Eklutna Hydroelectric Project
Draft Year 2 Study Reports

Aquatics TWG Meeting
March 28, 2023

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Stream Gaging

- Flows in 2021 were comparable to flows measured by USGS in 2002-2007
- Significantly more precipitation in 2022
- Above Thunderbird Creek…
  - 2021 - stable discharge of 4-7 cfs except for the study flow release period
  - 2022 - peak mean daily discharge of 26 cfs in April, with a more dynamic hydrograph and higher mean monthly flow volumes
- Continuing to collect flow data through October 2023

Stream Gaging

- Eklutna River Flow Accretion
  - From RM 10.3 to Thunderbird at RM 3.0 – gain 4-6 cfs
  - From Thunderbird at RM 3.0 to Railroad - lose ~4 cfs
- Lach Q'atnu Creek
  - May-June > 5 cfs
  - Winter flow < 1 cfs

Eklutna River Water Quality

- Flow releases from Eklutna Lake into the Eklutna River would *generally* meet ADEC criteria.
- Turbidity
  - During the 2021 study flow releases, there were increases in turbidity.
  - Future flow releases/increases will likely result in similar short-term increases in turbidity until the river stabilizes.
  - Should be considered for monitoring program.

Eklutna Lake Water Quality Update

- In general, for glacially fed lakes, increasing turbidity levels corresponds to a decrease in production
- For example…
  - Skilak Lake is a glacially fed lake that supports Sockeye
  - Recent increase in glacial melt has led to increased turbidity
  - Decrease in copepod densities/food resource
  - Decrease in juvenile sockeye weights (concern for lower survival rates)
- Similar situation for Eklutna Glacier

Impacts to Public Water Supply

- A Seattle Public Utilities study determined that passing a large number of sockeye (~ 260,000) into their water supply was an unacceptable risk to water quality, but that a low number of chinook, coho, and steelhead (~5,000) would be acceptable.
  - Marine derived nutrient study indicates that even under natural conditions, no more than 10,000 salmon made it into Eklutna Lake
- 10-year average of 498 spawning adults in the Cedar River has significantly increased total phosphorus.

Adult Salmon Spawning

- **Periodicity** in 2022 was similar to 2021
- **Distribution** in 2022 was similar to 2021
- **Total number** of adults and redds observed in 2022 was lower than 2021 due to excessive rain/ turbidity.
  - A few coho observed immediately upstream of Thunderbird in 2022
  - Fewer surveys possible in Thunderbird in 2022 due to flooding/ wading hazards.

Spawning Periodicity in 2021

- Chinook Salmon: July 16-August 6, 2021
- Pink Salmon: July 31-September 09, 2021
- Chum Salmon: August 20-September 03, 2021.
- Coho Salmon: September 03-October 14, 2021
- Dolly Varden (resident): September 23-October 22, 2021

