Enclosure: US Fish and Wildlife Service Comments on the Draft Fish and Wildlife Program and Draft Summary of Study Results for the Eklutna Hydroelectric Project

Overview

The Draft Fish and Wildlife Program (Draft Program) does not address fish passage, it proposes to release a baseline level of year-round instream flows from the Anchorage Water and Wastewater Utility portal valve located approximately 1 mile downstream from the Eklutna Lake dam, and it does not propose infrastructure changes to accommodate the higher flows required for channel and habitat maintenance. As drafted, we believe the Program does not entirely meet the intent of the 1991 Agreement, which was established in part due to of concerns for the sockeye salmon (*Oncorhynchus nerka*) run[1], and which was expected to be as protective as the Federal licensing process[2]. Instead, the U.S. Fish and Wildlife Service (Service) recommends a phased approach which sets interim terms or benchmarks to spur incremental progress towards a long-term and mutually agreeable solution that ultimately provides fish passage at the dam and instream flows capable of supporting fish and wildlife into the future.

Overall, to meet the intent of the 1991 Agreement, we believe the Final Fish and Wildlife Program should include the following:

- Provide water to the full length of the river on a year-round basis.
- Provide a long-term solution to get marine derived nutrients from the river to the lake.
    - We have expressed openness to a phased approach in returning sockeye salmon to the lake. The Final Program should provide a commitment to design a phased approach within 5 years of the Final Program.
- Include methods to facilitate larger channel maintenance flows from the lake, such as a new gate at the dam.
- Include a higher instream flow regime to increase downstream salmon rearing habitat; the channel maintenance flow regime should be increased commensurate with the increased instream flow regime.
- Include a summary section in the Program or Draft Summary of Study Results that provides quantification of acres impacted, where possible.
- Include physical habitat manipulation in both the Program and the Adaptive Management Plan.
- Provide more flexibility in the Adaptive Management Plan so that PMEs can be implemented as effectively as possible.

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[1] According to the Alaska Energy Administration's EA, during negotiations of the Eklutna sale, "One significant problem was identified; namely, loss of a sockeye run that once spawned in Eklutna Lake. The loss was caused by a small private power development constructed in 1929. This problem was not identified in pre-authorization studies for the Federal Eklutna Project and the Federal project does not include any mitigation. This specific problem and the desires of the fish and wildlife agencies to provide appropriate consideration to fish and wildlife resources over the long run led first to recommendation that the two projects [Eklutna and Snettisham] be placed under FERC jurisdiction; and subsequently to the August 7, 1991 Agreement that provides a process similar to FERC's but without a requirement for Federal regulation." (AEA 1992).

[2] The 1991 Agreement specifically states the Agreement is a "mechanism to develop and implement measures to protect, mitigate damages to, and enhance fish and wildlife (including related spawning grounds and habitat) [and] obviate the need for the Eklutna Purchasers and AEA to obtain FERC licenses". The 1992 Divestiture Summary Report stated that the 1991 Agreement would work "at least as well as Federal regulation for the intended purpose of mitigation and enhancement of affected fish and wildlife resources" and would therefore be sufficient to restore and maintain habitat.

Enclosure: USFWS Comments on Draft Fish and Wildlife Program

The Service provides the following comments on the Draft Fish and Wildlife Program and Draft Study Results Summary. Comments are provided according to the sections of the Draft Program.

2.4 Comprehensive Alternatives

The Draft Program presents in Table 2-1 (p. 37) the preferred infrastructure modifications of stakeholders, with a footnote explaining the Service's alternatives C and D are in descending order of preference if public and financial support for alternative A and B are not obtained.

In a letter dated July 3, 2023, we presented our preferred alternative, including our preferred engineering measures:

> "Our preferred alternative includes Measure P, the replacement dam as described in the enclosure because it greatly increases the amount of available fish habitat while providing for year-round power generation. Although this alternative seems to find a balance with a wide range of stakeholder values and considerations, we understand that the capital expenditure estimates for construction are appreciable. Therefore, we support a Fish and Wildlife Program that includes time and opportunities for gathering public and financial support with the option to use components of Measures K, A, or C as described in the enclosure as part of a phased implementation approach or as a tiered contingency plan should public and financial support for Measure P fall short.
>
> If it is not possible for a Fish and Wildlife Program to include opportunities for gathering public and financial support for Measure P as described above, then our preferred engineering measure would be Measure K, the existing dam with fish passage as described in the enclosure."

It was not our intent to suggest that engineering measures that do not provide fish passage would be acceptable on their own as part of the Fish and Wildlife Program. Our long-term goal has been ecological connectivity to the lake, and for the Fish and Wildlife Program to reflect that same goal.

3.1 Impacts to Fish and Wildlife

One of the main ecological functions of a river in a watershed is to transport water, sediments, and nutrients to and from freshwater and marine environments. Eklutna Lake and other headwater features in the watershed are a critical source of these nutrients. Recognizing the importance of this component of the watershed, the Service recommends the Fish and Wildlife Program include methods to reconnect Eklutna Lake to the Eklutna River at the dam.

Rivers are the lifeblood of a watershed. They connect headwaters to wetlands, estuaries, and oceans, moving objects as large as boulders and whole cottonwood trees along the way. They clear debris, transfer sediment, shape channels and create new ones that provide habitat for countless aquatic species which, in turn, support a myriad of other fish and wildlife through interconnected food webs.

