Eklutna River Workshop

Summary of Outcomes, Recommendations, and Future Needs

June 27-29, 2018

I. Introduction

The Eklutna River is a vital subsistence fishery that once supported thriving populations of all five species of North American Pacific salmon. While each of these fishes remain present in the lower portions of the Eklutna River, and there are anecdotal reports of landlocked sockeye (kokanee) persisting in Eklutna Lake, today's populations are greatly reduced and limited in distribution.

The Lower Eklutna Dam, which was completed in 1929, was built without any provision for fish passage and entirely blocked up and downstream migration. Additionally, the Upper Eklutna Dam, which was completed in 1955, similarly does not accommodate fish passage. Operation of the Upper Eklutna Dam also typically diverts the entire lake outflow out of the Eklutna watershed and into the adjacent Knik River watershed through the Eklutna tailrace. These two facilities have had a significant adverse effect on the Eklutna River watershed, its salmon populations, and the people of the Native Village of Eklutna.

The Lower Eklutna Dam became obsolete and abandoned decades ago. A multi-year effort to remove the Lower Eklutna Dam culminated in deconstruction of the dam in the summer of 2018. Removing the Lower Eklutna Dam was a monumental endeavor that presents a unique opportunity to restore the historic Eklutna River salmon fishery. To that end, over the course of three days, the Native Village of Eklutna and Trout Unlimited convened a workshop to improve scientific understanding of the Eklutna River system and its important wild salmon populations. This workshop was an important step in developing a collaborative vision for salmon recovery on the Eklutna and for identifying concrete next steps to improve conditions for salmon in the near-term.

II. Participants

Participants of the Eklutna River Workshop were invited because of their scientific or technical expertise, or their particular familiarity with the Eklutna River and its salmon populations. Participants represented a diverse group of experts to help address the complex issues relating to the restoration of the Eklutna River watershed. While many individual participants may be employed by various federal or state agencies, their participation in this workshop does not necessarily signify endorsement by that agency. Individual participants include (in alphabetical order):

Jay Baumer, Sport Fish Area Management Biologist, Alaska Department of Fish and Game
Ronald Benkert, Division of Habitat Regional Supervisor, Alaska Department of Fish and Game

Carrie Ann Brophil, Land and Environment Coordinator, Native Village of Eklutna
Janet Curran, Hydrologist, U.S. Geologic Survey
Michael Daigneault, Restoration and Partnerships Coordinator, U.S. Fish and Wildlife Service
Sean Eagan, Hydrologist, National Marine Fisheries Service
Kevin Foley, Biologist, U.S. Fish and Wildlife Service
Heather Hanson, Fish Passage Engineer, U.S. Fish and Wildlife Service
Rene Henery, Science Director, Trout Unlimited
Christopher Hoffman, Biologist, U.S. Army Corps of Engineers
Crane Johnson, Hydrologist, National Oceanic & Atmospheric Administration
Jonathan Kirsch, Fishery Biologist, Alaska Department of Fish and Game
Marc Lamoreaux, Land and Environment Director, Native Village of Eklutna
Susan Walker, Fish Biologist, National Marine Fisheries Service Hydropower Coordinator

For additional information, please contact Austin Williams, Trout Unlimited's Alaska Policy Director, at awilliams@tu.org or 907.227.1590.

III. Workshop Agenda and Goals

Participants met on June 27, 2018, to tour the Eklutna River Watershed and become familiar with the river system. Workshop participants visited Eklutna Lake, the upper Eklutna Dam site, the moraine and valley reach of the Eklutna River downstream from Eklutna Lake, and the overlook along the canyon near the Lower Eklutna Dam site. Several participants were also already familiar with the lower portions of the Eklutna River, including Thunderbird Creek, the areas around the bridges, and the estuary.

Participants met at the Eklutna Native Village Tribal Office on June 28 and 29, 2018, to further discuss and work through various issues relating to restoration of the Eklutna River and its salmon populations, as discussed in greater detail below. Eklutna River Workshop participants met with the goals to:

- Improve our understanding of the Eklutna River and its salmon populations, including the geography, landscape, and habitat; historic and current conditions; and desired conditions and limiting factors;
- Increase collaboration and alignment among stakeholders working to support and conserve Eklutna River salmon populations; and
- Create a common conceptual model and scientific basis for recommendations related to high priority mitigation and restoration actions necessary for restoration of salmon to the Eklutna River.

