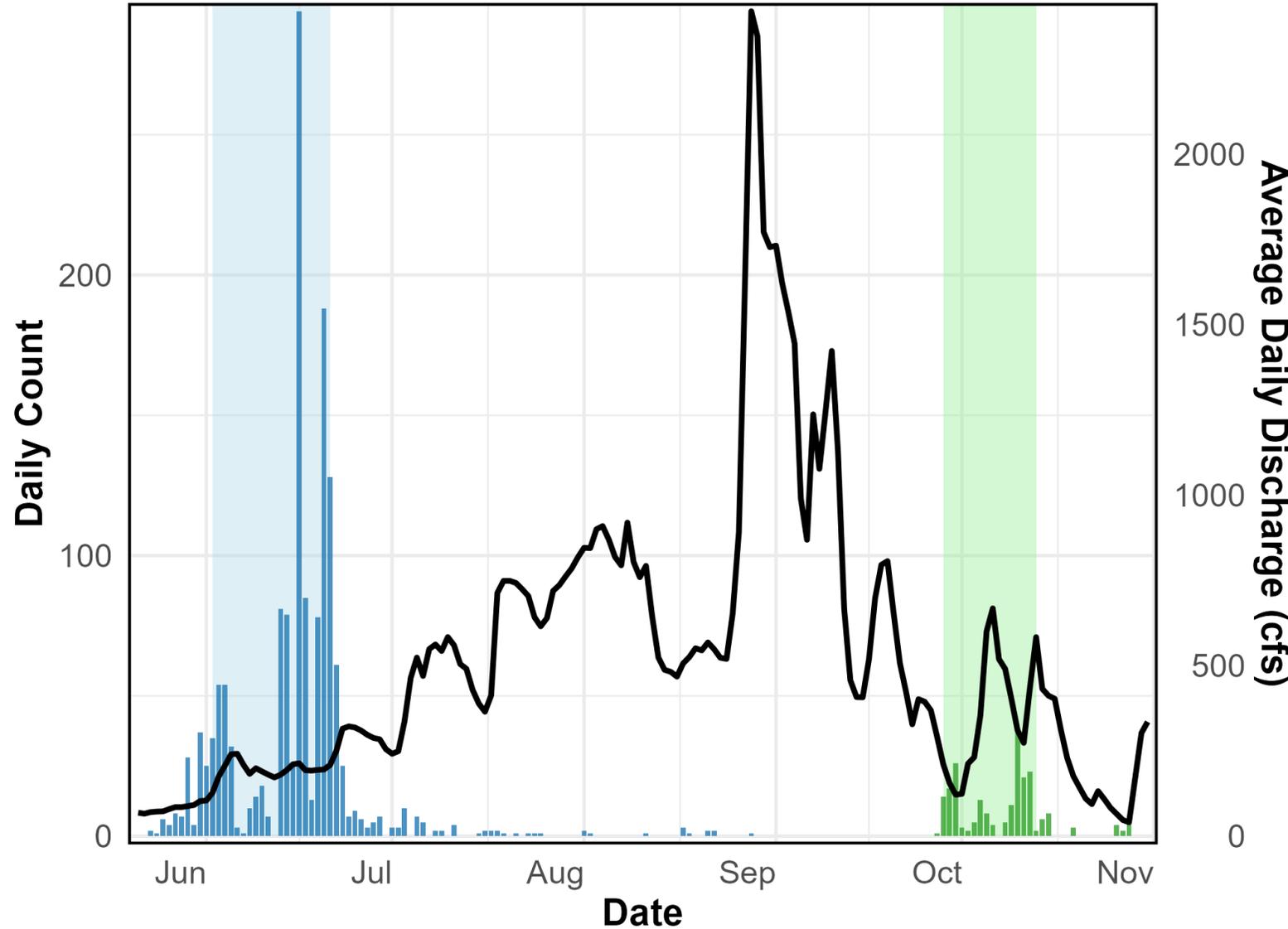
- Sockeye
  - 6/11 – 6/25
- Coho
  - 10/2 – 10/9

\*outages

# 2025 Red Lake AVCT Salmon Counts and Flow

**Total Count**

- 1,500 Sockeye
- 214 Coho



**80% of run:**

- Sockeye
  - 6/2 – 6/21
- Coho
  - 9/28 – 10/13

\*outages

# QUESTIONS?

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# Martin River Fish Use: Red Lake AVCT

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Ted Otis

Alaska Department of Fish and Game

3298 Douglas Place, Homer

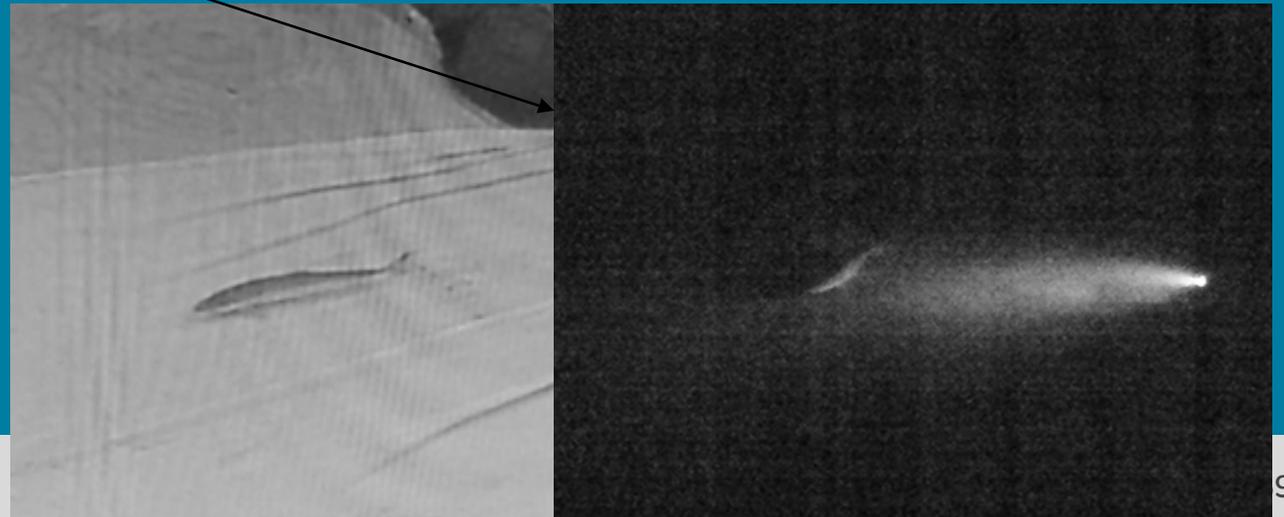
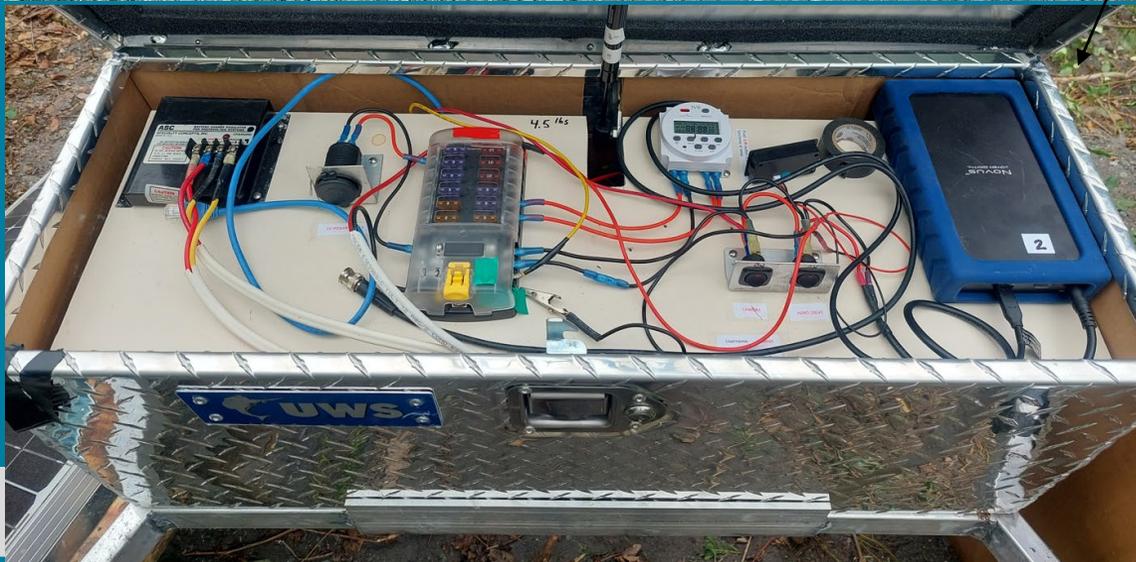
ted.otis@alaska.gov



# Red Lake Fish Monitoring- Methods



- Autonomous Video Counting Tower (AVCT)
  - high resolution time-lapse video camera (MJPEG)
  - “flash-panel” (enhances contrast)
  - strongbox with electrical components
  - 2 Group 31 12VDC AGM batteries
  - solar panels to recharge batteries
  - records 24-h per day
  - all video is reviewed (no sub sampling)
  - adult fish identified to species and counted
  - *underwater lights added in 2023 (night counts)*



Pre-flood (2022)



Post-flood (2024)



# AVCT operations: 2022 – 2025

- 2022
  - No video interruptions, but day counts only
- 2023
  - 2 video interruptions (9-22 June, 27 July-24 Aug)
  - Installed underwater light to assess nocturnal migration
  - Illuminated 4-12 hrs of darkness per night
  - Expanded counts to estimate total nocturnal migration
- 2024
  - No video interruptions
  - Flood caused UW light to fail 2x (7-28 Aug, 8-23 Sep)
  - Illuminated 8 hrs per night (exp counts for remainder)
  - Flood dramatically changed the site, high turbidity
- 2025
  - 1 minor video interruption, no impact to counts
  - UW light worked flawlessly
  - Illuminated most of the night, no expansion needed