Spawning Periodicity in 2022

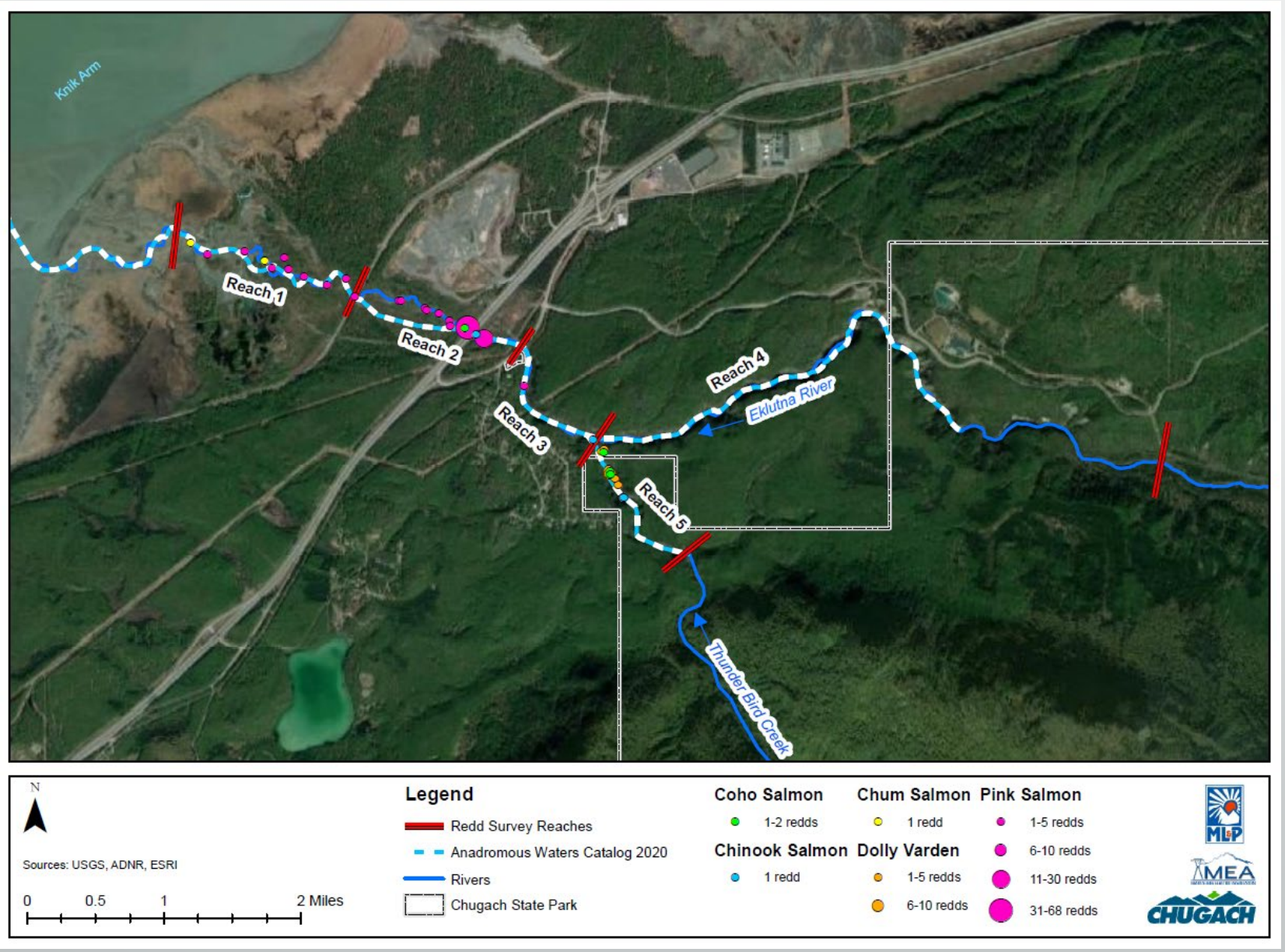
- Chinook Salmon: July 16-August 22, 2022
- Pink Salmon: August 1-August 22, 2022
- Chum Salmon: September 9-September 13, 2022
- Coho Salmon: August 22-October 24, 2022
- Dolly Varden (resident): September 23-October 24, 2022