Before the workshop began, participants identified the following potential outcomes, which are described below in further detail:

- Selection of target/focal species;
- Description of desired conditions for focal species populations and habitat reaches;
- Identification of limiting factors;
- Creation of a template hydrograph; and
- Identification of research needs and information gaps.

IV. Workshop Conclusions and Recommendations

a. Future Seasonal Streamflow Should be Patterned After a Natural Hydrograph.

Using historic stream flow data from the Eklutna River, gauge data from the Eklutna Lake, and a comparison to the seasonal patterns exhibited by similar streams located throughout Alaska, a hydrograph was created for streamflow at the Eklutna Lake outlet from 1947 to 1954. This period predated completion of the upper Eklutna Dam and is a time where there was limited ability to manipulate streamflow at the lake outlet. Participants agreed this hydrograph closely mimics natural streamflow at the lake outlet and serves as a helpful template for natural flows.

Figure 1: Eklutna Lake Outlet Streamflow Normalized by Mean Annual Flow, 1947 to 1954

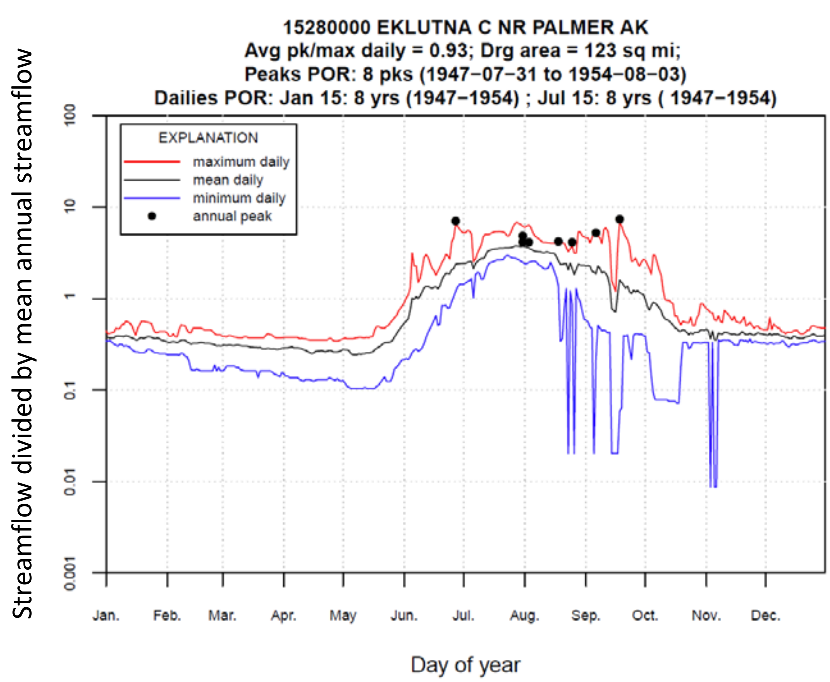


Figure 2: Lower Eklutna River Flows, Past and Present

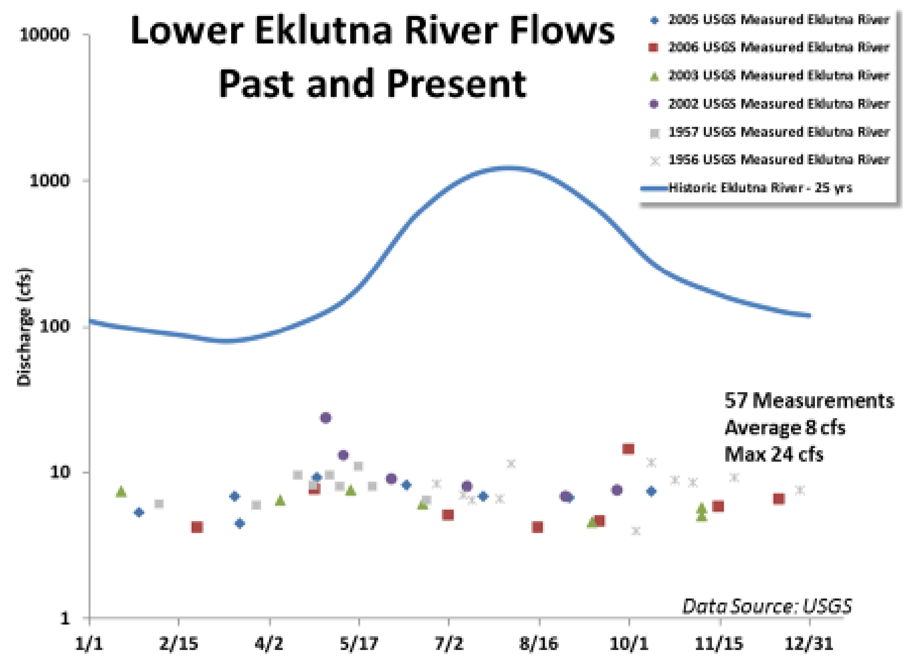
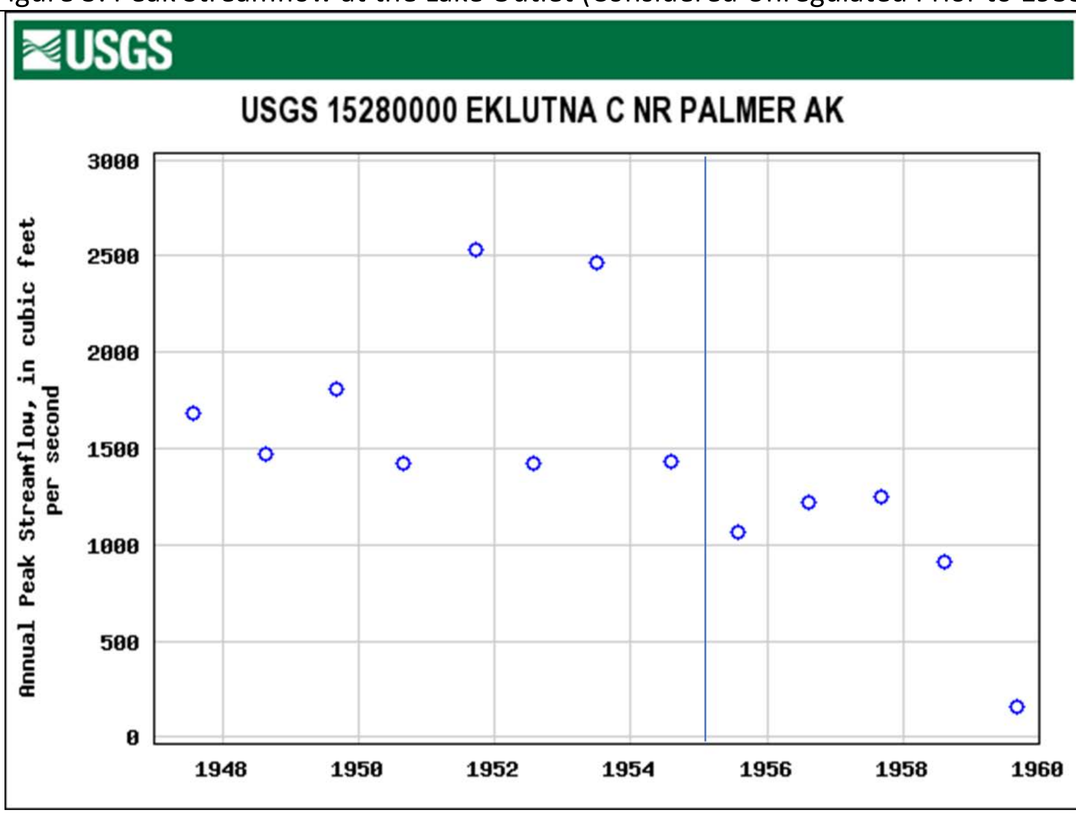