# Results: AVCT performance and fish counts

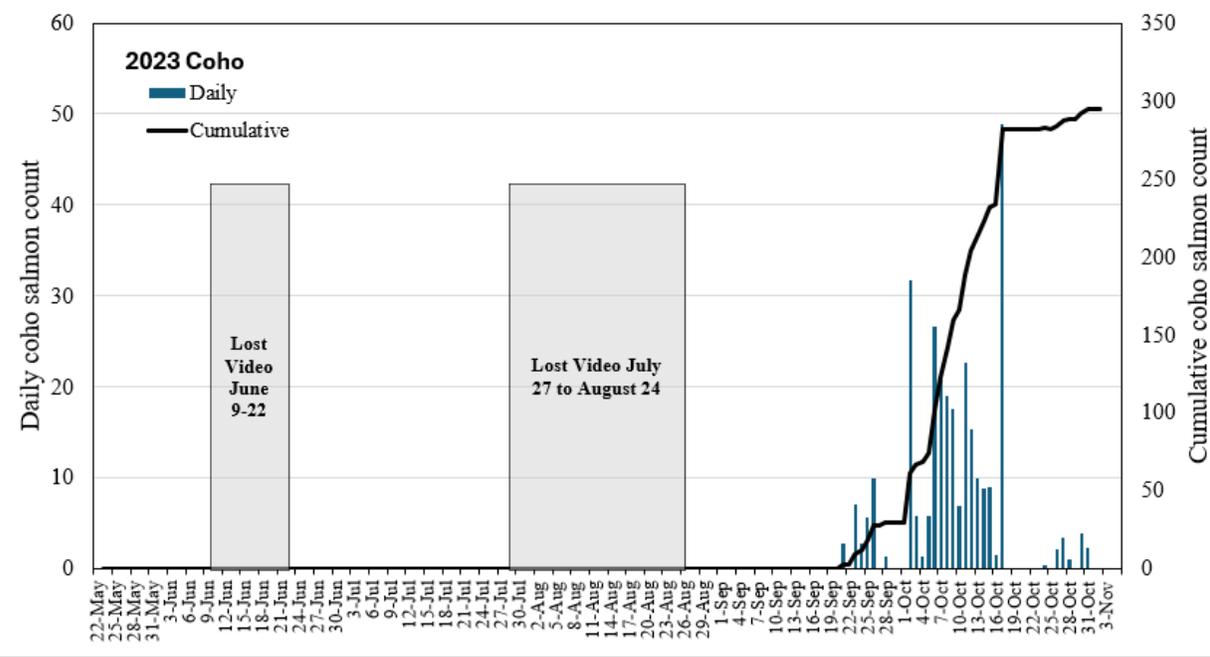
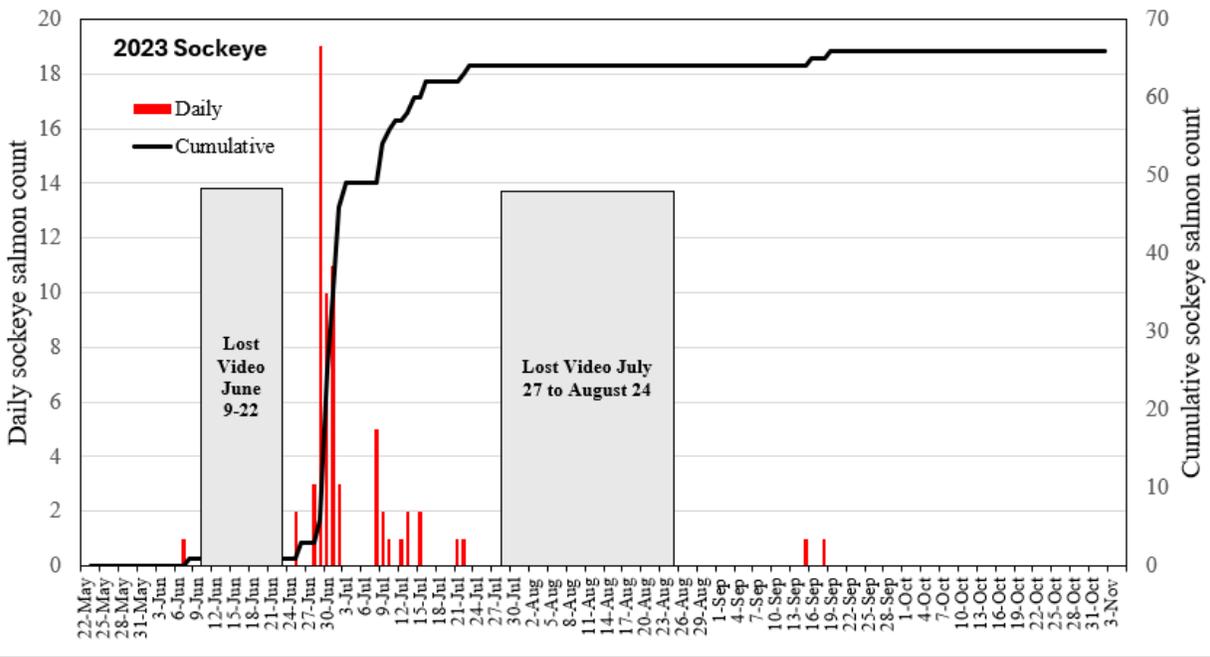
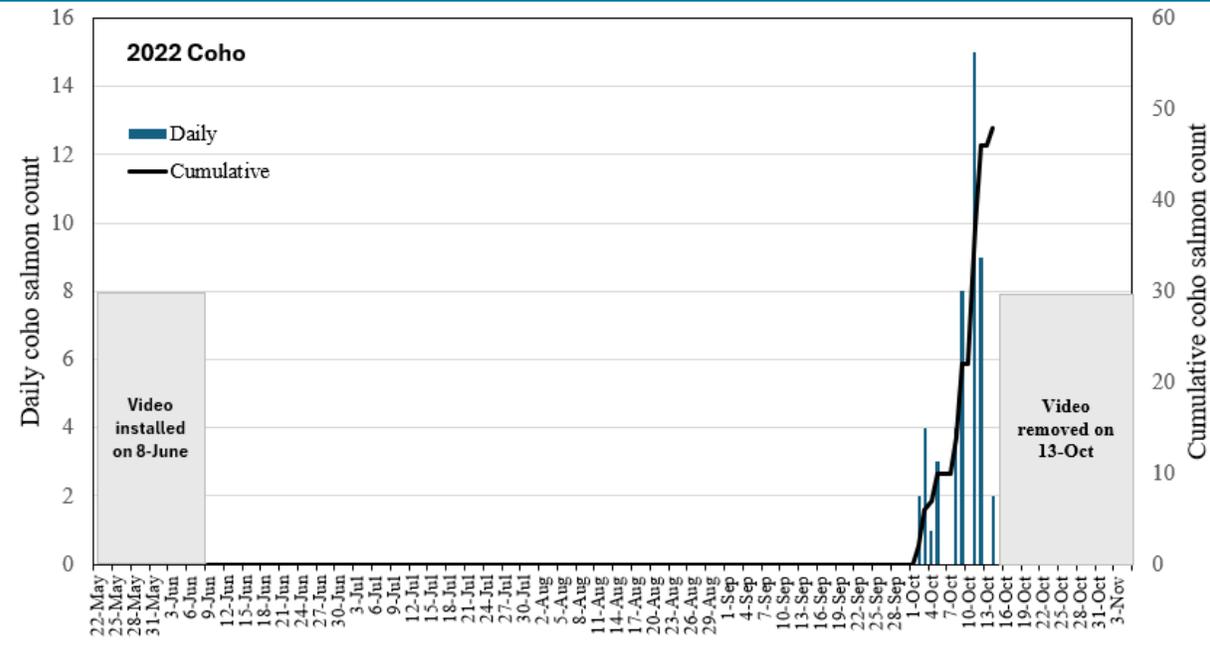
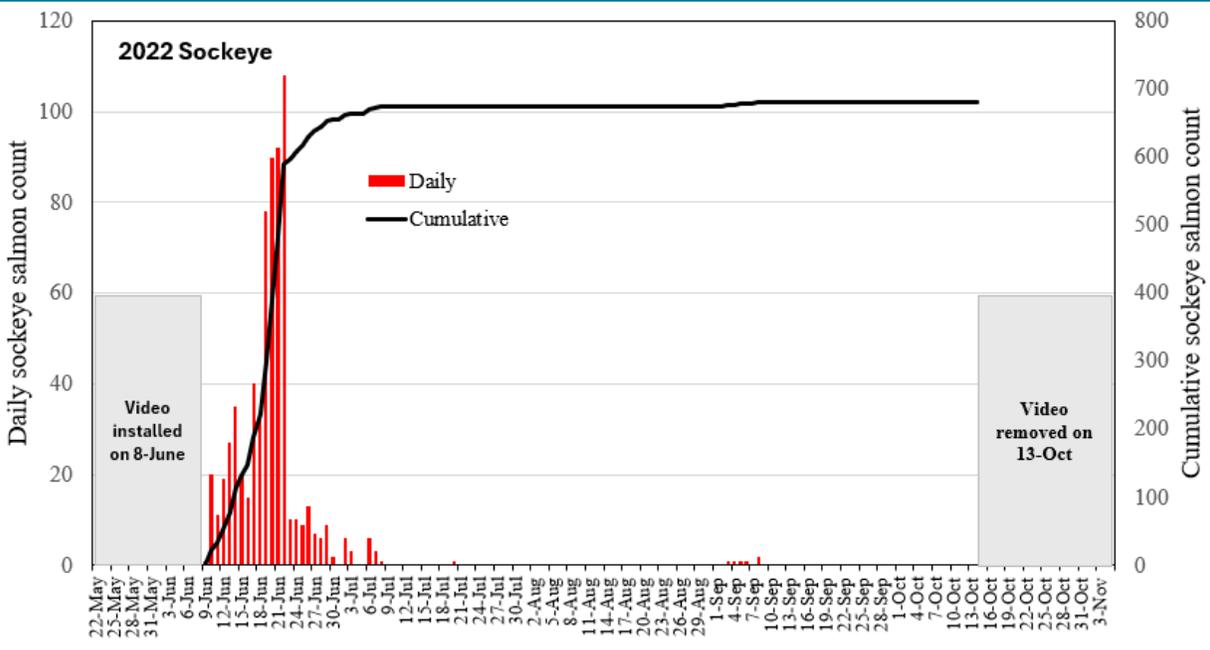
Year	Dates of operation		Days recorded	Hours recorded	Video reliability	Total escapement			
	Start	End				Sockeye	Coho	Pink	Dollies
2022 <sup>a</sup>	8-Jun	13-Oct	127	2,540	100%	681	48	5	53
2023 <sup>b</sup>	22-May	1-Nov	163	2,960	73%	66	294	0	58
2024 <sup>c</sup>	28-May	2-Nov	158	3,812	100%	1,197	182	0	88
2025 <sup>d</sup>	22-May	4-Nov	166	3,870	97%	1,500	214	0	855
Avg.			154	3,295	93%	861	185	1	264