Periodicity Chart

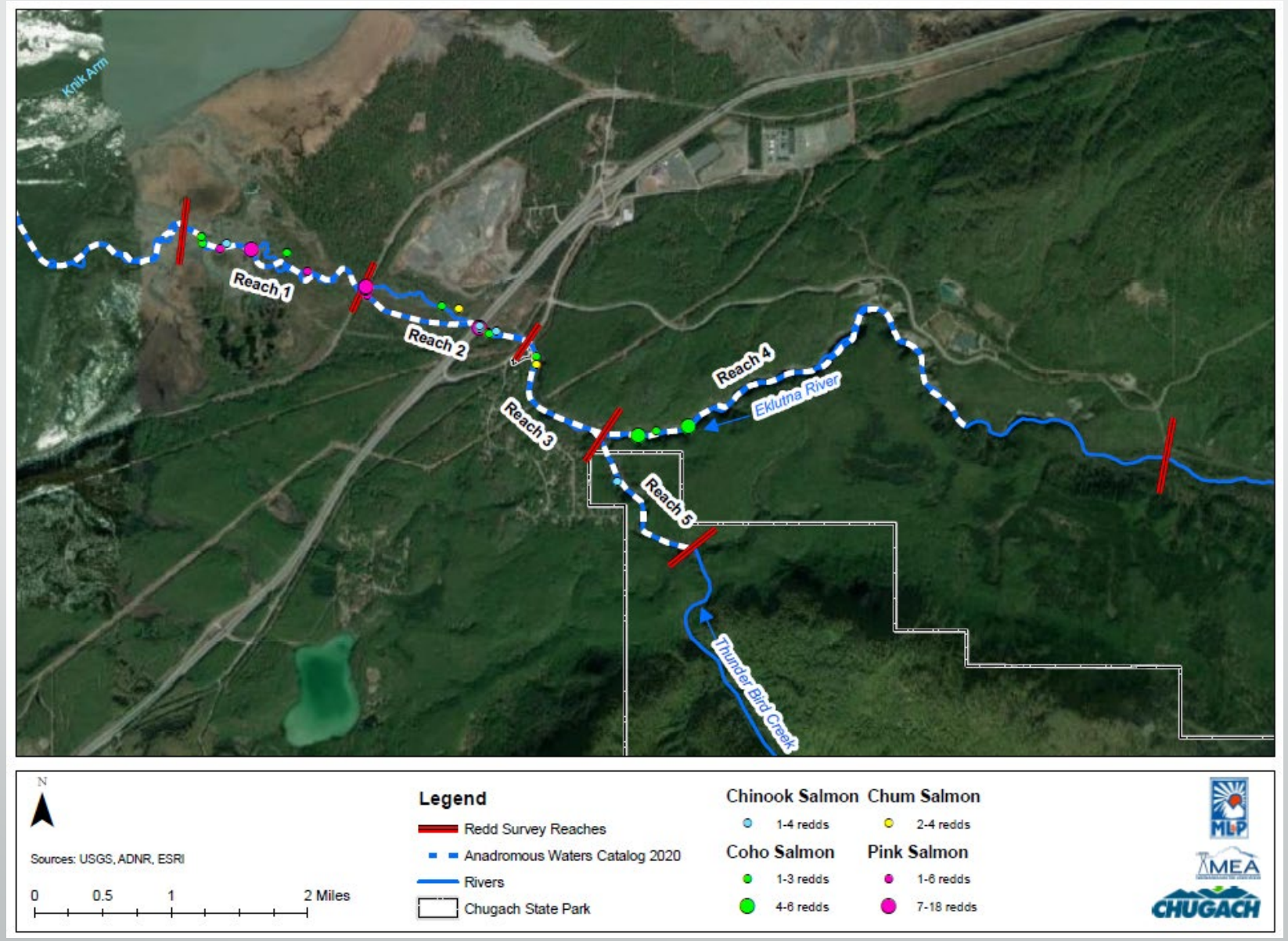
Life Stage	Species	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
Adult Migration	Coho												
	Chinook												
	Sockeye*												
Adult Spawning	Coho												
	Chinook												
	Sockeye*												
Egg Incubation and Emergence *	Coho												
	Chinook												
	Sockeye												
Juvenile Rearing (parr)	Coho												
	Chinook												
	Sockeye*												
Juvenile Outmigration *	Coho												
	Chinook												
	Sockeye												

** Not assessed during 2021 River Fish Sampling. Data presented from USACE (2011)*

Spawning Distribution in 2021



Spawning Distribution in 2022



Adult Salmon Counts

2021¤					2022¤				
Date¤	Chinook¤	Coho¤	Chum¤	Pink¤	Date¤	Chinook¤	Coho¤	Chum¤	Pink¤
7/9/2021¤	0¤	0¤	0¤	0¤	7/8/2022¤	0¤	0¤	0¤	0¤
7/16/2021¤	0¤	0¤	0¤	0¤	7/16/2022¤	1¤	0¤	0¤	0¤
7/22/2021¤	7¤	0¤	0¤	0¤	7/25/2022¤	0¤	0¤	0¤	0¤
7/31/2021¤	9¤	0¤	0¤	17¤	8/1/2022¤	0¤	0¤	0¤	27¤
8/6/2021¤	2¤	0¤	0¤	61¤	8/8/2022¤	0¤	0¤	0¤	0¤
8/11/2021¤	0¤	0¤	0¤	65¤	8/15/2022¤	1¤	0¤	0¤	19¤
8/20/2021¤	0¤	0¤	3¤	120¤	8/22/2022¤	4¤	2¤	0¤	16¤
8/26/2021¤	0¤	0¤	1¤	13¤	8/29/2022[B]¤	°¤	-¤	-¤	-¤
9/3/2021¤	1¤	3¤	1¤	1¤	9/6/2022¤	0¤	4¤	4¤	0¤
9/11/2021¤	0¤	4¤	0¤	-¤	9/13/2022¤	0¤	3¤	2¤	0¤
9/18/2021[A]¤	0¤	3¤	0¤	-¤	9/19/2022[B]¤	-¤	-¤	-¤	-¤
9/23/2021[A]¤	0¤	0¤	0¤	0¤	9/26/2022¤	0¤	1¤	0¤	0¤
9/29/2021¤	0¤	2¤	0¤	0¤	10/3/2022¤	0¤	0¤	0¤	0¤
10/5/2021¤	0¤	0¤	0¤	0¤	10/11/2022[B]¤	-¤	-¤	-¤	-¤
10/14/2021¤	0¤	2¤	0¤	0¤	10/17/2022¤	0¤	6¤	0¤	0¤
10/22/2028¤	0¤	0¤	0¤	0¤	10/24/2022¤	0¤	2¤	0¤	0¤
Total·Fish¤	19¤	14¤	5¤	277¤	Total·Fish¤	6¤	18¤	6¤	62¤