The Service shares the Native Village of Eklutna's (NVE) desire to return salmon to the Eklutna River, which NVE has stated in Resolution 2022-04[3]. The original Eklutna hydropower project in 1929, 94 years ago, marks the beginning of watershed function decline. Since that time, impacts to the riverine and wetland ecology have continued to mount; notable among these is the 1955 and 1964 establishment of the

[3] Native Village of Eklutna Tribal Government Resolution 2022-04, Addendum to Resolution 2019-11. May 14, 2022

present-day dam at the outlet of the historical glacial moraine lake, namesake of the Eklutna people, which all but cut off stream flows downstream of the hydropower dam.

The historical impacts associated with the complete dewatering of an anadromous stream of ecological and cultural significance have not been adequately quantified through the 1991 Agreement process. According to the 1991 Agreement, Project Owners are required to fund and conduct studies to examine and, if possible, quantify impacts to fish and wildlife as a result of the Project. The Draft Program (p. 45) does qualitatively describe impacts associated with river impoundment, stating the existing hydroelectric project "diverted all outflows from Eklutna Lake, [and that] reduced flows to the Eklutna River led to loss of winter rearing habitat, poor sediment transport, excessive siltation of stream channels, gravel starved stream channels, reduced water quality, and insufficient water depth for Chinook salmon spawning." Adding, "in addition to impacting fish habitat, the Project also impacted wetlands downstream of Eklutna Dam, both riparian wetlands that existed in the upper river and estuarine wetlands below the railroad bridge." The Draft Program (p. 45) summarizes, "[i]mpacts to salmon and wetlands likely had an indirect impact on the wildlife that depend on the salmon and utilize those wetlands".

While the Draft acknowledges historical conditions and loss of ecosystem functions, it stops short of attempting to quantify the change between pre-development and existing conditions, stating that "the original impact of the Project on fish and wildlife resources is difficult to quantify since no fish or wildlife studies were conducted pre-construction (p. 45)." This statement discounts multiple lines of inquiry which could have been followed to estimate actual system wide impacts associated with dam river impoundment and hydropower operation. Using models developed for this project could provide another means of comparing relative habitat losses with potential habitat gains. While the models developed for estimating habitat gains under different alternatives are only calibrated to 375 cubic feet per second (cfs), it would be informative to see what they would predict for spawning and rearing habitat at the historic flow levels to estimate loss.

Section 3.1 of the Draft Program does not quantify impacts to fish and wildlife. Therefore, as the majority of the watershed has been affected by the ecological repercussions of removing water, we recommend the final Program include impacts to consider the watershed effects. Avenues to explore quantification of impacts include: 1) employing higher test flow releases to calibrate instream flow and habitat models to flow levels commensurate with historical, formative flows; 2) giving due credit and scientific credence to Indigenous Knowledge provided by Native Village of Eklutna knowledge bearers regarding the historical state of the fishery and watershed; 3) empirical inferences of pre-dam hydrology and habitat conditions based on cross section morphology; and 4) an analog comparison of similar river systems through either reference stream case studies or literature review.

Fish and wildlife habitats, including those upstream, downstream in and around Eklutna Lake, Eklutna River, connected wetlands, off-channel habitat and nearby uplands have been impacted by the Eklutna Hydropower Project. Drastic changes to water and sediment balances stemming from the disconnected lake have created ripple effects of impacts throughout historically connected habitats both up and downstream from Eklutna Dam (Magilligan and Nislow 2005). Changes to drainage hydrology, including extreme lake fluctuations and discontinuity of instream flows below the dam have disrupted littoral lake and sockeye spawning habitats, ground water dynamics and sediment transport processes. These changes have severed the connection between floodplains and the active river channels and cut off the lower river from its headwaters. Loss of floodplain connectivity is directly related to wetland and riparian corridor degradation.

These direct, indirect, and cumulative impacts over time and throughout the watershed have degraded the river channel and floodplain to the point they are no longer capable of self-maintenance. Unstable sediment transport causes riverine habitats to excessively fill or cut as flows are either incapable of routing incoming silt, sand, and rocks, or are unable to reach historical elevations for incipient points of flooding where stream power diminishes upon contact with the floodplain and erosive power is tempered. Reduced or lost access to upstream and lateral (side channel, slough, and wetland) habitats directly interferes with the ability of salmon to complete their complicated lifecycles and reduces the ability of all aquatic species to move in response to disturbance. Salmon begin their lifecycle in fresh water; as they move through the river and off channel areas to the marine environment, they are an important food source to many predators from other fish to birds, beluga whales, and humans. They also provide food to many species, including eagles, wolves, and bears, as they migrate back upstream through the river, ponds, lakes and tributaries, where they complete their life cycle and decay to transfer important marine derived nutrients back to the system.

The Service agrees with the U.S. Army Corps of Engineers (USACE 2004) in their assessment that "salmon populations are severely impacted by the removal of all Eklutna Lake water from the Eklutna River." For decades, the majority of Eklutna Lake water has been captured and discharged outside of the Eklutna River watershed. As water was diverted for power, not only was the Eklutna Lake and stream channel affected, but the entire watershed was impacted. Diverted water was used for hydropower and a fish hatchery in Knik Arm, with that the richness of salmon as food and nutrients were diverted from the Eklutna watershed as well.