Figure 3: Peak Streamflow at the Lake Outlet (Considered Unregulated Prior to 1955)

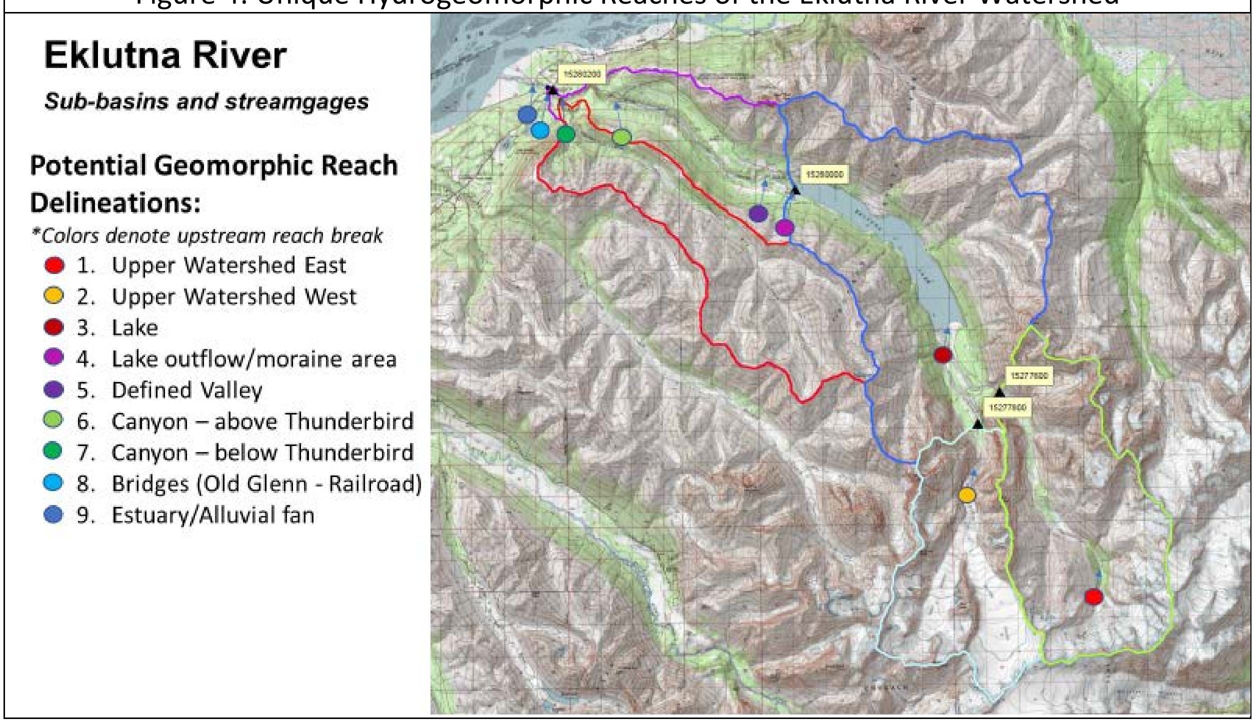


While typical pre-1955 seasonal streamflow ranged from approximately 100 cubic feet per second (cfs) to as much as 1,000 cfs, recent streamflow measurements on the Eklutna River downstream from the lake outlet, excluding rare spill events, have averaged 8 cfs with a maximum measured flow of 24 cfs.

b. Restoration and Mitigation Efforts Should Account for the Unique Hydrogeomorphic Stream Reaches of the Eklutna River Watershed.

Participants identified multiple unique hydrogeomorphic reaches of the Eklutna River Watershed that deserve consideration when planning restoration or mitigation efforts. Each of these reaches contributes, or has the potential to contribute, to the productivity of salmon populations in different ways considering each indicator species' life history stages, stream flow, and the season. These reaches include: (1) upper watershed east; (2) upper watershed west; (3) Eklutna Lake; (4) lake outflow and moraine area; (5) defined valley; (6) canyon above Thunderbird Creek; (7) canyon below Thunderbird Creek; (8) Old-Glenn Highway Bridge to the Railroad Bridge; and (9) the estuary and alluvial fan. These reaches are identified in Figure 4, below.