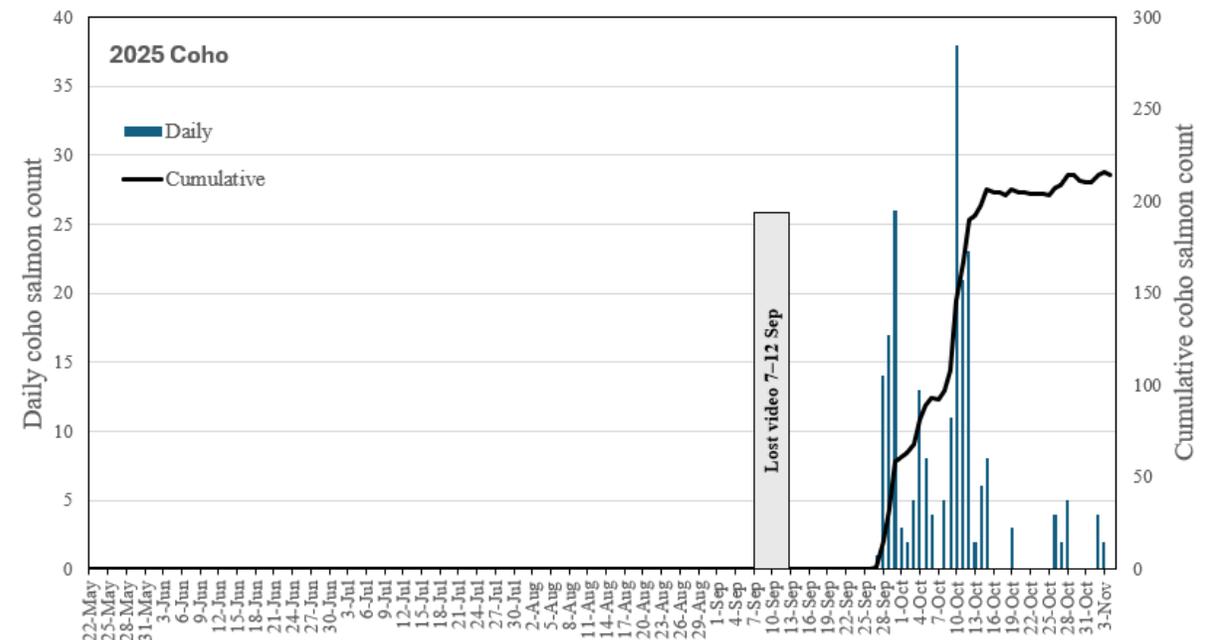
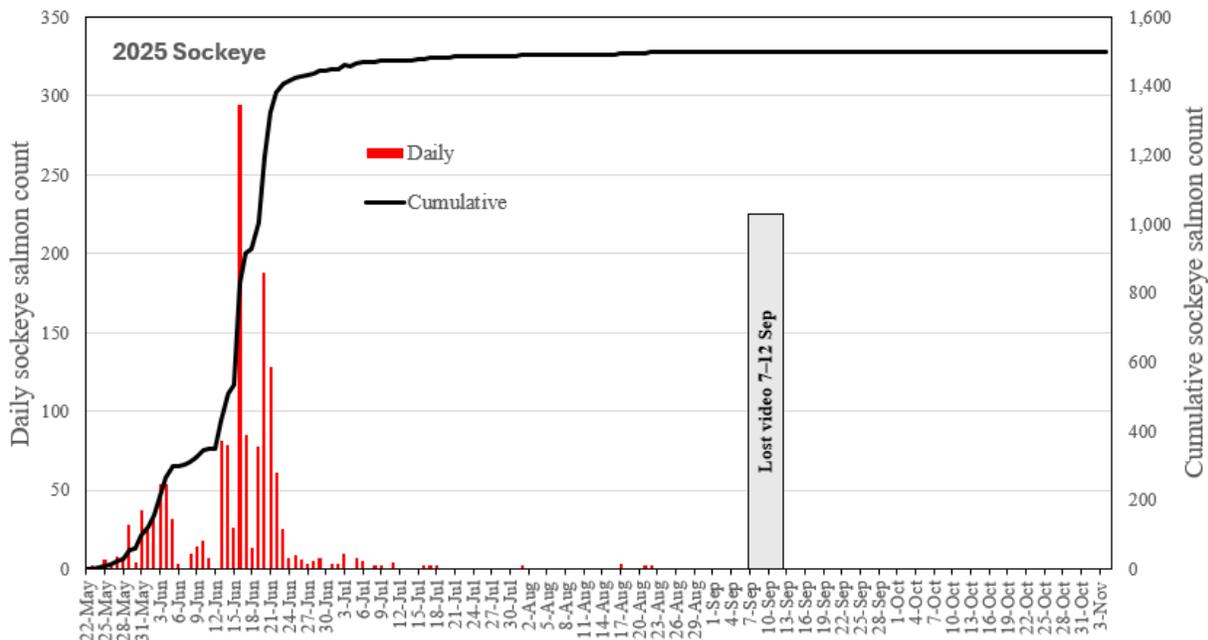
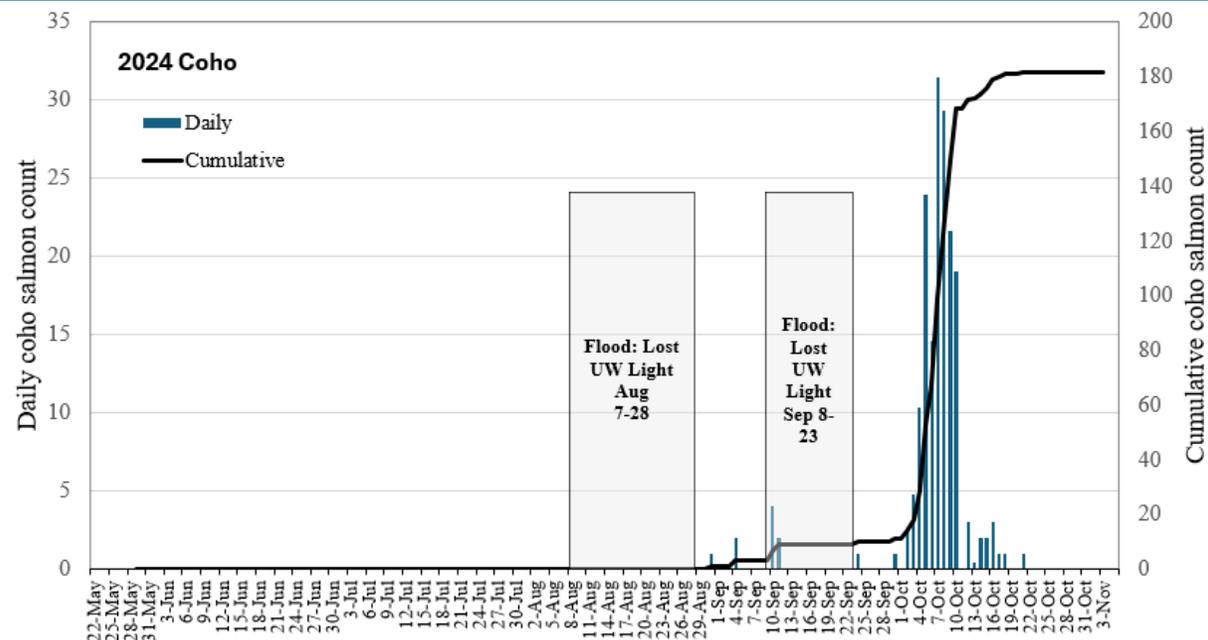
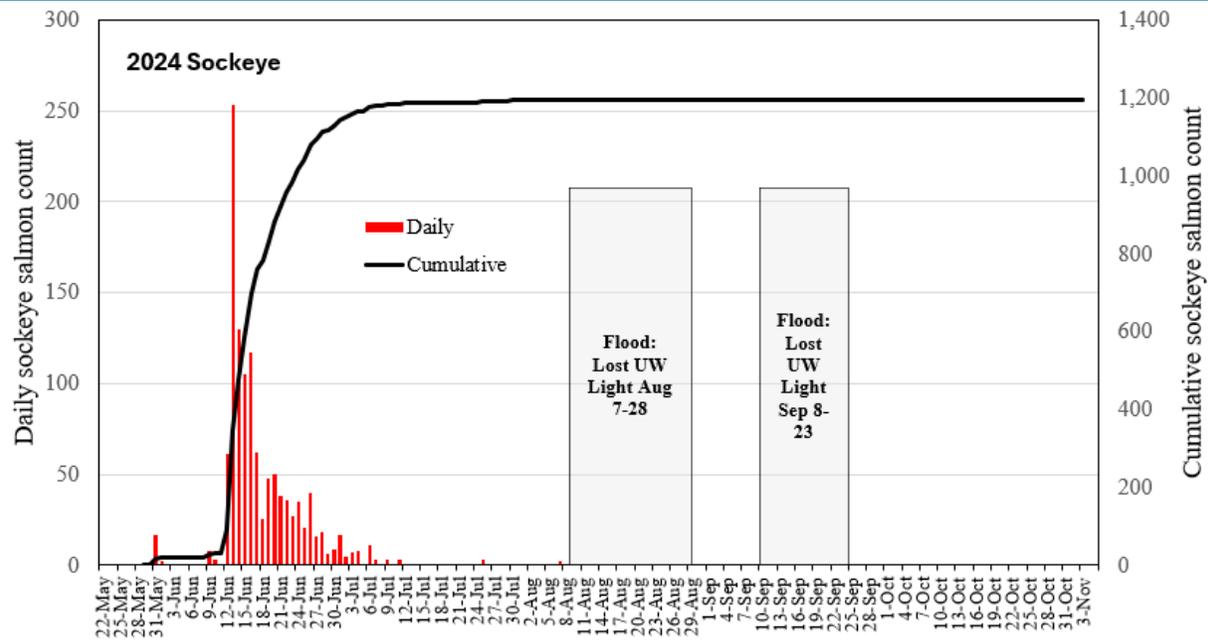
<sup>a</sup> 2022: no nocturnal counts likely resulted in a very conservative coho salmon estimate

<sup>b</sup> 2023: video loss affected the sockeye count; 98% of coho passed at night; includes expansion count of 89 coho salmon

<sup>c</sup> 2024: 76% of coho passed at night; includes expansion count of 39 coho salmon

<sup>d</sup> 2025: 95% of coho passed at night; stopped counting Dolly Varden on Sept 30<sup>th</sup> due to excessive milling behavior





# Other wildlife observed (19 species)



- American dipper *Cinclus mexicanus* (2022, 2023, 2024)
- American mink *Neogale vison* (2023, 2024)
- Bald eagle *Haliaeetus leucocephalus* (2022, 2023, 2024, 2025)
- Beaver\* *Castor canadensis* (2022, 2023, 2024, 2025)
- Belted kingfisher *Megaceryle alcyon* (2023, 2024, 2025)
- Black bear\* *Ursus americanus* (2022, 2023, 2024, 2025)
- Black-billed magpie *Pica hudsonia* (2024)
- Brown bear\* *Ursus arctos* (2022, 2023, 2024, 2025)
- Common merganser\* *Mergus merganser* (2022, 2023, 2024, 2025)
- Coyote *Canis latrans* (2022, 2023)
- Great blue heron *Ardea herodias* (2024)
- Harlequin duck *Histrionicus histrionicus* (2022, 2023)
- Mountain goat *Oreamnos americanus* (2023)
- Red fox *Vulpes Oreamuno's* (2023)
- Red squirrel *Tamiasciurus hudsonicus* (2022, 2024)
- River otter\* *Lontra canadensis* (2022, 2023, 2024, 2025)
- Spotted sandpiper *Actitis macularius* (2022, 2024)
- Trumpeter swan *Cygnus buccinator* (2025)
- Unidentified hawk *Accipiter sp.* (2022, 2023, 2024)