The Eklutna River is approximately 12 river miles long from dam to discharge into Knik Arm with a historic average width of 100 feet. That amounts to 145.5 acres of direct impacts in addition to other watershed impacts (wetlands, off-channel habitat, lake habitat, upper tributaries, and coastal habitat) that should be considered, as well as impacts on fish and wildlife using surrounding riverine and upland habitat.

Using the watershed approach sets a boundary to quantify potential direct, indirect, and cumulative impacts on fish and wildlife based on habitat. The Eklutna watershed is 174 square miles (111,360 acres) of which Eklutna Lake is 119 square miles (76,160 acres), the Eklutna River drainage is 17 square miles (10,880 acres), and the remaining area is in the Thunderbird Falls sub-watershed (USACE 2004, p.9). Therefore, the Draft Program should consider the 10,880 acres of habitat impacted in the Eklutna River drainage and should also include acres of habitat impacted by fluctuations in Eklutna Lake, areas of upstream tributaries, downstream river, wetlands, and coastal habitats in the watershed. Functional loss should include temporal loss and modifications of habitat.

The Wetlands and Wildlife Study covered an area of 1,357.5 acres (ABR 2023b) using 2022 LiDAR and aerial photos from the 1950s to compare the extent and ecological function of current wetlands and wildlife habitats to historic conditions. Comparing total change of acres by waters, wetlands, and uplands in Section 5.2 does not adequately represent loss of function or impacts of habitat modification and lack of water on fish and wildlife. However, distinct changes begin to emerge as wetland types were compared from historic to current conditions in Appendix D[4]. In the 1950s there was greater complexity and off-channel habitat throughout the river, especially from River Mile (RM) 5 to the old upper dam location, when the river was still getting discharge from the lake. After the new dam was built and water

[4] Appendix D: National Wetland Inventory (NWI) wetland types mapped from current (2022) and historical (1950) imagery in the Wetlands and Wildlife Habitat Study area, Eklutna Hydroelectric Project, 2022