Potential Spawning Habitat for Ocean-Run Salmon in Main Channel of East/West Forks

	Total Length Surveyed	Proportion Glide	Wetted Width		50% capacity		100% capacity	
			Min.	Max.	Total Ac. Min	Total Ac. Max	Total Ac. Min	Total Ac. Max
Total Length Surveyed	6001.1 yards	1215.8 yards	6.1 yd	9.6 yd	0.765	1.205	1.53	2.41
Total Length Incl. Unsurveyed	8289.6 yards	1823.4 yards	-	-	1.145	1.805	2.29	3.61

IHN Disease

- 77.3% of kokanee tested positive for IHN
- 32.8% had the highest infection level with high viral transmission
- …the virus may also be transmissible to other fish species in Eklutna Creek, in the Eklutna Tailrace Fishery, or to other juvenile and adult fish in the Eklutna River which may be exposed to IHN from Eklutna Lake source water (J. Ferguson, ADFG, pers. comm 11/16/2022).

Geomorphology and Sediment Transport

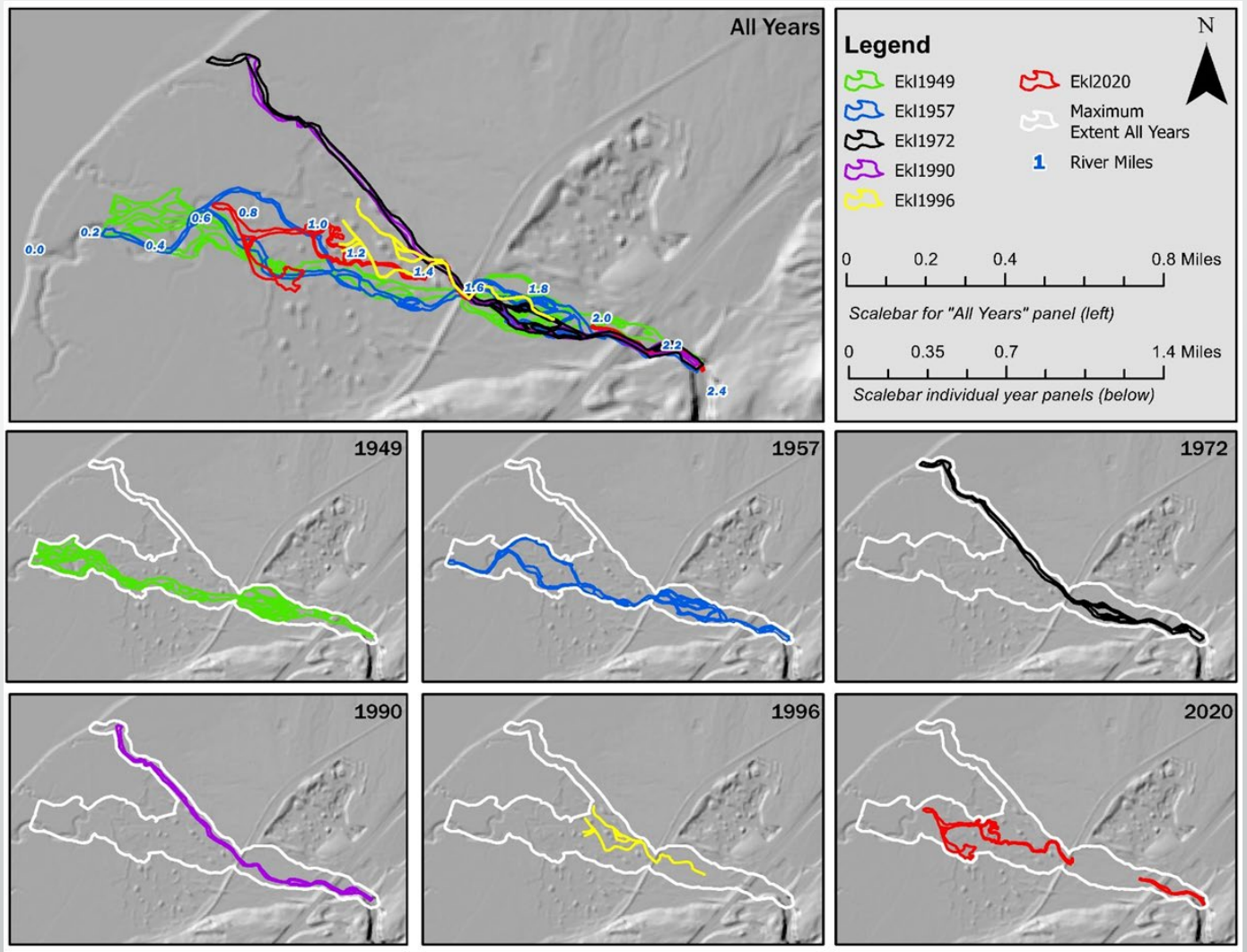
- Year 2 study results presented at October TWG meeting include:
  - Field data collection (monitoring transects, scour monitors, grain size, effects of study flow release)
  - Sediment source mapping and analysis
  - 1-D HEC-RAS sediment transport model
    - Tool for scenario modeling