\* Most frequently observed

# Questions?



# Hydraulic and Habitat Connectivity Modeling

Kleinschmidt Associates:  
Mike Gagner  
Chiming Huang

***Kleinschmidt***



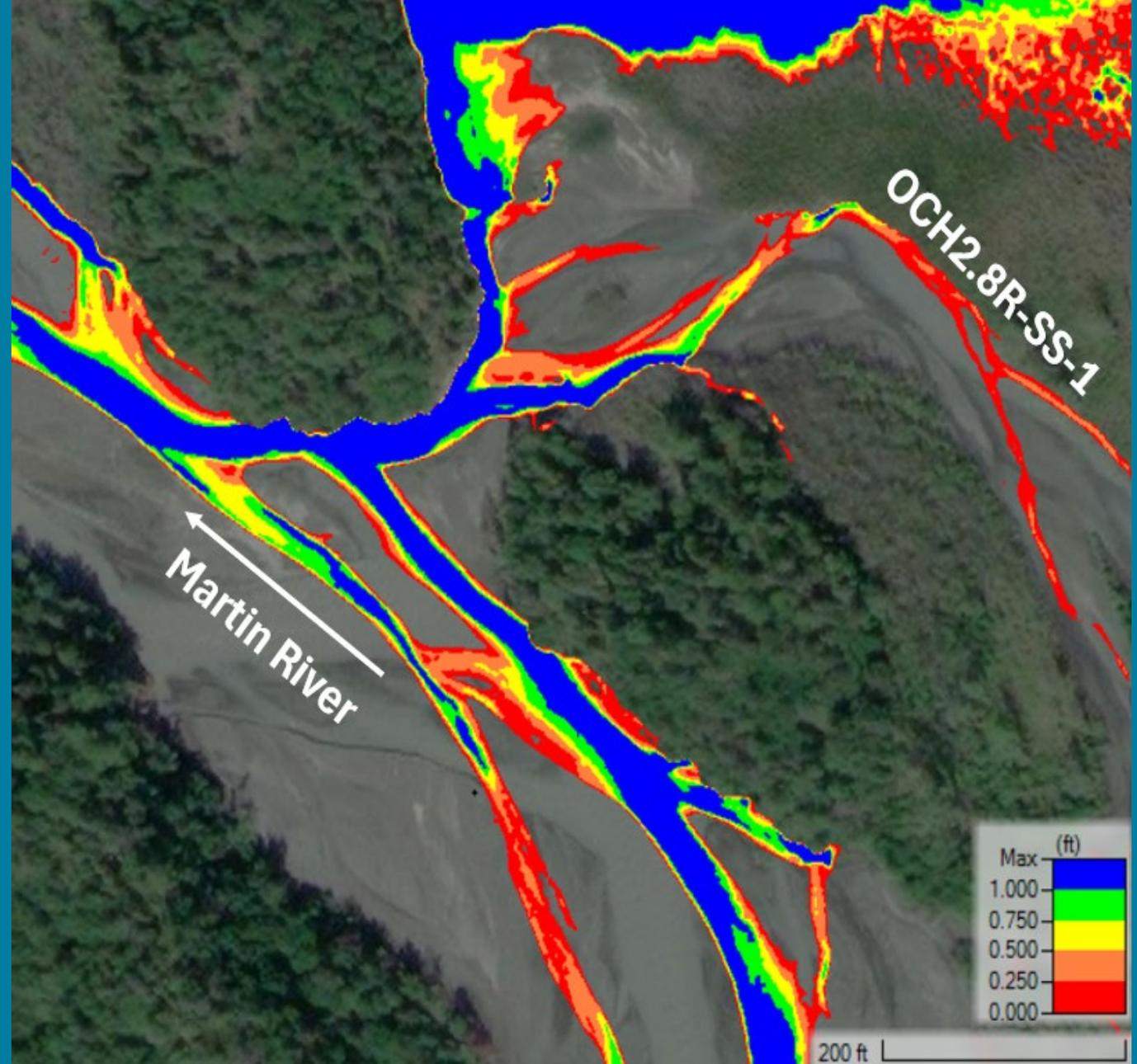
# Fish Passage & Habitat Connectivity Study

- Developed hydraulic model based on May 2024 channel
- Estimated water depth at different EFMR flows:
  - ✓ 100, 150, 200 cfs
- Evaluated fish passage and habitat connectivity based on water depth and velocity criteria



# Hydraulic Modeling

- HEC-RAS 2D model
- Model Calibration
- Application to 3 EFMR flow scenarios:
  - 100, 150, & 200 cfs



# Passage Criteria

## Water Depth:

- Coho, Sockeye, Dolly Varden
  - ✓ Adult – 0.70 ft

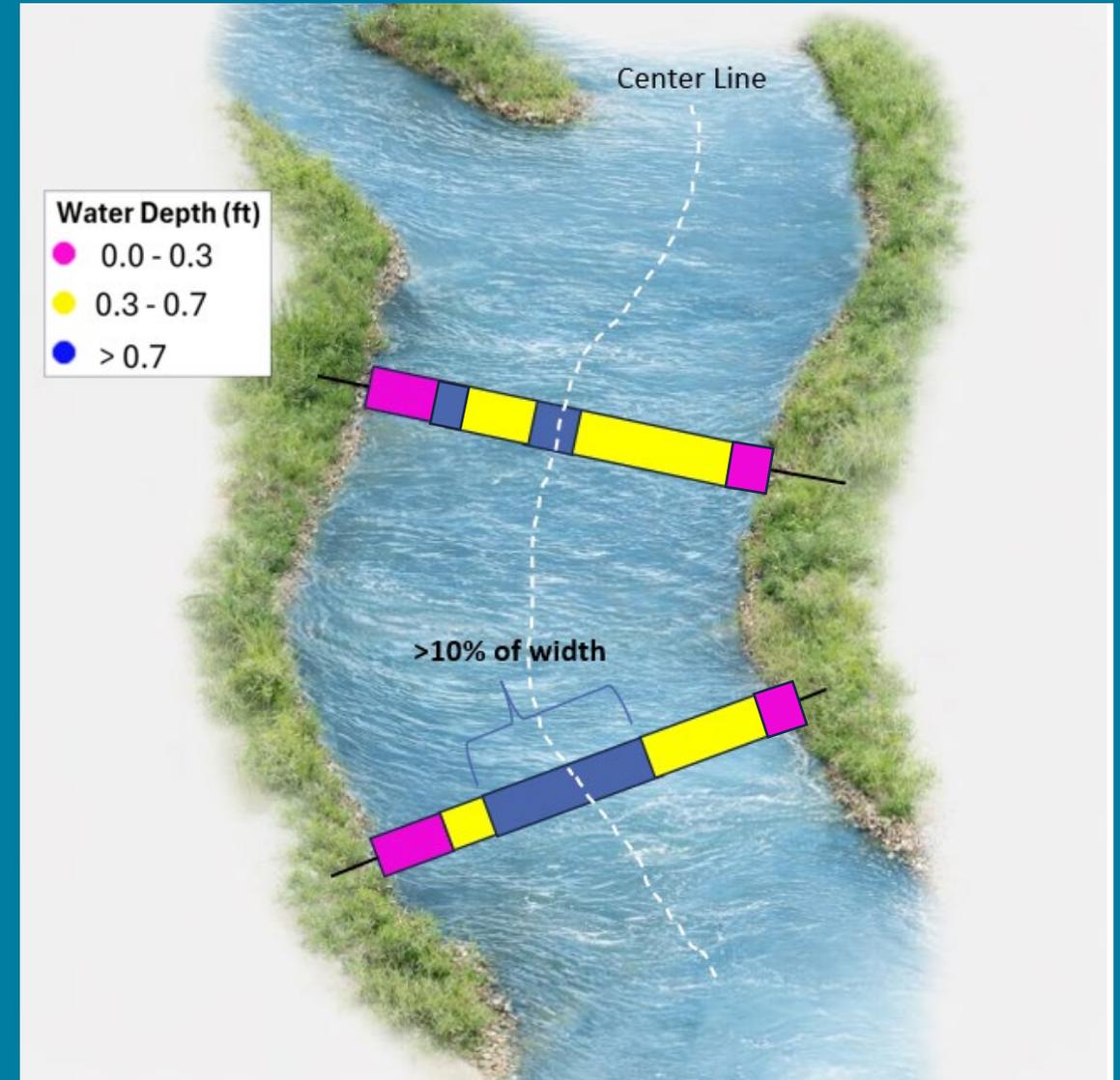
## Water Velocity

- ✓ 2.5-3.5 ft/sec Sustained
- ✓ 4-11 ft/sec Prolonged

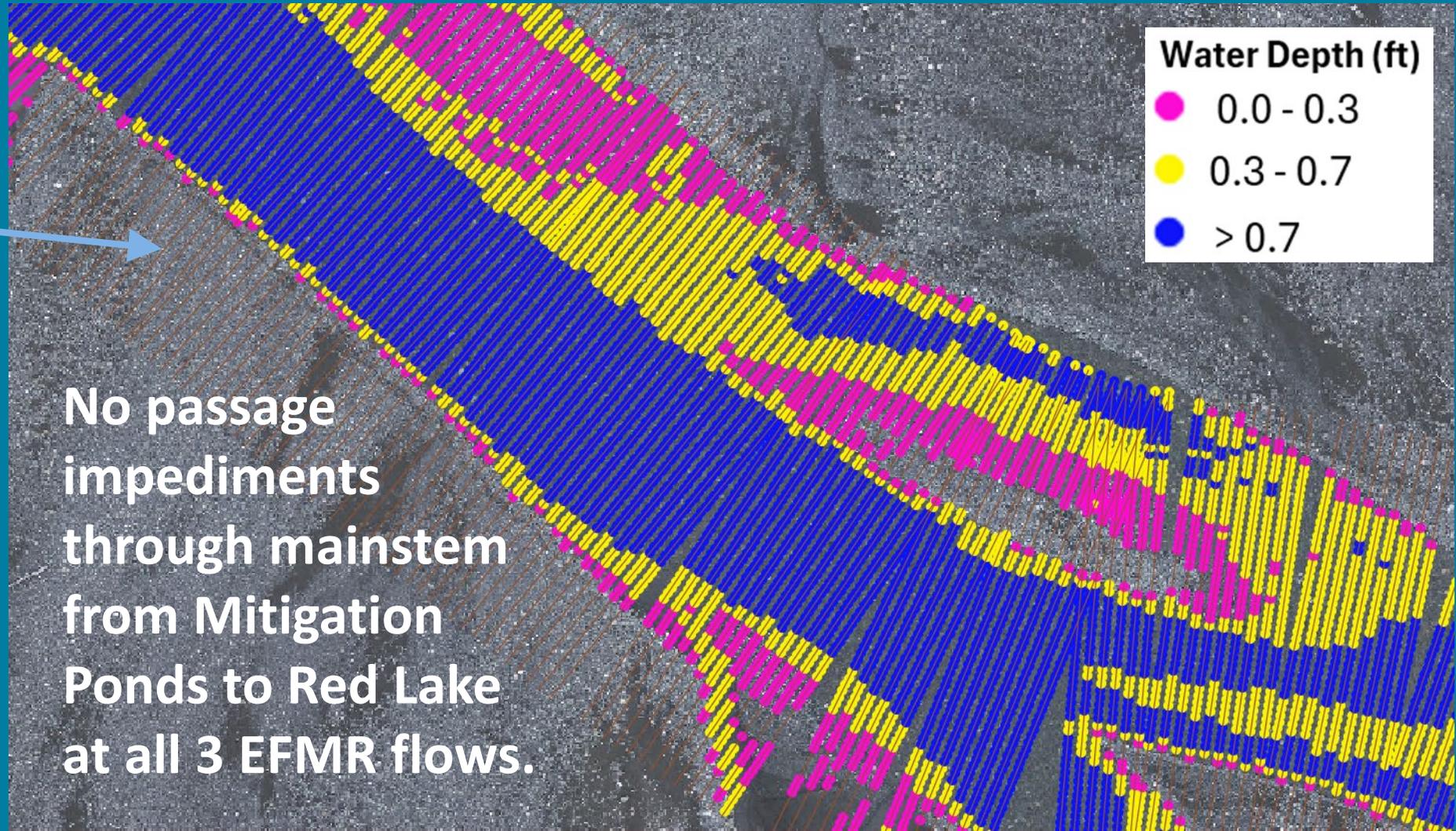
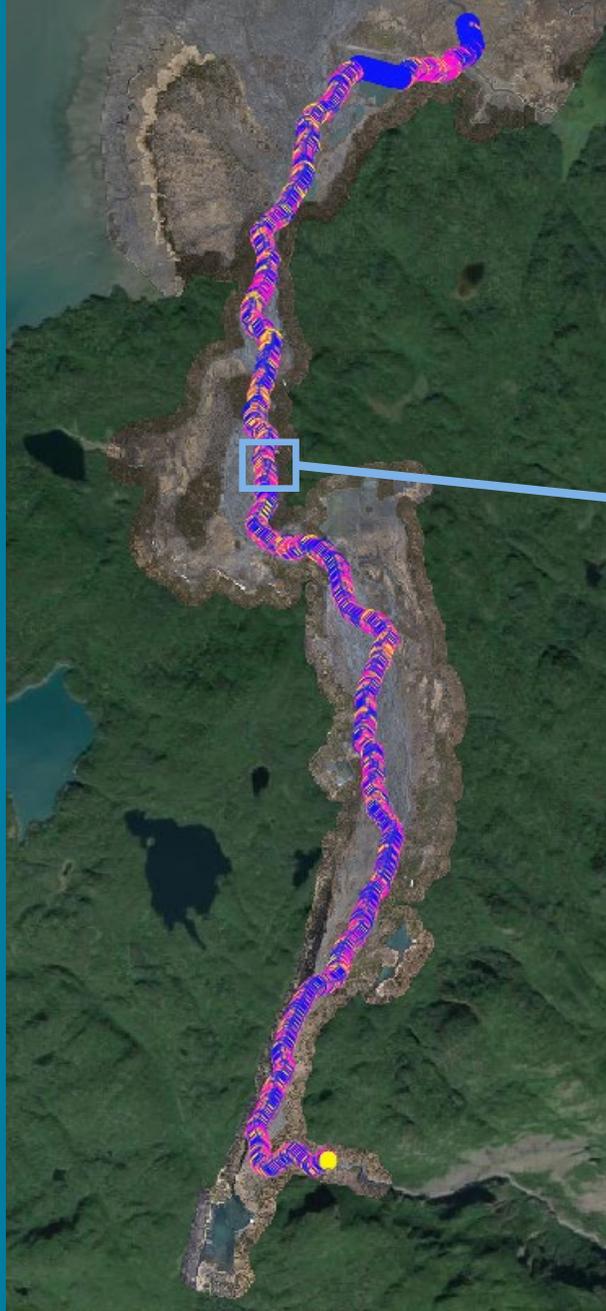
## Wetted Width:

- ✓ >10% of contiguous wetted width

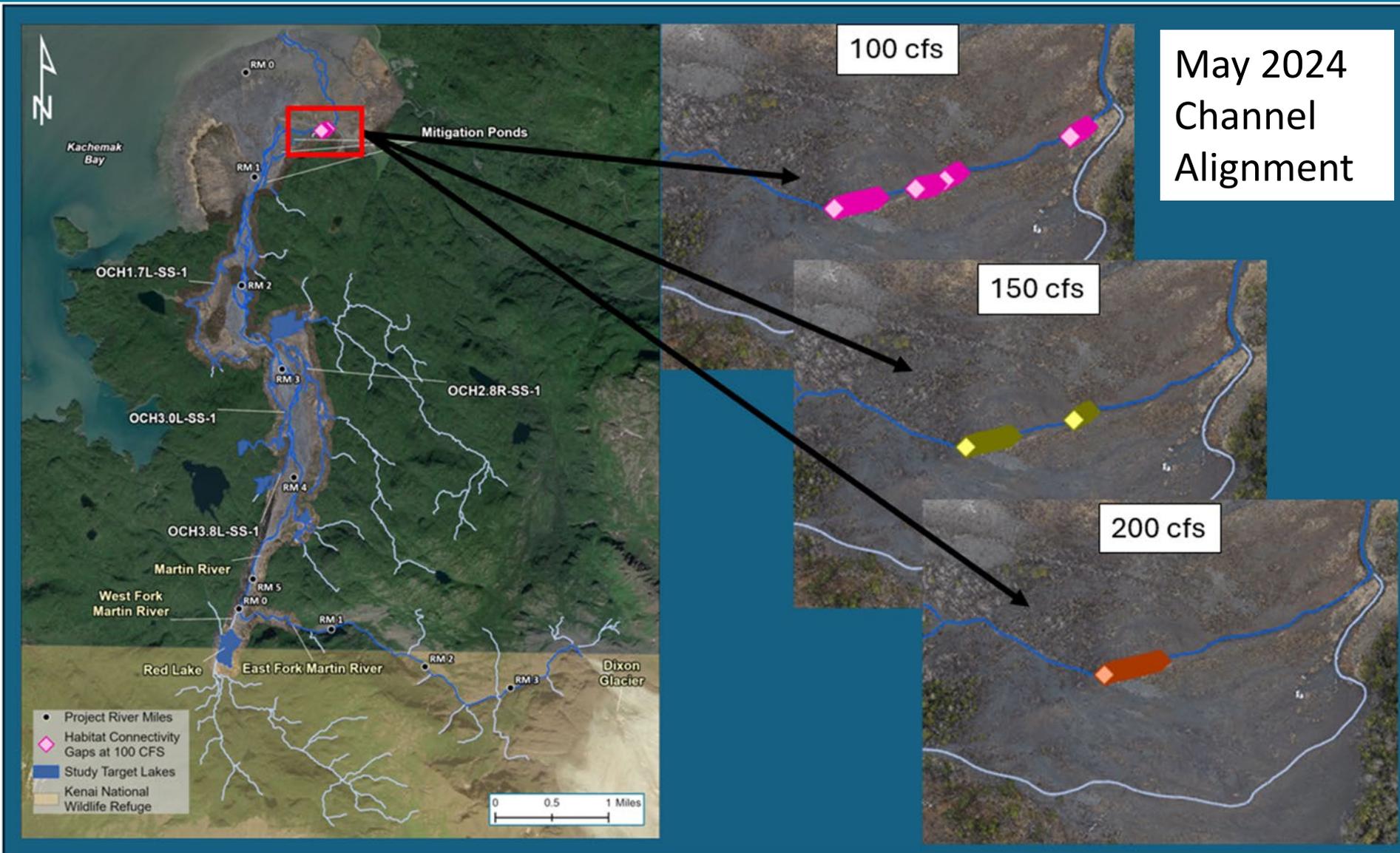
ADFG 2001, Bell 1991, Bates et al. 2003, CDFG 2017, Thompson 1972



# Connectivity Results – Mainstem Habitat (100 cfs)



# Connectivity Results – Martin River Outlet



- Passage impediments found in new channel outlet formed downstream of Mitigation Ponds after August 2023 dike breach at all 3 EFMR flows modeled due to shallow depth