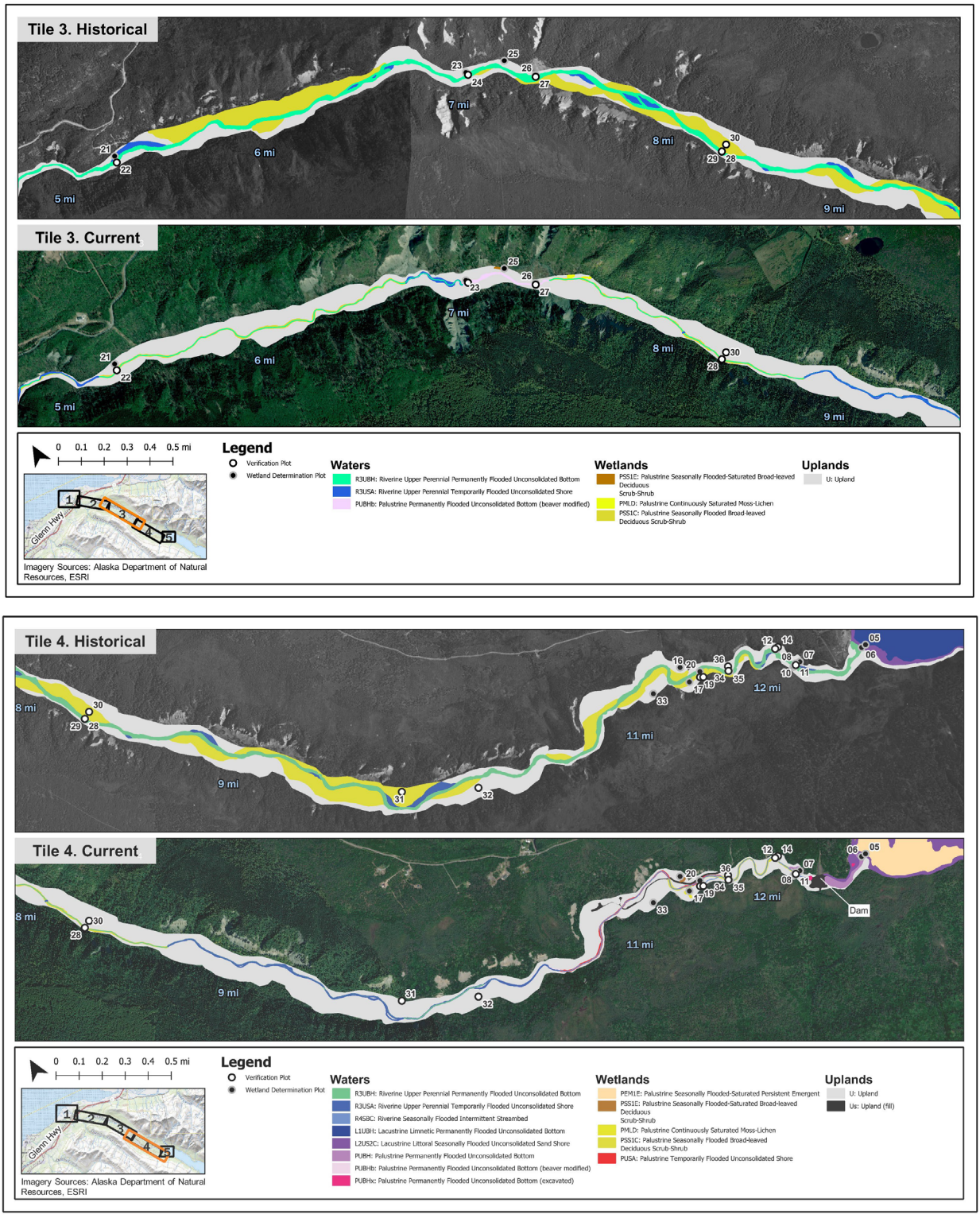

Figure 1. Example conversions, Tile 3 and Tile 4, mapped wetland types comparing historic to current habitats (ABR 2023b).

was diverted, significant habitat changes developed. This is especially evident from RM 12 to RM 5 and at the mouth of the river from RM 1 to RM 0, (Figure 1, Appendix D, Tiles 1, 3, and 4; ABR 2023b).

The largest areas of loss and conversion are permanently, temporarily, and seasonally flooded areas (R3UHB, R3USA, L1UBH, and PSS1C). Together these areas represent 522.3 acres of direct impacts for just those four wetland types, which still does not account for impacts for fluctuations at the lake, uplands, tributaries, or coastal impacts.

The Terrestrial Study Report (ABR 2023a) uses the information compiled in the Wetlands and Wildlife Habitat Study (ABR 2023b) to estimate the acreage of change from historic to current habitats due to changes from construction and water diversions of the hydroelectric Project on wildlife in the Eklutna River drainage. It verifies riparian habitats were more extensive in the Eklutna River drainage prior to construction of the upper dam. According to ABR (2023a), prior to water diversion in 1959, Seasonally Flooded Low and Tall Alder-Willow Shrub Scrub covered approximately 151 acres in the August 1950 aerial photographs, compared to the approximate 47 acres identified in 2022 LiDAR imagery. This change "is almost certainly due to the dewatering of the river and the reduction in peak flood flow events, which ranged from 1,420 to 2,530 cfs between 1947 and 1954 and began to drop in 1955 after construction of the earthen dam at the outlet of Eklutna Lake; peak flow then dropped substantially to 162 cfs in 1959 after the Goat Mountain diversion tunnel began operation" (USGS 2022 as referenced in ABR 2023a). Historic overbank flows, which likely occurred twice annually (spring and late summer), were sufficient to maintain riparian areas in an early to mid-successional shrub phase and the extent of the riparian shrub in the 1950s photography may be underestimated.

The Eklutna Lake Aquatic Habitat and Fish Utilization Study (Kleinschmidt 2023a) found Dolly Varden, rainbow trout, and kokanee in the shallows of Eklutna Lake. This study estimated a range of up to 3.61 acres of existing suitable habitat for spawning ocean-run fish in the East and West Forks of Eklutna Creek. In addition, spawning kokanee were observed in lower Eklutna Creek and the East Fork, Tributary 4.1 and Tributary 4 below the perched culverts (p. 45). Observed spawning kokanee ranged up to 6.5 inches in length. There is also a small pond on the east shoreline of Eklutna Lake that has season habitat for Dolly Varden, rainbow trout, and kokanee.

All of these watershed impacts should be quantified in the in the Fish and Wildlife Program. Quantifying these impacts gives context to the PME measures proposed.

3.2 PME Measures for Fish and Wildlife

The protection, mitigation, and enhancement (PME) measures the Project Owners proposed provide year-round base flows and periodic channel maintenance flows from Eklutna Lake into the Eklutna River. This is an improvement over the current conditions of no flow. However, year-round water is proposed to be released 1 mile downstream from the dam and only during channel maintenance (flushing) flows from the existing gate at the dam. This would only supply a small percentage of historical water flow back to the river and would leave a 1-mile reach remaining completely dewatered. No other measures were proposed for mitigation of impacts to fish and wildlife, other than an Adaptive Management Plan that limits the volume of water to be released.

The proposed Program does not mitigate for all impacts of the Project. Performance of a wetland functional assessment was previously planned to quantify impacts, as agreed upon by the TWG. However, according to the Wetlands and Wildlife Study Results (p.38, ABR June 2023), because no

permits were needed, functional loss was based on best judgement of the Project Owner's consultant instead, and no mitigation for loss of wetlands was proposed.

The Service recommends a broader scale of PME measures be developed to mitigate the full range of impacts from the Project. The Service provided our preferred alternative on July 3, 2023. In summary, our recommendation included the replacement dam and our preferred flow regimes: year-round instream flows of 160 cfs June through October and 75 cfs January to May, with an adaptive management strategy that allows for adjusting the flow regime based on new information and monitoring results; and channel maintenance flows of 800 cfs once, then 700 cfs every 3 years.

Additionally, as described in our recommendation letter, dated July 3, 2023, the Service recommends AWWU bridge construction, partial lakeside trail improvements, and physical habitat improvements. We are open to a phased implementation approach whereby more water is returned to the Eklutna River as soon as possible while time is provided in the Fish and Wildlife Program for planning a new dam. If a new dam is not possible, then the next best alternative would be the existing dam with new infrastructure for fish passage.