Geomorphology and Sediment Transport

- New Year 2 results (since October TWG meeting):
  - Channel migration analysis
  - 2-D HEC-RAS sediment transport analysis
    - Used output from 2-D hydraulic model, estimated grain size mobilized at the four 2-D study sites – more detail than 1-D model/overbank areas

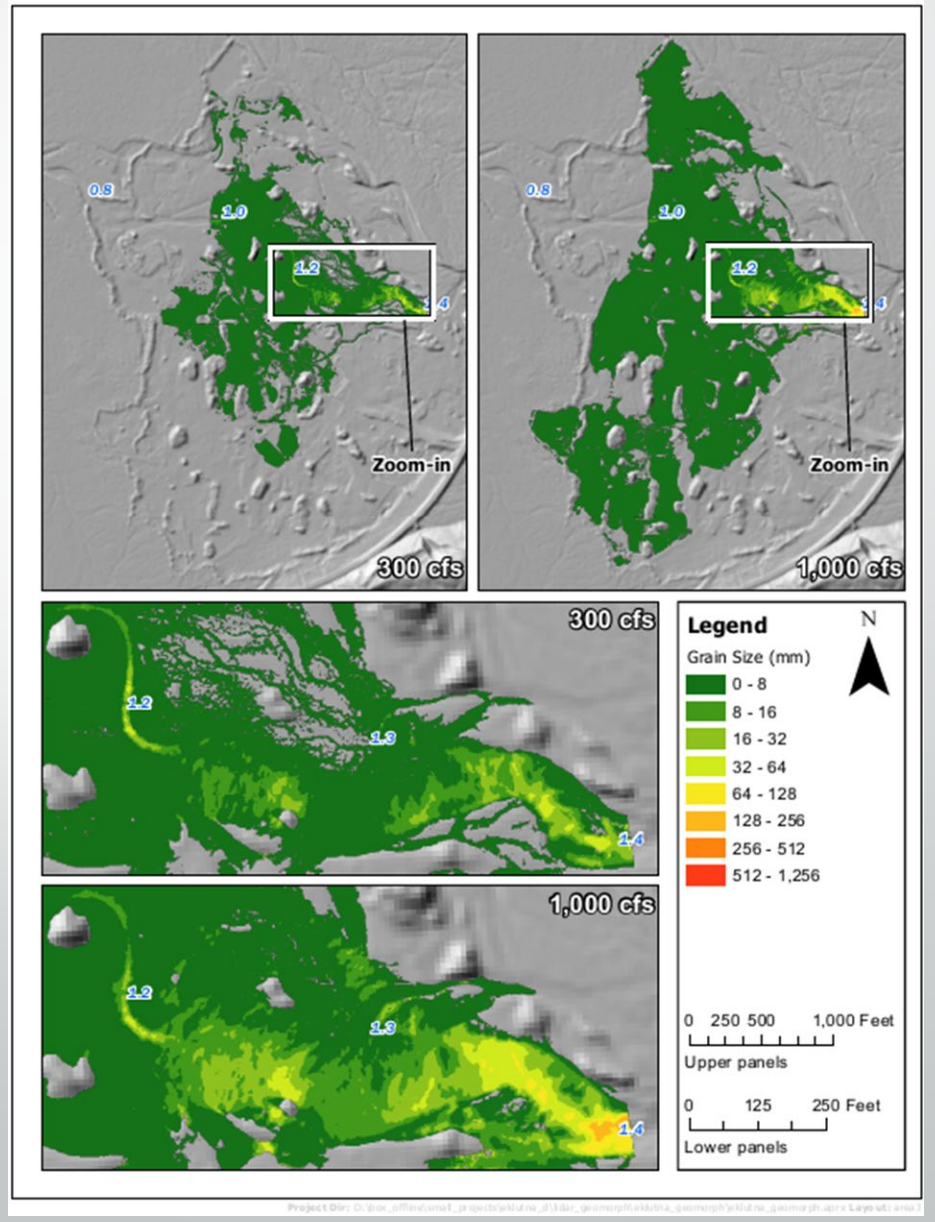
Channel Migration

- Analysis area – downstream from canyon (upstream areas not analyzed due to lack of historic aerial photographs)
- Prior to out-of-river water withdrawals, river wide and braided
- 1972-1990 – river channelized to accommodate gravel removal
- Since 1990 migration primarily in tidally-influenced reach
- Sediment load/deposition areas result in channel migration