Figure 4: Unique Hydrogeomorphic Reaches of the Eklutna River Watershed



c. Restoration and Mitigation Activities Should Focus on Coho, Chinook and Sockeye Salmon as Indicator Species Because of their Unique Requirements.

Workshop participants identified coho, Chinook and sockeye salmon as target indicator species due to the variability in their spatial and timing distribution as well as their diverse habitat requirements for different life stages. These species have broad distribution and living condition requirements that cannot be accounted for without considering each individual species' unique needs. However, by considering each of these species, restoration and mitigation activities are likely to also satisfy the needs of other species, such as pink and chum salmon. As such, restoration and mitigation activities in the Eklutna River watershed should be undertaken with each of these species' unique life histories and needs in mind.

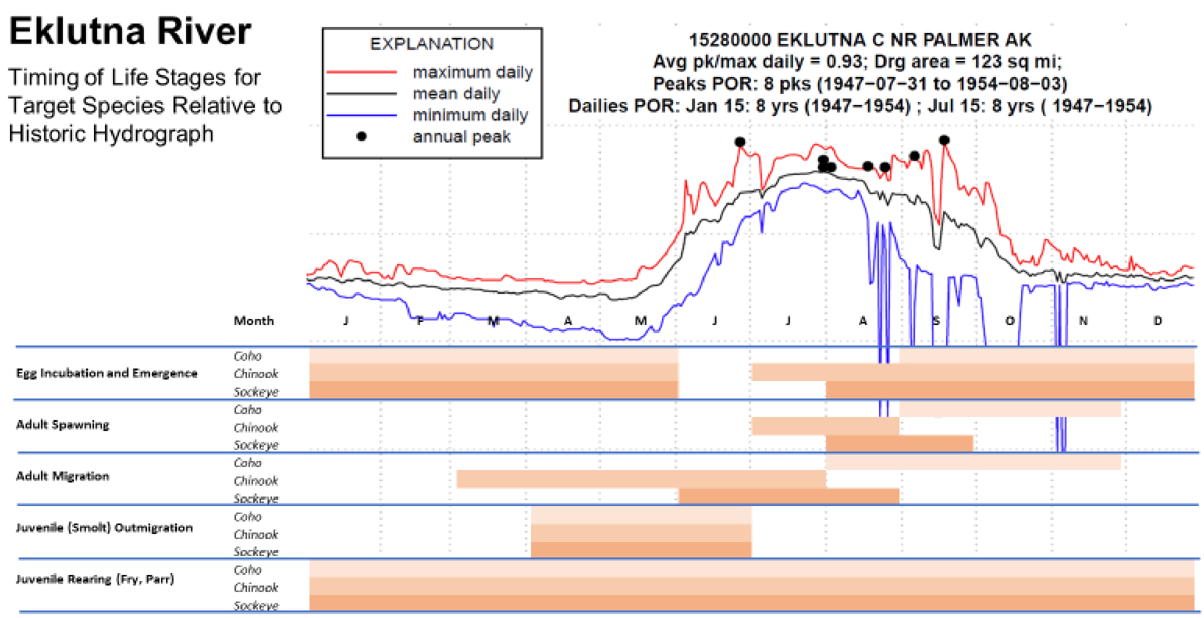
d. Future Streamflow Should Account for each Focal Species' Unique Needs and Life Histories.

Participants agreed that mitigation and restoration efforts should focus on recreating a natural hydrograph that accounts for the separate life stages of each focal species. Each focal species has a unique life history that causes it to be present in the specific reaches of the Eklutna River at different life stages at different times of the year. Successful mitigation and restoration efforts must account for the unique needs of each life stage and the timing of each life stage, for each focal species. Providing adequate streamflow for adult migration and spawning in the summer months will have limited value for restoring wild salmon populations if there is insufficient streamflow for juvenile rearing over the winter months, for example.

Using the template hydrograph discussed above and the participant's expertise with each species' life histories, the participants developed a chart (Figure 5, below) identifying when each species, by life history stage, would naturally be present in the Eklutna River. This chart illustrates which life stage for each focal species would naturally be present in the river, the different timing for each life stage of each focal species, and the seasonal change in the historic hydrograph.