Summer 2022



Spring 2024



# Martin River Outlet Changes

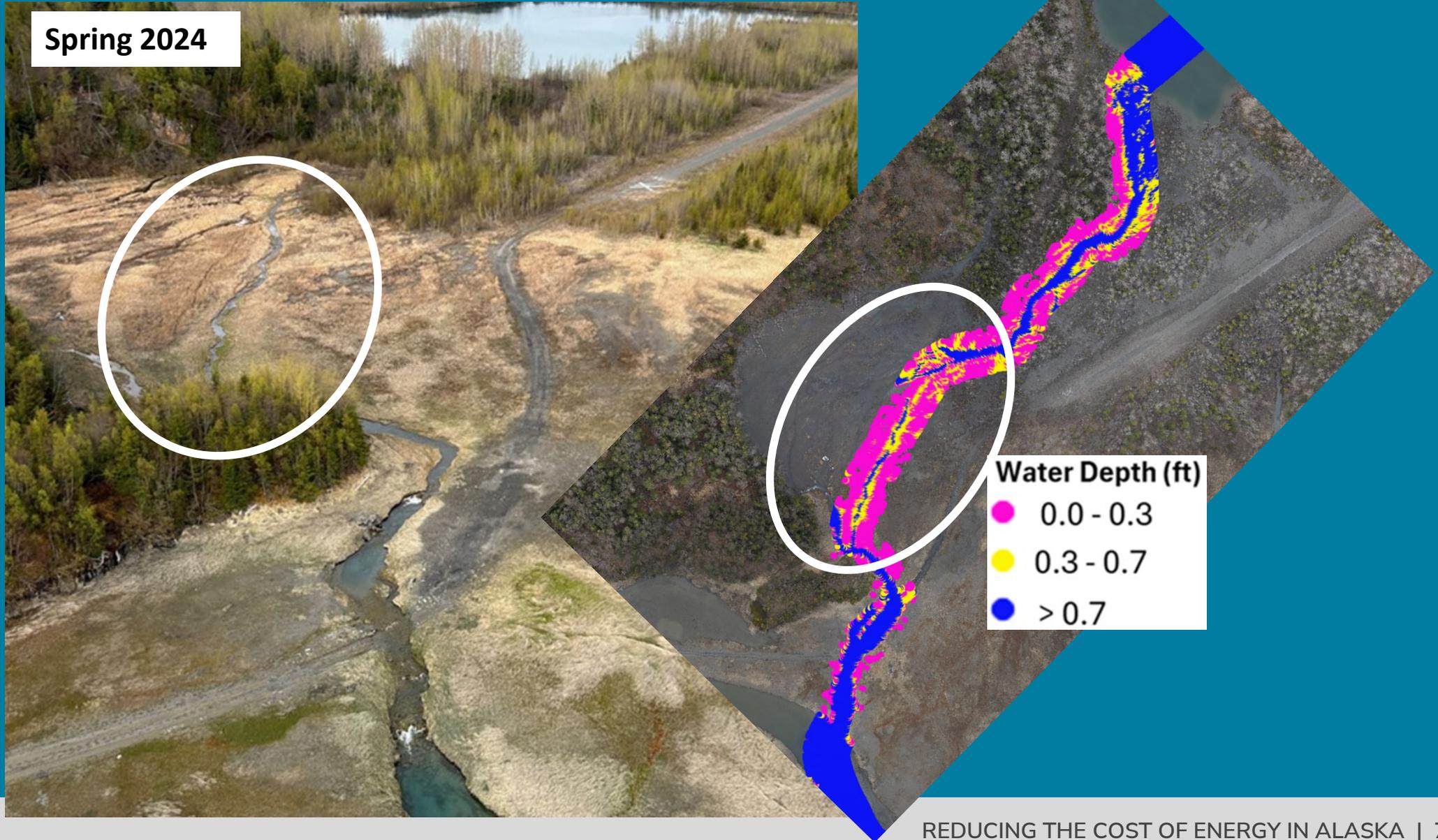
Fall 2023



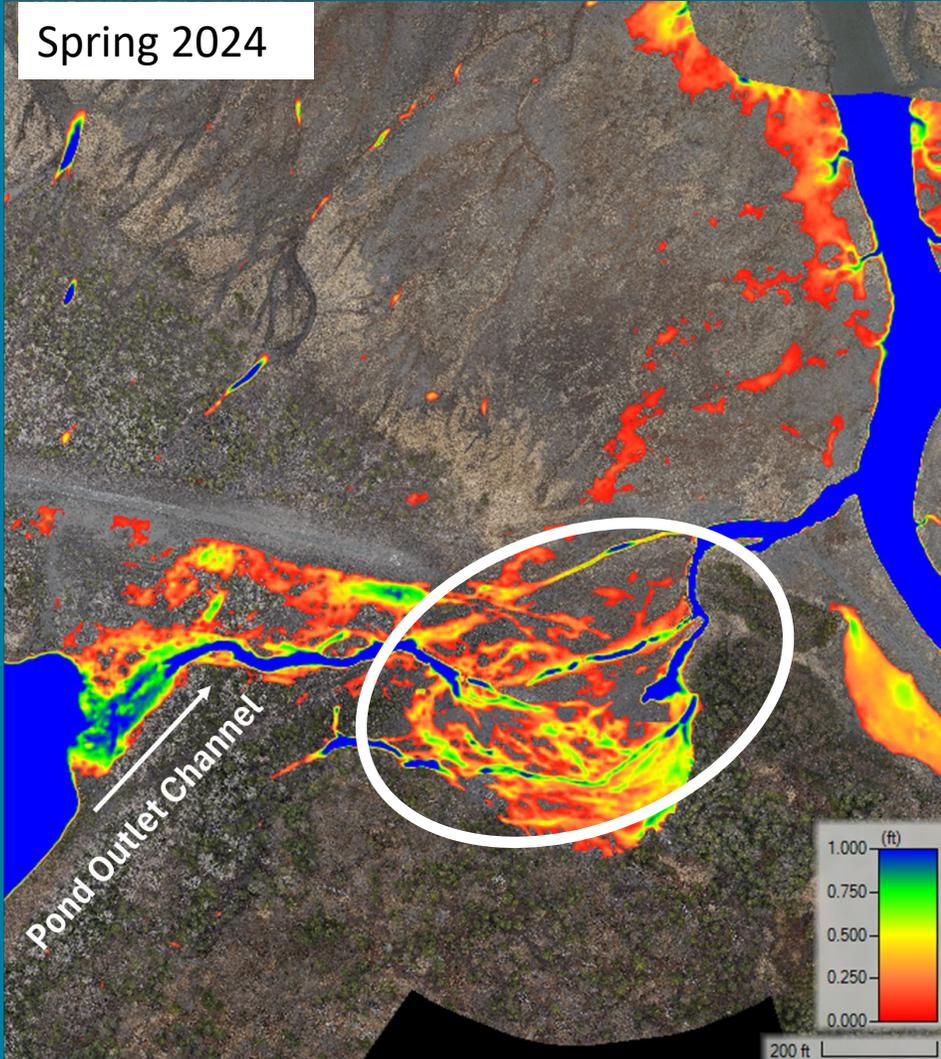
Fall 2025



# Martin River Outlet – Spring 2024



# Martin River – Mitigation Pond Outlet

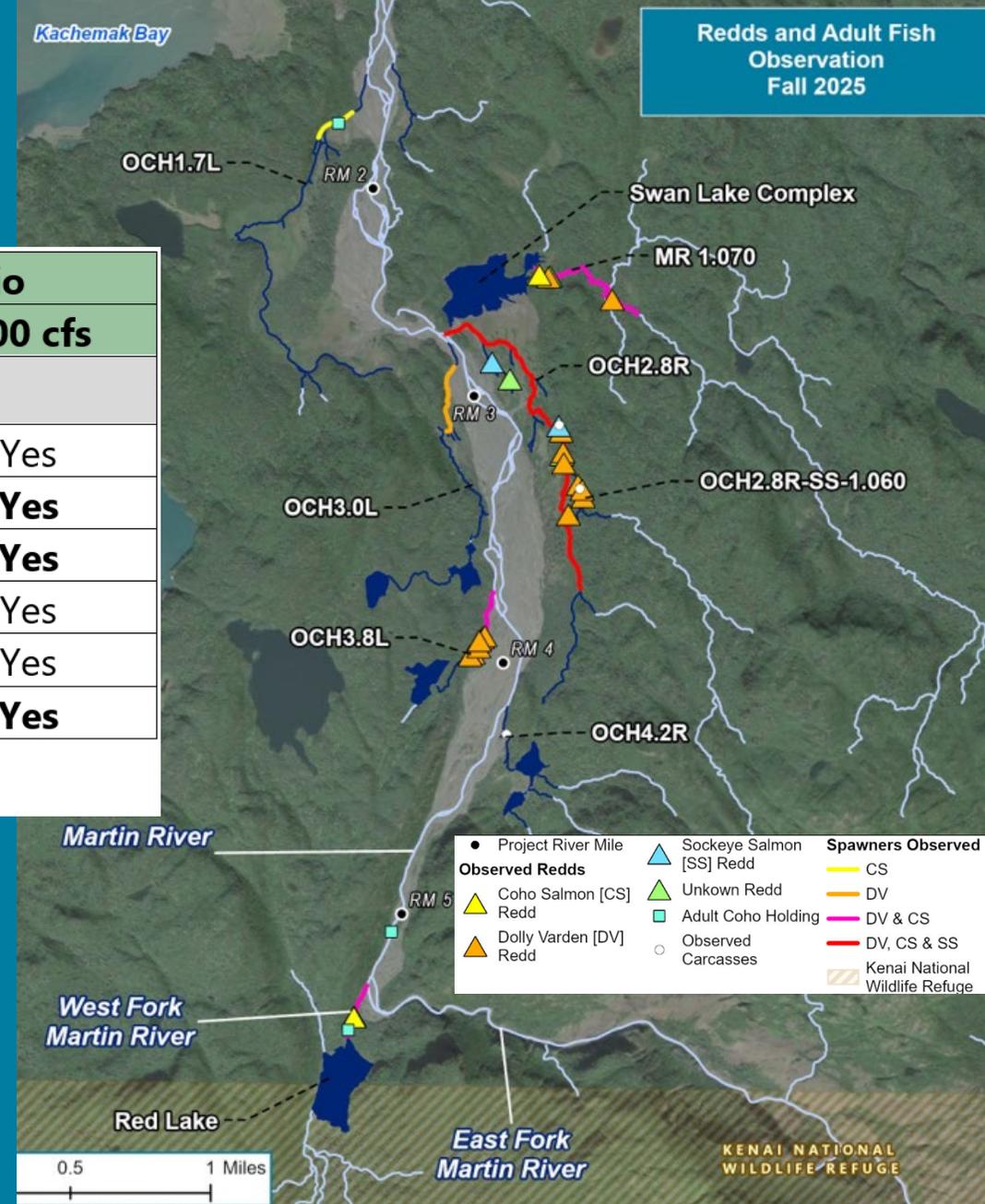


# Connectivity Results – OCH

Habitat Connectivity	Spawning Use	EFMR @ Mouth Flow Scenario		
		100 cfs	150 cfs	200 cfs
		Minimum Depth (0.7 ft)		
OCH1.7L-SS-1	None	Yes	Yes	Yes
<b>OCH2.8R-SS-1</b>	<b>DV, CS, SS</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>OCH3.0L-SS-1</b>	<b>DV</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>OCH3.8L-SS-1</b>	<b>DV, CS</b>	<b>No</b>	<b>No</b>	Yes
OCH4.2R-SS-1	None	No	No	Yes
<b>WF Martin River</b>	<b>DV, CS, SS</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

EFMR=East Fork Martin River

DV=Dolly Varden Trout, CS=Coho Salmon, SS=Sockeye Salmon



# QUESTIONS?

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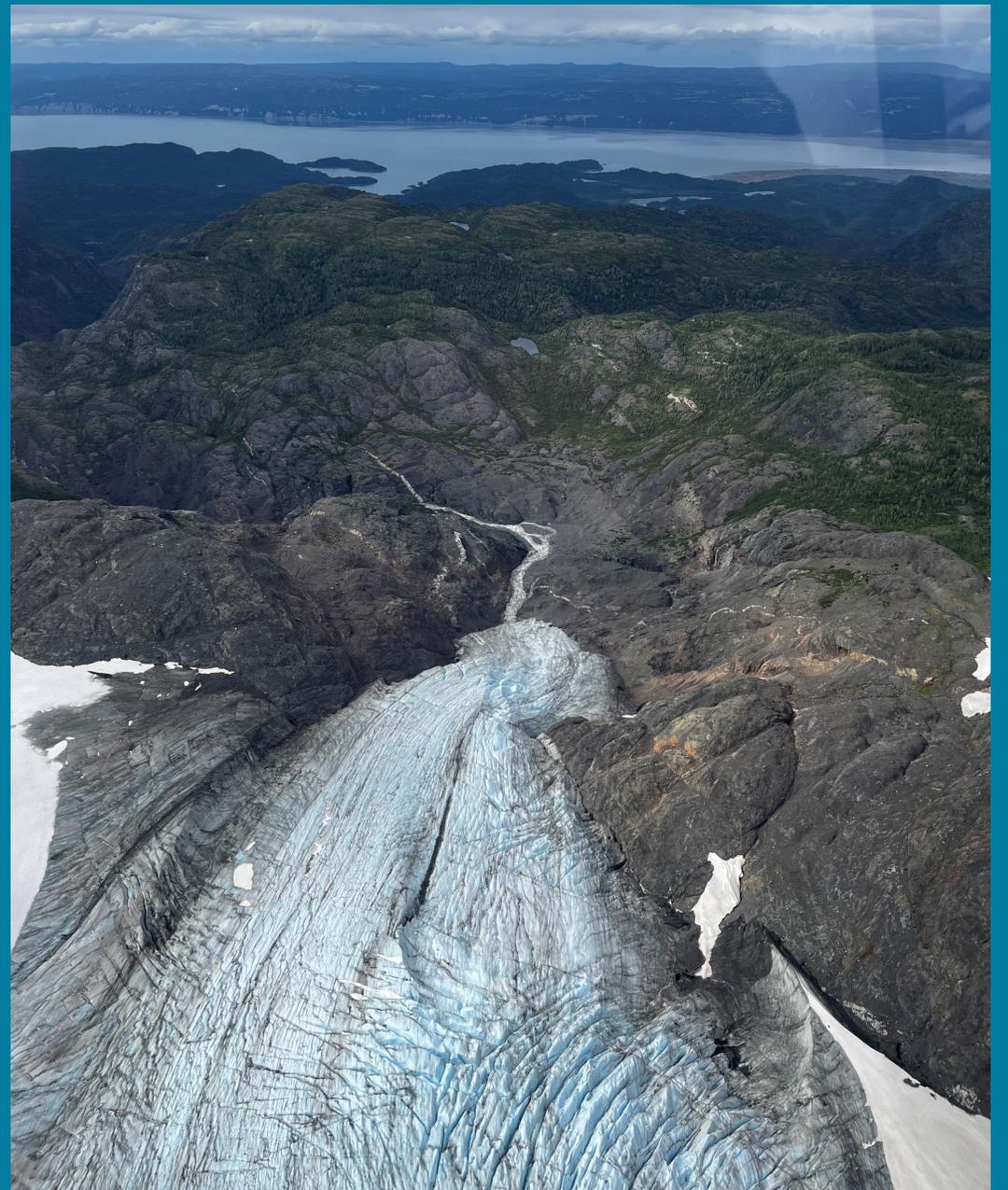
# Protection, Mitigation, & Enhancement Measures - PM&Es

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- **Erosion and Sediment Control Plan**
- **Fuel and Hazardous Substance Spill Plan**
- **Comply with AK Pollution Discharge Elimination System Permit**
- **Prevent spread of non-native species**
  - Require all construction equipment be cleaned of debris prior to coming onsite to ensure invasive and/or non-native species are not introduced.
- **Consult with ADF&G for in-water work window and water diversions**
  - Communicate with ADF&G prior to diversion from EFMR during construction and operations
- **Proposed Flow Regime – EFMR MIF, sediment management, channel maintenance**
- **Monitor during construction and post-diversion**

# Proposed Project Operations

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# Proposed Dixon Diversion Operations