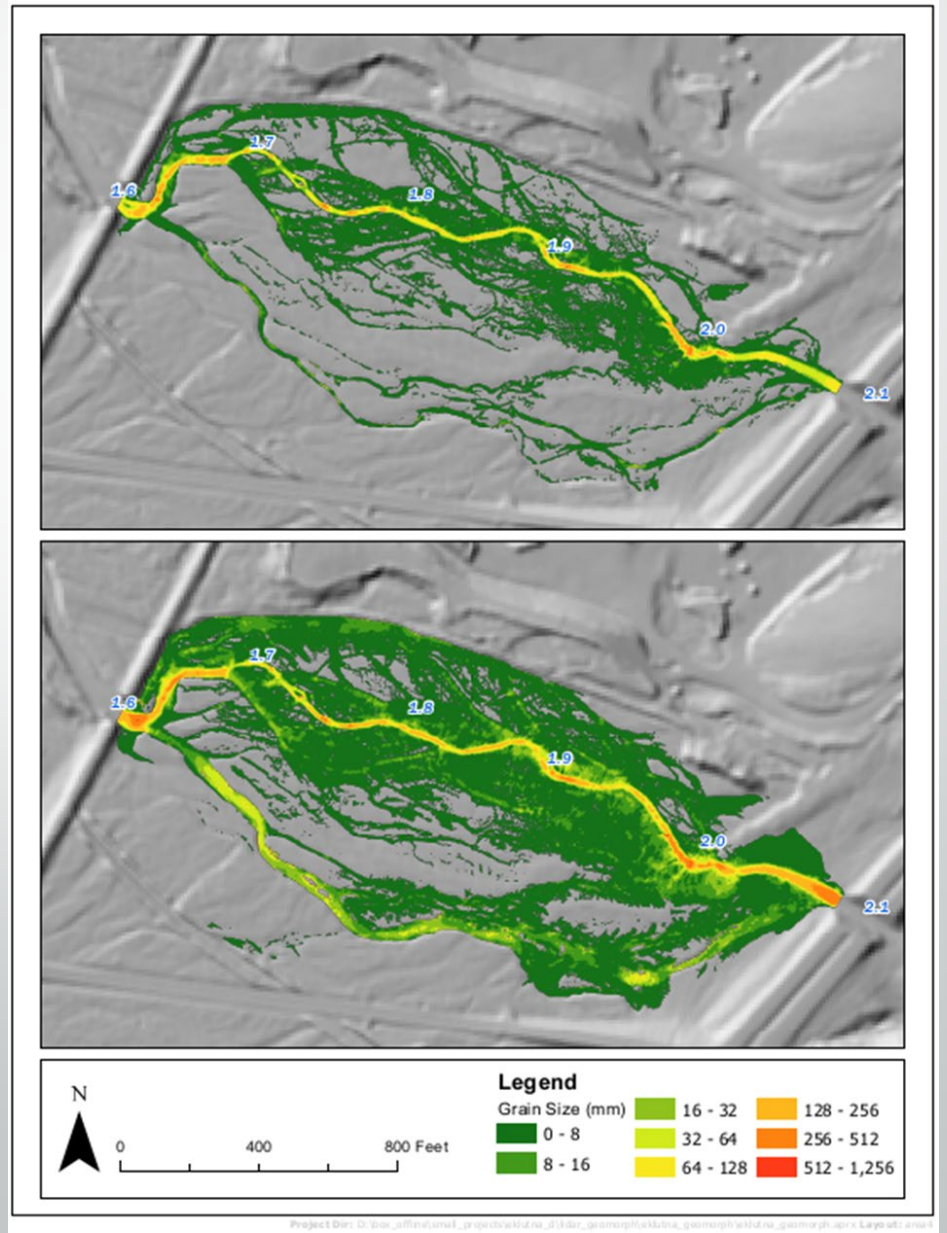
Two-Dimensional HEC-RAS

- Reach 3, tidal influence, deposition zone
- Gravel (up to 64 mm) mobile in main channel under both 300 cfs flow (top) and 1,000 cfs flow
- Flow spreads out into tidal flats and ponds