The Fish and Wildlife Program should incorporate habitat improvements, including repair and maintenance of the perched culverts and other fish passage structures such as those along the AWWU access road. The Program should include enhancement and protection of spawning a rearing habitat in Eklutna Lake and tributaries, and Eklutna River habitat. Additional PMEs and Adaptive management Strategies are provided below in Section 3.4.

3.2.1 Year-Round Instream Flows

The Draft Program states:

> "…a flow release prescription has been developed that is focused on restoring habitat for Pacific salmon in the Eklutna River to productive levels, but at the same time, and in accordance with the 1991 agreement, is balanced with the needs of other water resource users in the basin (e.g., wildlife, electric rate payers, municipal water utilities, recreation, and others)…As discussed previously, the flow regime proposed in this Draft Program was selected to achieve a significant amount of the potentially available habitat in the Eklutna River within prudent capital, O&M, and replacement energy costs, and within the capacity of existing AWWU infrastructure to release the water" (p.47).

While introducing some flow is an improvement over no flows, we disagree that introducing baseline levels for 11 out of the 12 miles of river with no connectivity to the lake restores habitat to productive levels or that the proposed flow regime would achieve a significant amount of the potentially available habitat, and the Service has provided previous comments on this subject.

Habitat loss associated with dam development is not enumerated. Instead, existing conditions were set as the baseline for assessing potential PME measures for instream flow, geomorphology, sediment transport, and habitat models. These analyses were all based on test releases of up to 150 cfs, one tenth of historical bankfull flows (1,527-1,682 cfs in the pre-development historical channel; Hanson 2019, p. 6 and Appendix B). This flow level allowed for extrapolation of modeling up to 375 cfs (Kleinschmidt 2023b, pp. 18-19), which only evaluates habitat within the historical low flow channel. At this intermediate flow, the water never reaches the tops of the stream banks or accesses the floodplain. As we have stated previously (Service 2022, p. 3), this produces flawed estimates of rearing habitat gains and losses at different flow levels.

Intermediate flows in an oversized channel that has no access to a floodplain will produce depths and water velocities that are unsuitable for both salmon spawning and rearing, but particularly rearing (as rearing habitats are largely associated with side channel, wetland and riparian areas). The lack of modeled suitable rearing habitat in this case does not reflect reference watershed conditions. All of the figures and tables in the Eklutna River Instream Flow Year 2 Study Report (Kleinschmidt 2023b) and Draft Summary of Study Results referencing "maximum available habitat" are speaking to the modeled depth and velocity of water within the historical low flow channel up to 375 cfs. Models show rearing habitat declining at intermediate flows as current velocities and shear stress within the low flow channel increase until the water surface reaches the incipient point of flooding and accesses the floodplain, at which point, rearing habitat is maximally available. The rearing habitat analyses did not capture the range of flows necessary to model floodplain habitats critical to understanding Eklutna River rearing habitat potential and losses. The 2D HEC-RAS modeling does show increasing gains of off-channel habitat with increases in flow, with those habitat increases continuing beyond 375 cfs and may be a more useful tool for understanding rearing habitat dynamics across potential flow release levels (Kleinschmidt 2023b, pp. 93-97).

The Service continues to recommend an instream flow regime that targets 160 cfs during the salmon spawning and migration window, and 75 cfs throughout the winter and shoulder seasons. These are the modeled flow levels which produce stream depths suitable for Salmon spawning and rearing, respectively (Moyle 2002, OSGC 1963, Thompson 1972, and DeVries 1997). Service recommended flow levels consider the literature as well as empirical Eklutna River reference stream channel measurements reported on in Hanson 2019.

3.2.2.2 Channel Maintenance Flow Regime

The Draft Program (pp. 55-56) proposes channel maintenance flows with a duration of 72 hours in 3 out every 10 years. Flows would start at 40 cfs, be at a maximum of 220 cfs for 36 hours, and slowly decrease to mimic a more natural hydrograph. Channel maintenance flows are proposed to occur in fall (when lake levels are highest) as spill events from the existing maintenance gate at the dam in combination with flow releases at the Eklutna River Release Facility downstream. According to the Draft Program, if there is not enough water to spill over, then the proposal is to raise reservoir surface height to achieve the desired flow rate. According to the Terrestrial Wildlife Study Report (p. 66) there have only been nine high-flow events between the 1965 and 2019, when water overtopped the Eklutna Lake Dam spillway, during this period flows ranged from 85 cfs to 1,022 cfs (ABR 2023a). This proposal does not provide adequate flows to restore natural watershed hydrologic dynamics.

The Service recommends an initial release of 800 cfs to reorganize the downstream channel and route as much aggraded sediment as possible, followed by triannual peak flows of 700 cfs. Routine peak flows target a water quantity that is seven times the mean annual flow, mimicking the rainfall peak in similar Alaskan rivers (Cathy Dube, personal communication).

The Draft proposes a maintenance flow regime that fails to meet the standards of the Agreement studies themselves. A channel maintenance flow regime of a 220 cfs flow in 3 out of every 10 years is inadequate, and less than the lowest peak flow considered in the Geomorphology and Sediment Transport Study (lowest was 300 cfs; Watershed GeoDynamics 2023, pp. 109-110). The study highlights channel maintenance flows of 300 to 500 cfs for encouraging substrate particle sorting within the range of preferred spawning gravels for the target species coho salmon (*O. kisutch*) and Chinook salmon (*O. tshawytscha*; Watershed GeoDynamics 2023, p. 115).