Adult migration would occur from as early as late May for Chinook salmon to as late as November for coho salmon. Spawning would occur from July for Chinook salmon into November for coho salmon. Incubation and emergence would occur from July for Chinook salmon to May for all three species. Outmigration of smolt would occur from April to June for all three species. Rearing of juvenile would occur during all months. Multiple life stages for each species would be present for each month of the year.

Figure 5: Timing of Life Stages for Target Species Relative to Historic Hydrograph



Participants engaged in lengthy discussion about the various limiting factors for each focal species' life stage, the desired conditions for each life stage, the function of streamflow magnitude relative to the desired conditions and limiting factors for each life stage, and the relationship of the focal species to each identified reach of the Eklutna River. In general, coho and Chinook used every reach for at least one life stage, with sockeye likely to exhibit stronger affiliation with lake and slow-moving areas than other species. Participants agreed that the canyon reach functioned principally, but not exclusively, as a migration corridor at certain flow levels. The below chart summarizes this discussion and the primary limiting factors that should be taken into account during restoration and mitigation efforts for each reach by season.

Summary of Natural Flow Regime Derived Habitat Function, by Season and Reach

Reach	Winter (Dec-March)	Spring (April-June)	Summer (July-Sep)	Fall (Oct-Nov)
General Overview	• **Critical Life-stages**: Incubation and Overwintering component of rearing • **Flow functions:** Stable flows,	• **Critical Life-stages**: All life stages present and movement occurring • **Flow functions:** Connectivity for fish	• **Critical Life-stages**: Spawning and Adult migration, Juvenile rearing • **Flow functions:** High to peak flows, flow variability,	• **Critical Life-stages**: Spawning, incubation, rearing, • **Flow functions:** Flow recession, sufficient flow for connectivity between summer and

	maintain sufficient temp to prevent freezing, fill low flow channel, keep eggs wet, mobilize metabolic wastes, provide adequate dissolved oxygen	movement in all reaches from the lake downstream; Flow levels increase in transition to summer; migration cues; habitat area expansion	groundwater recharge, upwelling and downwelling; connection and disconnection (based on flow variation and high vs. low flow years)	winter habitats, adequate for coho to distribute; maintenance of longitudinal and lateral connectivity; slow recessions with spikes to facilitate movement; sufficient flow to protect fish from predation pressure
Upper Watershed East	• Flow present and potential for some habitat use	• Flows present	• Flows present	• Flows present (receding)
Upper Watershed West	• No Flow present	• Flows commence and increase	• High to peak flows	• Flows present and receding
Lake	• Frozen surface • Potentially disconnected from downstream reaches • Lake level consistent enough for sockeye incubation	• Lake level increase • Lake turnover	• Lake level increase • High to peak outflows	• Lake Level dropping • Lake turnover • Connectivity between lake and downstream reaches of the river
Lake Outflow to Moraine	• Some lateral habitat • Remain wet for overwintering • Will require more water to keep wet due to lateral extent; (groundwater may be present, potential for tributary rerouting)	• Off channel habitats connected • Emerging fry moving into rearing habitat • Potential Ice scour from lake Ice	• Potentially best spawning habitat • Sufficient depth for spawning • Potential for veg recovery and beaver dams expanding lateral habitat area • Relatively clear water as mostly from lake or groundwater sources	• Lateral habitat and depth decrease as lake level drops • Slow recession with spikes to promote downstream distribution • Connectivity with lake
Defined Valley	• (Similar to Lake Outflow to Moraine) • Stable flows • Wetted conditions maintained for incubation • Ice jams occasionally inundate off and side channel habitat	• (Same as Lake Outflow to Moraine)	• Similar to Lake Outflow to Moraine • Suitable spawning conditions • Significant reconnection and wetting of side channels • Extended activation of floodplain • Large wood transport	• Sufficient flow to facilitate fish distribution • Slow recession • Spikes to stimulate movement • Off channel connectivity maintained as off channel habitats shrink due to recession • Sufficient flow to buffer against predation pressure
Canyon – Above Thunderbird	• (If Defined Valley conditions met, should be sufficient)	• Fluctuating flows to allow passage through velocity	• Large wood transport • Log jams	• Slow recession with spikes