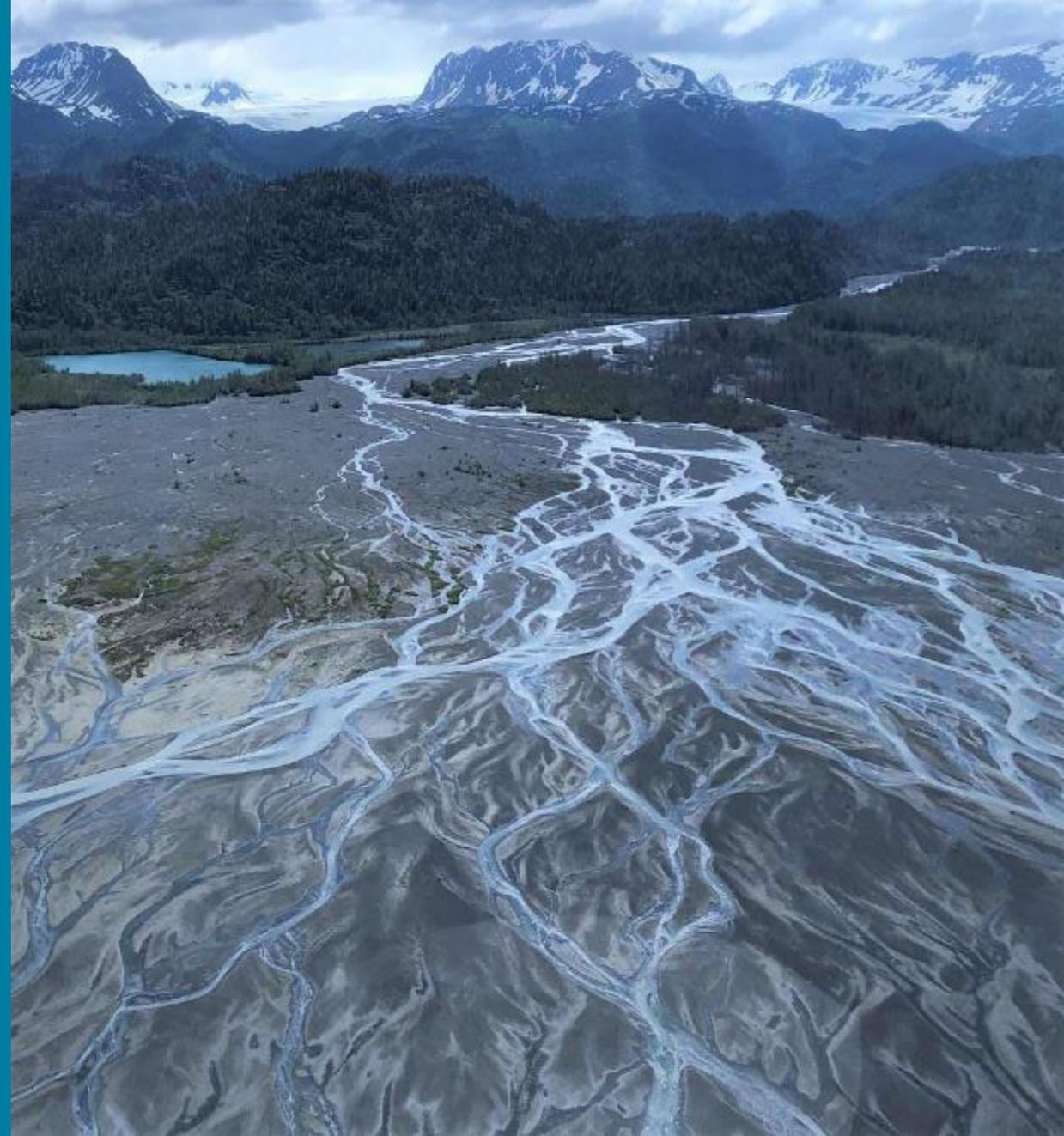
- **Start 2030 or 2031**
- **May 1 – November 30**
- **Minimum Instream Flow (MIF)**
  - 100 cfs EFMR @ diversion
- **Diversion Tunnel Capacity**
  - 1,650 cfs
- **Sediment Management Flows**
  - Flush sediment from Diversion Dam forebay on an as needed basis
- **Channel Maintenance Flows**
  - 1,000 cfs for 12 hours at least 3 years out of each moving 10-year average

Month	Volume (acre-ft)				Percentage		
	Total Runoff	MIF	Diverted	Bypass in Excess of MIF	MIF	Diverted	Bypass in Excess of MIF
May	4,100	2,800	1,300	0	68%	32%	0%
June	17,300	5,700	11,600	0	33%	67%	0%
July	60,700	6,100	53,200	1,400	10%	88%	2%
Aug	62,100	6,100	52,500	3,400	10%	85%	5%
Sept	34,200	5,800	27,300	1,100	17%	80%	3%
Oct	13,200	4,300	8,700	200	33%	66%	1%
<b>Total*</b>	<b>191,600</b>	<b>30,800</b>	<b>154,600</b>	<b>6,100</b>	<b>16%</b>	<b>81%</b>	<b>3%</b>

\* May 15 - October 31

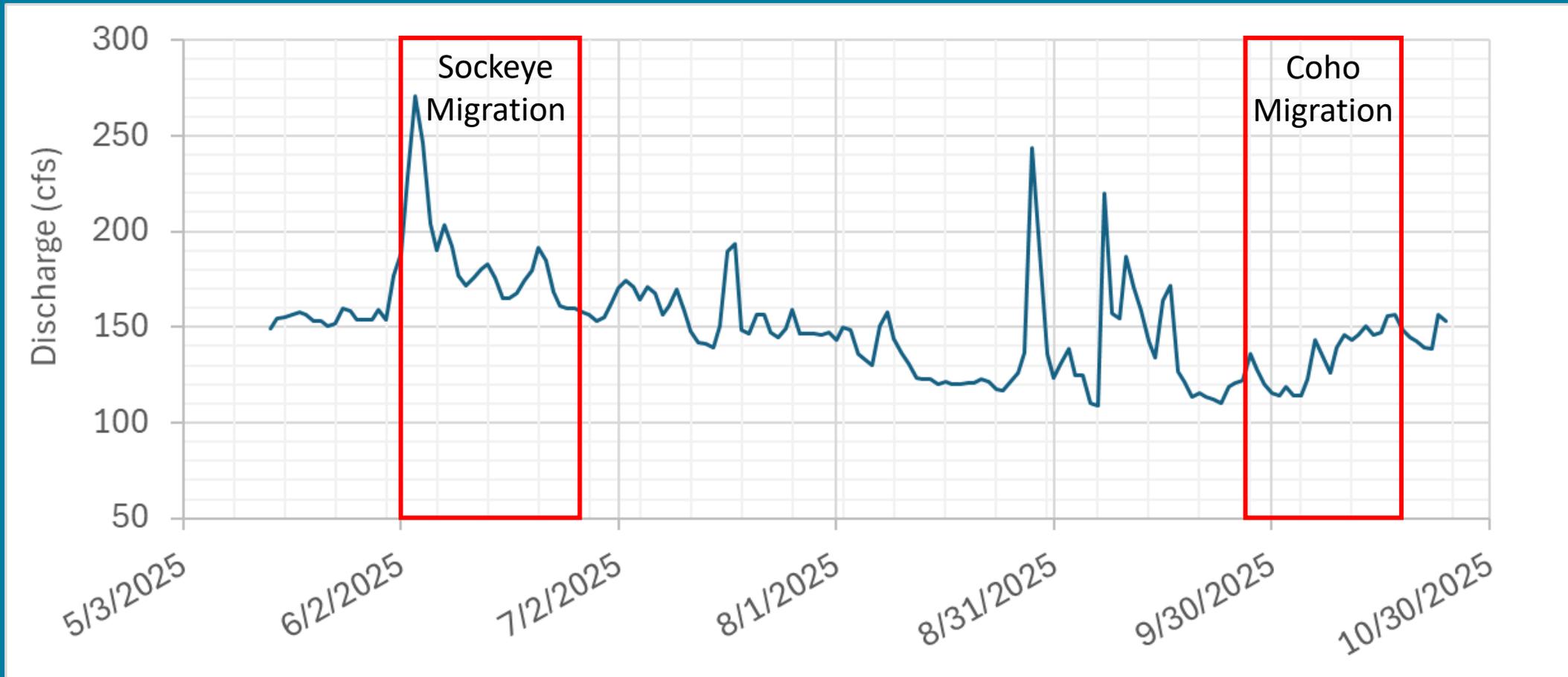
# Potential Future Conditions

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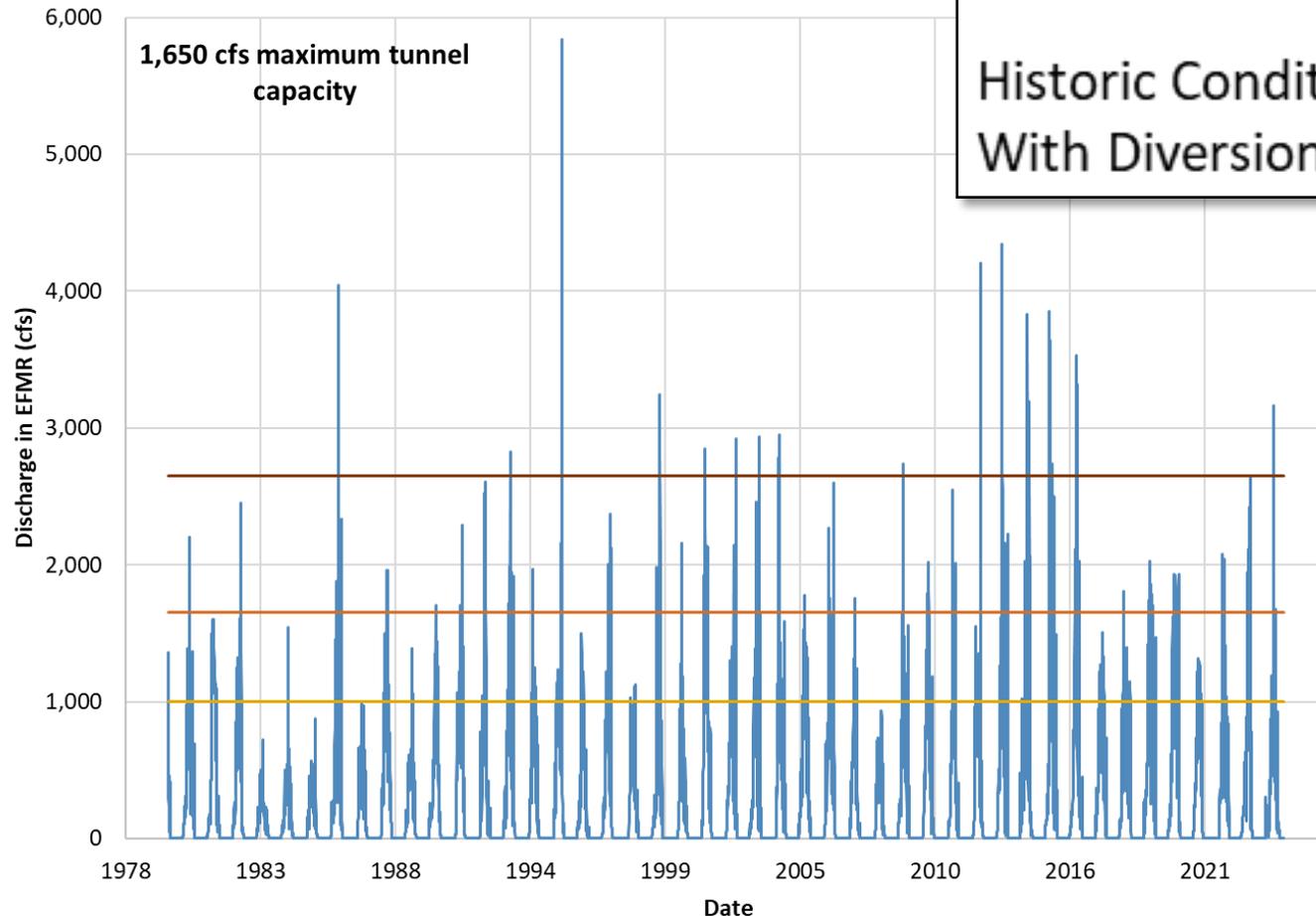
# Martin River Flow at RM 1.9 with EFMR = 100 cfs @ Diversion