The notion that fractional maintenance flows are capable of maintaining instream habitats created under significantly higher flow conditions conflicts with our understanding of basic stream processes. A flaw in instream flow, habitat, and sediment transport analyses is that the studies assume the size and shape of the downstream channel will remain consistent with existing conditions. All flow levels less than historical conditions will be incapable of maintaining existing channel conditions in their reference (pre-impoundment) state. Every proposed flow level will therefore require modification of channel and floodplain to create self-sustaining habitat conditions within the river channel and adjacent side channel, wetland, and riparian habitats.

The surface water elevation of the agreed upon maintenance flow sets the target elevation for floodplain restoration. The lower the maintenance flow surface water elevation and, therefore, floodplain bench elevation, the more technically challenging, prone to failure, and costly it becomes to restore these habitats.

It is important to also note that the infrastructure modifications proposed in this Draft cannot accommodate the higher channel maintenance flows needed. All previously analyzed alternatives included a fixed-wheel gate which provided flexibility for controlled flow releases originating entirely at the lake.

3.4 Monitoring and Adaptive Management Program

Because the Service believes the selected year-round instream flow and the channel maintenance flow regimes are inadequate to achieve ecological connectivity and watershed restoration, the proposed water budget is also inadequate. Not only should it be higher to accommodate larger flow regimes, but it should have more flexibility for adaptive management. The Adaptive Management Plan needs more flexibility so that PMEs can be implemented as effectively as possible.

The Draft Plan includes conditions limiting the amount of banked water that can be used the following year, limiting how long water can be banked, and setting a May 1 deadline for flow modification requests. While the Service understands the Project owners need to minimize uncertainty to be able to effectively manage operations, we believe the conditions placed on water management restrict the effectiveness of the Adaptive Management Program. Banked water should not expire, and while the Adaptive Management Committee could submit a proposed water budget by May 1, the Adaptive Management Program should have a mechanism to make modifications within the water year if the Committee identifies a need and implementing the change is feasible. The Adaptive Management Committee should include a Project Owner representative.

There should also be a mechanism to address the water budget should any significant differences be found between modeled and actual habitat gains at different flow release levels.

Additionally, we proposed other PMEs with their own adaptive management components, and we continue to believe these should be a part of the Adaptive Management Program.

Additional PMEs and Adaptive Management Plan Objectives

The Draft Program should include other actions to avoid, reduce, mitigate, and compensate for Project related impacts on fish and wildlife from the Eklutna Project. The Service worked with the Owners and others during TWG meetings to identify other mitigation (PMEs); those mitigation measures should be described in the Fish and Wildlife Program. The PME measures to be addressed in the Fish and Wildlife

Program include the following, all of which would need to be monitored under an adaptive management plan:

- Reestablish Eklutna River hydrology through year-round instream flows that achieve longitudinal and lateral connectivity, fish passage through barriers, water quality standards, and suitable winter instream conditions to support functioning, resilient, and sustainable salmon habitat.
- Reestablish channel maintenance flows that maintain bedform diversity and sediment continuity, maintain fish passage through all river reaches, and avoid fish stranding during down-ramping.
- Create self-sustaining instream, off-channel, and lake habitat for fish and wildlife.
    - Design instream and floodplain habitat enhancements so that the channel is fitted to the watershed hydrology and sediment loads so that there is channel complexity, floodplain and wetland connectivity, and riparian function.
- Improve water quality at the lake by implementing measures to stabilize banks.
- Implement measures to enhance spawning and rearing habitat based on functional deficits.
- Implement stream crossing structures that promote stream functionality and flood resiliency.
- Restore wild sockeye salmon runs by implementing mechanisms for fish passage into and out of the lake, expediting the reestablishment of the runs, implementing other lake enhancements that increase nutrients and the quality of and access to spawning habitat, and reducing entrainment at the intake.
- Provide ongoing protection through continued collaboration so that adaptive management and monitoring remains effective and takes advantage of available resources.

The goal of an adaptive management program is to maximize the effectiveness of these PME measures. The plan should be structured such that PME measures have elements; each element has objectives and monitoring to measure success; and PME measures have strategies listed for adaptive management, as described in the Service's letter, September 29, 2023.

4.5 Measures Not Selected for Fish and Wildlife Program – Fish Passage

A sustainable Eklutna River fishery requires that fish have access to both lateral and headwater habitats. Effects of hydropower development and operation cannot be fully mitigated without reconnecting the river and the lake.