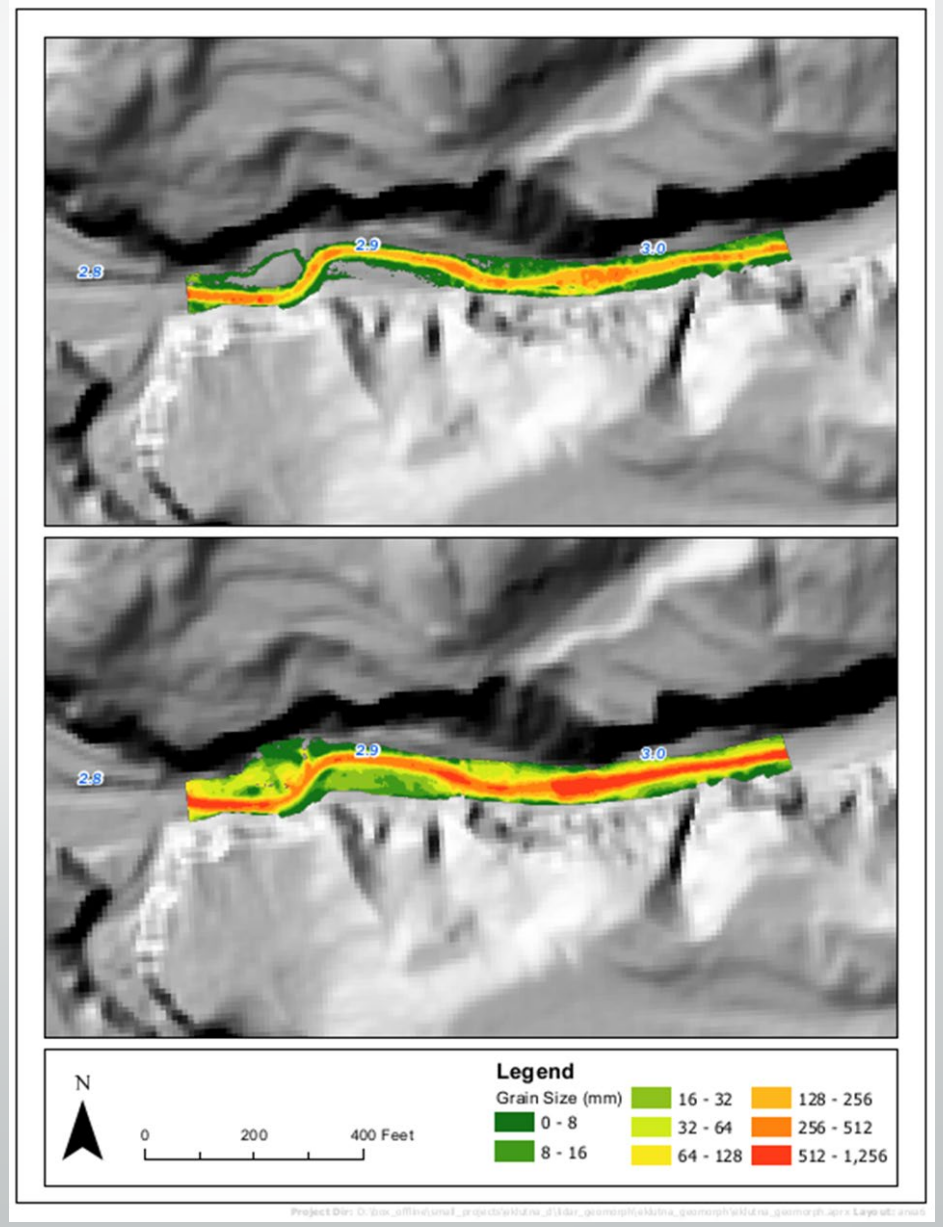
Two-Dimensional HEC-RAS

- Reach 4, flooded forest
- Cobble/gravel (up to 256 mm) mobile under 300 cfs flow (top)
- Gravel/cobble/boulder (up to 512 mm) mobile under 1,000 cfs flow in main channel; fine material in overbanks