East Fork Martin River MIF (100 cfs) + Accretion



# Bedload Transport – Historic vs with-Diversion

**Estimated days/year with bedload transport**  
 Historic Conditions: 25 days/yr  
 With Diversion: 0.9 days/yr



- Analysis assumptions:
  - 1,650 cfs maximum tunnel capacity
  - 100 cfs instream flow
  - 1,000 cfs to initiate bedload transport
- **Proposed Channel Maintenance Flow**
  - 1,000 cfs for 12 hours at least 3 years out of each moving 10-year average

— East Fork Martin River Synthetic Discharge (cfs)      — Discharge estimated for bedload transport  
— Discharge estimated for bedload transport with diversion      — Tunnel Capacity

# Geomorphology and Bedload Transport – Potential Future Conditions

- **Changes:**

- Reduced input of flow and fine sediment (silt, clay, fine sand)
- Similar input volume of coarse sediment (coarse sand to boulder size)
- Coarse sediment input more episodic - flushing of diversion pool
- Reduced bedload transport potential – depends on flow during flushing

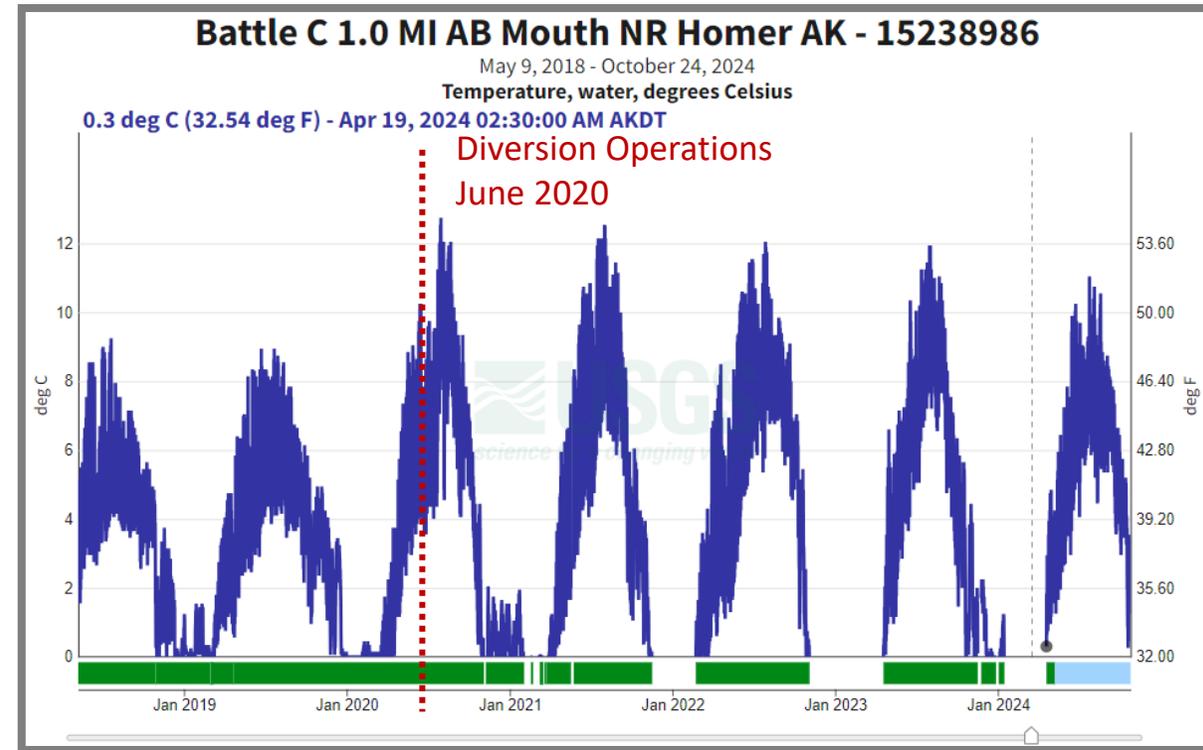
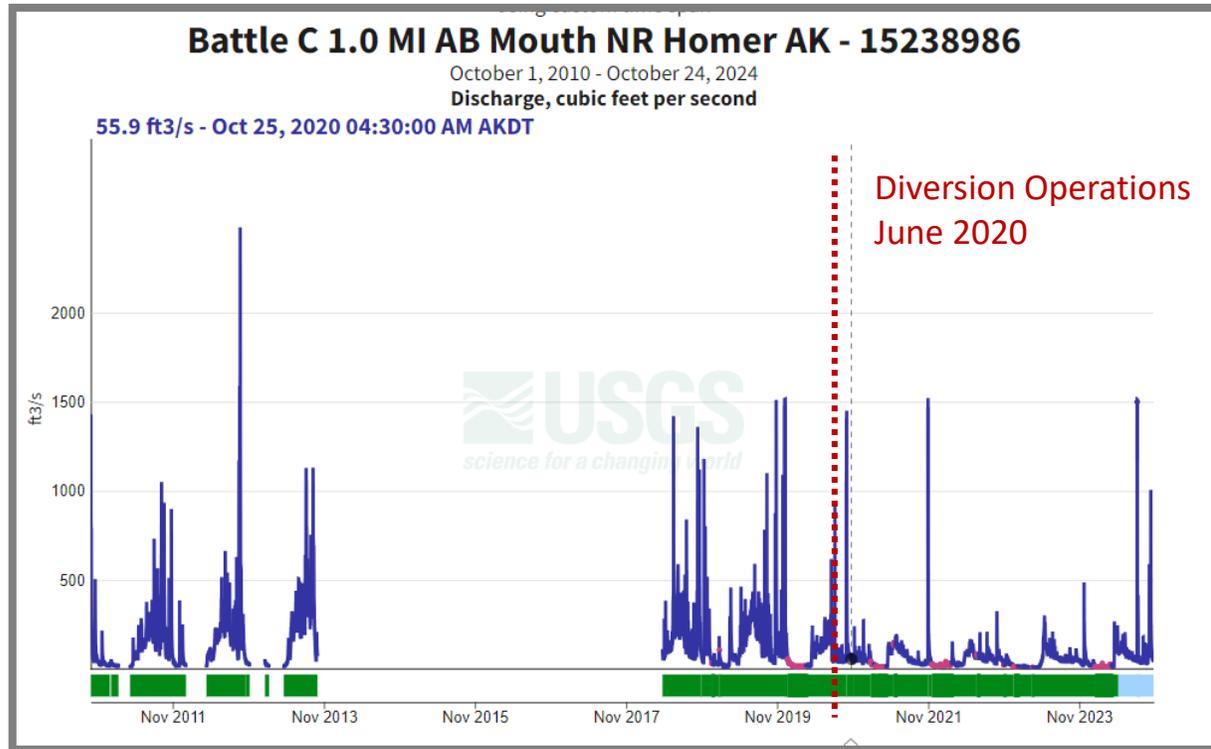
- **Results:**

- Most likely scenario – evolution from braided to primarily single thread river channel
- Possible multiple/braided areas following extreme flood events
- Riparian vegetation growth along streambanks will enhance channel stability
- Connectivity to off-channel/tributary areas will stabilize
- Possible areas of aggradation or fine sediment deposition in slow water areas



# Water Quality Future Conditions

- Mainstem Martin River With-Diversion
  - Warmer water temperatures
  - Lower turbidity



# Proposed Monitoring

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- Goals
  - Maintain fish passage through mainstem to Red Lake and to OCH/tributaries
  - Maintain water quality standards (temperature) to support aquatic life
  - Maintain adequate bedload transport
  - Evaluate effects of new flow regime on these resources/processes
    - Minimum instream flows
    - Sediment management flows
    - Channel maintenance flows



# Proposed Monitoring – Discharge and Water Quality



- **Pre-Diversion (2026 – 2030)**
  - Continue monitoring EFMR/MR discharge, temperature, and turbidity
  - Annually May-Oct/Nov until diversion operations begin
  
- **Post-Diversion (2031 through current license term\*)**
  - Monitor EFMR diversion flows, MIF, and flows released in excess of MIF
    - Annually May-Oct/Nov through license term
  - Monitor MR temperature and turbidity
    - Annually May-Oct/Nov for 5 years post diversion
    - Upstream and downstream of diversion during sediment management flows
  - Compare MR temperature and turbidity pre- and post-diversion, consult with agencies and evaluate need for additional monitoring

\* Current license expires 2035. Bradley Lake Project will begin relicensing in 2030.

# Proposed Monitoring – Red Lake AVCT Fish Counts



- **Goal**
  - Determine if flow regime maintains connectivity between Kachemak Bay and Red Lake
- **Pre-Diversion (2026 – 2028)**
  - Continue Red Lake AVCT adult salmon counts, document run timing and correlate counts with discharge
  - Annually May-Oct for 3 years
- **Post-Diversion (2031 – 2035/2036)**
  - Conduct Red Lake AVCT adult salmon counts, document run timing and correlate counts with discharge
  - Annually May-Oct for 5 years
  - Consult with agencies on findings annually
  - After 5 years, evaluate effects of the flow regime on sockeye and coho migration

# Proposed Monitoring – Habitat Connectivity



- **Goal**
  - Determine if flow regime maintains connectivity through mainstem and with tributary/OCH areas
- **Post-Diversion (2031 – 2035/2036)**
  - Pedestrian survey of mainstem MR and tributary/OCH connections to identify areas of aggradation and document connectivity
  - Measure water depth at mainstem MR thalweg and tributary/OCH connections
  - Assess mouth of EFMR and identify areas where the mainstem MR is shallow, wide and aggrading during spring and revisit in fall to evaluate effects of higher flows
  - Monitor annually spring (clear low flow) and fall (clear low flow) for 3 years for baseline and monitor aggraded areas periodically following sediment management operations or channel maintenance flow releases
  - Consult with agencies on findings annually
  - After 5 years, evaluate effects of the flow regime on connectivity

# Proposed Monitoring – Sediment Transport

- **Goal**
  - Determine if sediment management and channel maintenance flow regimes maintain bedload movement/limit aggradation in the mainstem Martin River
- **Post-Diversion (2030/2031 – 2040/2041)**
  - Complete channel-spanning pebble counts at 10 locations
  - Note any areas of fine sediment accumulation (during Connectivity Monitoring)
  - Timing: Monitor annually in spring (clear low flow) for 3 years for post-diversion baseline and in spring every year following a sediment management or channel maintenance flow
  - Consult with agencies on findings annually
  - After 5 releases, evaluate effects of the flow regime on sediment transport
  - Continue monitoring to capture at least 10 channel maintenance releases



# Proposed Monitoring – Geomorphology/Riparian Vegetation

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- **Goal**
  - Determine if flow regime maintains connectivity and limits aggradation
  - Evaluate channel form changes and riparian vegetation community development
- **Post-Diversion (2036)**
  - Collect aerial imagery and LiDAR at least 5-years post-diversion
  - Map and compare to pre-diversion conditions (May 2024 imagery/LiDAR)
  - Timing: at 5 years post-diversion during low, clear flow
  - Consult with agencies on findings and re-evaluate need and timing for additional data collection and monitoring

# Discussion

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