The Draft Program cites a 2011 U.S. Army Corps of Engineers (USACE) study where they surmise that limitations to productivity likely prevented any significant numbers of sockeye salmon from spawning in the lake (USACE 2011, pp. 25-26). That was likely based on the USACE 905b Eklutna Watershed study[5] (2004) which goes on to say that glacial fed systems, similar to Eklutna Lake, are more turbid and while they are not as conducive to significant primary production, they do support stable fish runs; "glacially dominated sockeye systems hold juvenile fish for 3 to 4 years before they enter the marine environment, and at a size similar to a sockeye rearing for 1 year in a productive system." Both the USACE studies and

[5] Eklutna Watershed 905(b) Study (p.7) "Current Eklutna River water quantity and stream system quality restricts habitat potential for resident and migratory fish. The Upper Eklutna Dam has eliminated all flows from Eklutna Lake into the Eklutna River. The only means to convey water to the upper Eklutna River is via an uncontrolled spillway at the crest of the dam during extreme flood events. This dam brought any existing Eklutna River sockeye runs to extinction and severely impacted remaining pink, Chinook, and chum salmon. Remaining salmon populations are severely impacted by the removal of all Eklutna Lake water from the Eklutna River. Resulting low flows have led to loss of over-wintering habitat, poor sediment transport, excessive siltation of stream channels, gravel starved stream channels, and insufficient water depth for Chinook salmon spawning.

the Draft Program acknowledge that Traditional Ecological Knowledge from the Native Village of Eklutna indicates that sockeye salmon were present before the dams blocked access to the lake.

The USACE Eklutna Watershed study recommended future analysis of marine derived nutrient levels in Eklutna Lake. The Draft Program mentions a study by Loso et al. (2017) that used marine derived nutrients as a biochemical marker in lake sediment to determine if there was a change in sediment composition after the lower dam was installed in 1929, indicative of the loss of marine derived nutrient chemical signals. While there was no significant difference, it was determined that annual escapements ranging from 1,000 to 15,000 sockeye salmon could have occurred without measurably altering the sediment composition[6] (Loso et al. 2017, p. 270). Even if historical escapements were less than 15,000 fish, Alaska has multiple sockeye salmon runs with escapements within or near this range that are important for subsistence, with Neva Lake near Hoonah (sockeye salmon escapement range of 2,823 fish in 2008 to 11,393 fish in 2003; Van Alen and Mahara 2011, page 20), and Redoubt Lake near Sitka (the State maintains an optimal sockeye salmon escapement goal of 7,000 to 25,000 fish; 5 AAC 01.760) as two examples.

The Year 2 Study Report for the Eklutna Lake Aquatic Habitat and Fish Utilization (Kleinschmidt 2023a) and associated Technical Memorandum for the draft report (Kleinschmidt 2022) provide greater detail about how lake and tributary habitats were assessed. Between September 28 and October 4, 2022, spawning surveys were completed throughout approximately 4.5 river miles of lake tributary reaches determined to be accessible by lake fish at the time of sampling. Limitations of the survey were acknowledged in several places, including the inability to definitively determine habitat suitability based on one observation at a singular low flow event (page 34), and the inability of the consultants to conduct a watershed wide habitat census (page 35). For these reasons, the tributary spawning survey should be interpreted as validation of the existence of suitable salmon spawning habitat upstream of the lake, as opposed to the extent of anadromy or a complete estimate of all available habitat. Suitable habitats modeled by the consultants are validated by NVE visual encounter spawning surveys. Staff biologists surveyed upstream tributaries and recorded each salmon or salmon carcass encountered by species and lifestage. Coordinates were logged and photographs taken. The NVE estimates there are 15 to 20 miles of suitable salmon habitat upstream of the lake (Carrie Brophil, personal communication). The Service believes the extent of tributary habitats upstream of Eklutna Lake that are suitable for salmon spawning is significant to the understanding of loss associated with dam construction and operation, and potential gains associated with an alternative that includes fish passage at the dam.

Also, the Service proposed spill with turbulent attraction flows as an additional downstream passage mechanism that was included in three alternatives (ND-2ST, ND-1ST, and ND-FL7ST). The idea was to use active methods (like water jets and propellors) to generate adequate attraction flows at the dam to support volitional downstream fish passage, all while not impacting the instream flow regime because the attractant flows would be returned to the lake once the juvenile fish reached a bypass gate. This measure was not discussed in the in Draft Program.

[6] Loso et al. 2017, "Our laboratory results provide only one piece of evidence regarding the question of historic salmonid presence or absence. Considering analytical uncertainties and natural variability, even a conservative interpretation of our sensitivity test confirms that thousands of salmon per year could have run into Eklutna Lake without being detected, and it is possible that a run as large as 15 000 salmon per year could have escaped notice. Our results do not demonstrate that such runs existed, but neither can our results be construed as evidence that they did not".

4.8 Physical Habitat Manipulation

The Draft Program excludes any physical habitat manipulation that would adjust the river to the new flow regime because, it says, Federal funding is being pursued for this work. However, the Service believes physical habitat manipulation should be included in the Program because it will be important mitigation for the impacts of the project, and because grant funding is not guaranteed. Habitat manipulation should be included in the Adaptive Management Program since funding, designing, and implementing projects will require a collaborative strategy to ensure concerns are addressed and habitat goals are met.

References

[ABR] ABR Incorporated Environmental Research and Services. 2023a. Terrestrial Wildlife Year 2 Study Report. Prepared by J. Welch, A. Bankert, R. McGuire, A. Prichard, C. Schick, and ABR, Inc. Prepared for Chugach Electrical Association, Matanuska Electric Association, and Municipality of Anchorage. June 2023. 109 pp. https://eklutnahydro.com/documents/

ABR. 2023b. Wetlands and Wildlife Habitat Year 2 Study Report. Prepared by W. Davis, S. Ives, C. Schick, and ABR, Inc. Prepared for Chugach Electrical Association, Matanuska Electric Association, and Municipality of Anchorage. 175 pp. https://eklutnahydro.com/documents/

Alaska Power Administration and U.S. Department of Energy. 1992. Divestiture Summary Report; Sale of Eklutna and Snettisham Hydroelectric Projects. 194pp.