	• Connectivity with lower reaches maintained • Overwintering habitat in pools • Side channels connected	barriers (e.g. sockeye) • Sufficient flow to surmount physical barriers and provide connectivity	• Channel maintenance flows • Spawning in wider sections	• Fish redistribution between summer and winter habitats • Potential barriers at pinch points as flows recede
Canyon – Below Thunderbird	• Stable flows for incubation • Microhabitat in backwaters near toe of canyon maintained	• Emergence • High flows causing emergent/ Juvenile fish movement • Rearing in microhabitat • Potential movement of pinks and chums	• (Similar to Canyon above T-Bird)	• (Similar to Canyon above T-Bird)
Bridges	• Maintain wetted channel • Likely single channel (due to Bridges) • Flowing/ not frozen (using eagle creek as example) • Spawning habitat/ incubation for chum and pink salmon	• Flows increase reconnecting limited off-channel habitat	• Primarily movement • (Management of flow releases/ large events for bridge safety/ to prevent scour)	• Slow recession with spikes • Fish redistribution between summer and winter habitats
Estuary/Alluvial Fan	• Sufficient wetting for incubation of pink and chum eggs • Juvenile overwintering in ponds • Groundwater contributions	• Similar to bridges but more extensive off channel and pond habitat connected	• Suitable spawning conditions • Similar to below Thunderbird • Sediment transport and deposition; Fan expansion • (Some loss of habitat possible if channelization necessary for bridge protection)	• Slow recession buffered some by Thunderbird • Sufficient connectivity for access to overwintering habitats

Participants also found agreement on a set of guiding principles for managing peak streamflow. First, a peak flow event likely is required to kickstart channel reformation and sediment transport. Second, regular peak flows are required to maintain off-channel habitat that is especially important for coho salmon. Third, streamflow must be sufficient for lateral connectivity between the main channel and side and off-channel habitat. Maintaining off-channel habitat and connectivity issues are especially important for coho salmon, but if these habitat needs are addressed for coho salmon they likely also will be addressed for Chinook and sockeye in the process. Fourth, recession flows in the fall should occur slowly and with several spikes in streamflow to replicate rainstorms.

V. Additional Restoration and Mitigation Opportunity Beyond Streamflow

Participants agreed that establishing and maintaining adequate streamflow with a similar seasonal variation to the natural hydrograph was the most important consideration for restoring abundant wild salmon runs to the Eklutna River, and that restoration could not occur without adequate streamflow. However, additional non-flow measures were also discussed that should be considered. The additional non-flow measures discussed at the workshop include: (1) habitat reconstruction and restoration to support spawning habitat and off-channel rearing habitat; (2) fish passage at the upper Eklutna dam to allow migration into and out of the lake; (3) vegetation management to promote lateral habitat expansion and reconnection; (4) large woody debris management; and (5) restoration of historic tributary channels near the lake outlet to increase flow in the Eklutna River.

VI. Additional Research Opportunities and Information Gaps

In addition to the various recommendations and the conceptual model discussed above for restoration and mitigation of the Eklutna River, participants of the Eklutna River Workshop identified various research opportunities and information gaps. While the full restoration of the Eklutna River may require an increased scientific understanding of the watershed and its various processes, we already know enough today to start taking action to restore the watershed. The fact that additional research opportunities and information gaps exist should not be seen as an obstacle to initiating restoration and mitigation efforts. There is no reason for delay.

Specific research opportunities and information gaps include:

- What is the likely timing, frequency and magnitude of natural peak flows under unimpaired conditions?
- At what flows would relic channels reconnect with the main channel?
- What role did or could ice dams play in flood, scour and channel formation?
- What is the relationship between flow and alluvial fan size, growth and accumulation?
- Is there a need for an interim condition for habitat formation or sediment transport before restored conditions are achieved?
- What type of fishery is desirable or possible for each of the target species?
- What is the relationship between salmon populations in the Eklutna River and other nearby populations, including in the tailrace?