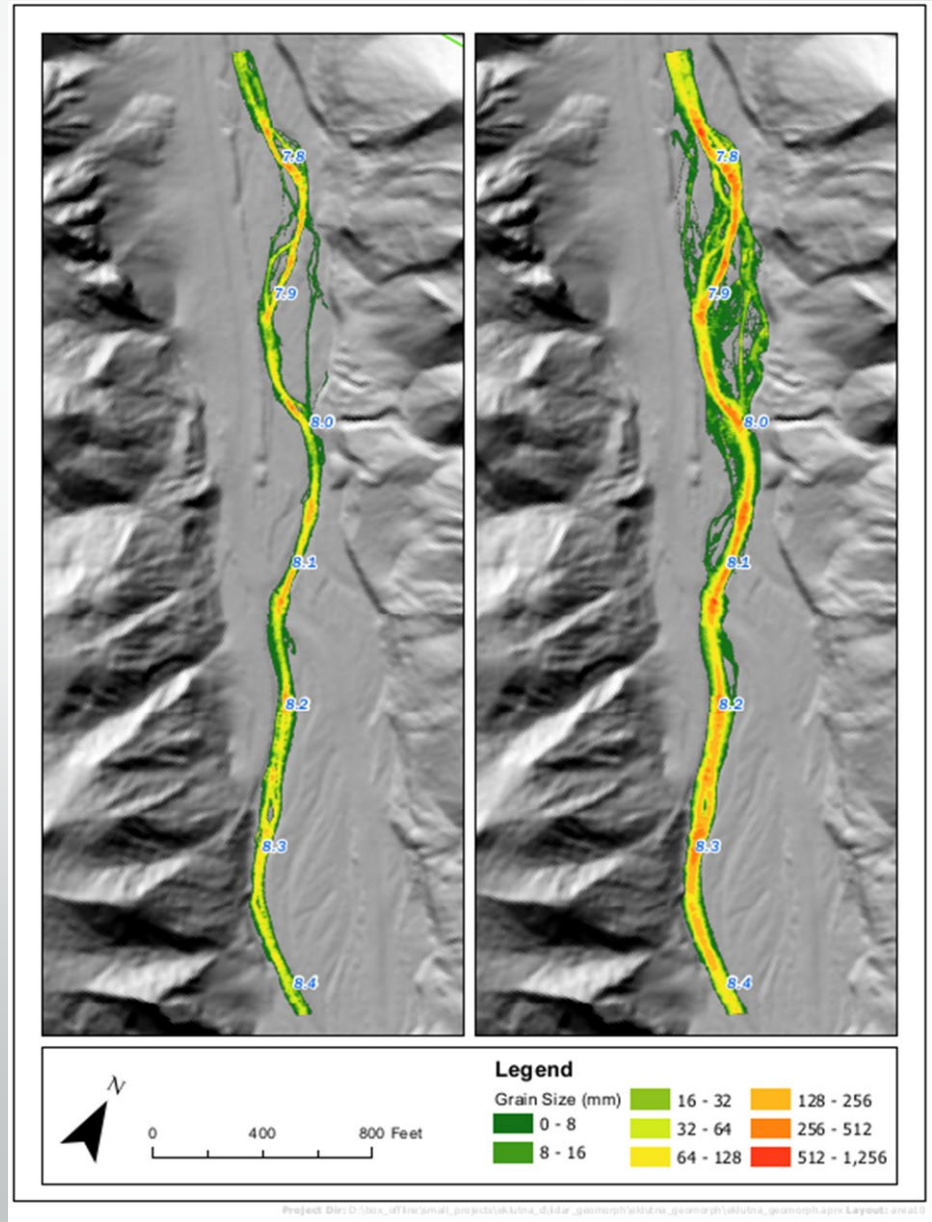
Two-Dimensional HEC-RAS

- Reach 9, lower canyon (confined)
- Cobble/gravel (up to 512 mm) mobile under 300 cfs flow (top)
- Gravel/cobble/boulder (over 512 mm) mobile under 1,000 cfs



Two-Dimensional HEC-RAS

- Reach 10, below lake
- Gravel/cobble (up to 256 mm) mobile in main channel at 300 cfs (left side of figure)
- Cobble/boulder (over 512 mm) mobile in main channel at 1,000 cfs flow (right side of figure)



Geomorphology and Sediment Transport Conclusions

- 2021 flow release met all the geomorphic flow goals except channel migration
- HEC-RAS sediment transport models are a valid tool for evaluating the effects of long-term flow release scenarios on substrate
- The Eklutna River will adjust to a new flow regime over several decades, resulting in different hydraulic/substrate conditions than in the existing model (consider for future monitoring)

Instream Flow Update

- All information in the draft year 2 study report was covered in the September 2022 and February 2023 TWG meetings
- Currently working on supplemental 2D analysis for spawning…
  - Updated approach for defining spawning habitat in Reaches 6 and 10 where on-the-ground surveys were not possible (i.e., extrapolation from adjacent reach data).
  - Updated approach of delineating flow-spawning habitat relationships in Reach 3 where sufficient substrate data to cover all modeled area was not available.
  - Time series analysis for chinook, coho, sockeye **spawning** at 4 flow levels and release options A-C. We'll show data for Chinook. Roll up of all model results (1D and 2D) for **spawning**.