Bell, M. 1990. Fisheries handbook of engineering requirements and biological criteria. U.S. Army Corps of Engineers, Portland, Oregon.

Chugach Electric Association, Matanuska Electric Association, and Municipality of Anchorage. 2023. Eklutna Hydroelectric Project Draft Summary of Study Results. 68 pp. https://eklutnahydro.com/documents/

DeVries, P. 1997. Riverine salmonid egg burial depths: review of published data and implications for scour studies. Canadian Journal of Fisheries and Aquatic Sciences 54: 1685-1698

Hanson, H. 2019. Upper Eklutna River Survey – Preliminary Fish Habitat Flow Assessment. U.S. Fish and Wildlife, Anchorage Wildlife Conservation Office, Anchorage, Alaska. 23 pp.

[Kleinschmidt] Kleinschmidt Associates. 2022. Technical Memorandum Regarding the Lake Habitat Study - Preliminary Results for Lake Fish Habitat Studies related to kokanee size, available spawning habitat for ocean-run salmon, and IHN results. Prepared by A. Thompson, M Keefe, and A. Shelly. Prepared for Aquatic Technical Work Group – Eklutna River Hydropower Project.

Kleinschmidt. 2023a. Eklutna Lake Aquatic Habitat and Fish Utilization Year 2 Study Report. Prepared by A. Thompson, M. Gagner, A. Shelly, M. Keefe, and Kleinschmidt Associates. Prepared for Chugach Electric Association, Matanuska Electric Association, and Municipality of Anchorage. 162 pp. https://eklutnahydro.com/documents/

Kleinschmidt. 2023b. Eklutna River Instream Flow Year 2 Study Report. Prepared by D. Reiser, B. Carey, C. Huang, S. Beck, M. Gagner, C. Yoder, and Kleinschmidt Associates. Prepared for Chugach Electric Association, Matanuska Electric Association, and Municipality of Anchorage. 471 pp. https://eklutnahydro.com/documents/

Loso, M., B. Finney, R. Johnson, and R. Sinnot. 2017. Evaluating Evidence for Historical Anadromous Salmon Runs in Eklutna Lake, Alaska. Arctic Institute of North America. Arctic, Vol. 70, No. 3 (September 2017), pp. 259-272.

Magilligan, F.J., and K.H. Nislow. 2005. Changes in hydrologic regime by dams. Geomorphology. Volume 71. Issues 1–2. Pages 61-78. ISSN 0169-555X. https://doi.org/10.1016/j.geomorph.2004.08.017).

Moyle, P.B. 2002. Salmon and Trout, Salmonidae - Chinook Salmon, (*Oncorhynchus tshawytscha*) in Inland Fishes of California. Los Angeles, California: University of California Press, 251-263.

[OGSC] Oregon State Game Commission. 1963. The fish and wildlife resources of the middle Willamette basin, Oregon, and their water use requirements. Report submitted to the State Water Resources Board, Portland. 27 p.

Powers, P.D., and J.F. Orsborn. 1985. Analysis of barriers to upstream fish migration. Albrock Hydraulics Laboratory, Contract DE-A179-82NP368523, Project 82-14, Pullman, Washington. Available: http://www.efw.bpa.gov/publications/U36523-1.pdf

Reiser, D.W., C. Huang, S. Beck, M. Gagner, and E. Jeanes. 2006. Defining flow windows for upstream passage of adult anadromous salmonids at cascades and falls. Transactions of the American Fisheries Society. 135:668-679

Roni, P., G. Pess, and T. Beechie. 2013. Fish-habitat relationships and effectiveness of habitat restoration. Northwest Fisheries Science Center, NOAA Fisheries. Seattle, Washington.

[Service] United States Fish and Wildlife Service. 2022. Comment letter regarding the Draft Technical Memorandum Eklutna River Geomorphology and Sediment Transport Considerations for Flow Augmentation, and Potential Dam Spillway Release Options for Year-round Flows. Service file number 2022-0074477. 5 pp. https://eklutnahydro.com/documents/

Thompson, K.E. 1972. Determining stream flows for fish life. Proceedings of the instream flow requirements workshop, Pacific Northwest River Basins Commission, Portland, Oregon, 31-50.

[USACE] U.S. Army Corps of Engineers. 2004. Section 905(b) (WRDA 86) Eklutna watershed study. Eklutna, Alaska. December 3, 2004. 28 pp.

USACE. 2011. Eklutna River Aquatic Ecosystem Restoration Technical Report. November 2011. 84 pp.

Van Alen, B., and C. Mahara. 2011. Neva Lake Sockeye Salmon Assessment, 2011. Annual Report for Study 10-612. USDA Forest Service Ranger District.

Watershed GeoDynamics. 2023. Geomorphology and Sediment Transport Year 2 Study Report. Prepared by K. Dubé and Watershed GeoDynamics. Prepared for Chugach Electric Association, Matanuska Electric Association, and Municipality of Anchorage. 172 pp. https://eklutnahydro.com/documents/