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Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Salmon Escapement Study
Study Plan Section 9.7

Initial Study Report
Part C: Executive Summary and Section 7

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

LGL Alaska Research Associates, Inc. &
Alaska Department of Fish and Game, Division of Sport Fish

June 2014

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EXECUTIVE SUMMARY

Salmon Escapement Study 9.7	
Purpose	The primary goal of the study is to characterize the distribution, abundance, habitat use, and migratory behavior of all species of adult anadromous salmon across mainstem river habitats and select tributaries above the Three Rivers Confluence. A second goal of this study is to estimate the distribution, abundance, and migratory behavior of adult Chinook salmon throughout the entire Susitna River drainage, and the coho salmon distribution and abundance in the Susitna River above the confluence of the Yentna River.
Status	This multi-year study initiated in 2012, was carried out by ADF&G and AEA's contractors. Field work in the second study year was completed in November 2013, and the data collected during 2013 has been summarized in the ISR. All field work is scheduled to be completed in 2014.
Study Components	This study is comprised of eight major study objectives: 1) Capture, radio-tag, and track adults of five species of Pacific salmon in the Middle and Upper Susitna River in proportion to their species-specific abundance. Capture and tag Chinook, coho, and pink salmon in the Lower Susitna River. 2) Characterize the migration behavior and spawning locations of radio-tagged salmon in the Lower, Middle, and Upper Susitna River. 3) Characterize adult salmon migration behavior and timing within and above Devils Canyon. 4) If shown to be an effective sampling method, and where feasible, use sonar to aid in documenting salmon spawning locations in turbid water. 5) Compare historical and current data on run timing, distribution, relative abundance, and specific locations of spawning and holding salmon. 6) Generate counts of adult Chinook salmon spawning in the Susitna River and its tributaries to estimate the proportions of fish with tags for populations in the watershed. 7) Collect tissue samples to support the Fish Genetic Baseline Study (ISR Study 9.14). 8) Estimate the system-wide Chinook salmon escapement to the entire Susitna River, the coho salmon escapement to the Susitna River above the confluence with the Yentna River, and the distribution of Chinook, coho, and pink salmon among tributaries of the Susitna River (upstream of Yentna River confluence).
2013 Variances	AEA implemented the methods as described in the Study Plan with the exception of the following variances. The significance of these variances is

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	discussed within the ISR. Significant variances in 2013 included: 1) Due to CIRWG land access limitations, AEA did not operate a fishwheel in Devils Canyon to supplement the Middle River fishing effort for Chinook salmon (see Section 4.1.8.1). Instead, AEA increased the tagging goal (from 400 to 560) and fishing effort at the Curry fishwheels. (RSP Section 9.7.4.1). 2) AEA operated a floating picket weir and underwater video system on the Indian River in 2013 to sample adult salmon for mark rates and size distributions (to test capture probabilities at the tag and recovery locations; see Section 4.1.8.3). The Study Plan (RSP Section 9.7.4.1.5) indicated these samples would be collected on selected spawning grounds. 3) Due to CIRWG land access limitations, five of the fixed-station receiver sites listed in the Study Plan (RSP Section 9.7.4.2.1) were not installed in 2013. Because of this, AEA added six new fixed-station receiver sites (see Section 4.2.4). In addition, to compensate for the absence of fixed stations within Devils Canyon (RSP Section 9.7.4.3), helicopter surveys for tagged fish were flown through Devils Canyon daily starting in late June, and twice daily during the period of Chinook salmon passage (see Section 4.3.5). 4) Due to high stream discharges, it was not safe or feasible to operate weirs as recapture sites on Willow and Lake Creeks, or the Talachulitna and Middle Fork Chulitna rivers. Instead of Willow Creek, Montana Creek was selected as a weir site in 2013; and sonar was operated on the Talachulitna and Middle Fork Chulitna rivers. (RSP Section 9.7.4.8; see Section 4.8.1 for more detail).
Steps to Complete the Study	Field work will be completed in 2014 to fully achieve the eight objectives listed in the Study Plan (RSP Section 9.7.1.2). AEA will use the methods presented in the Study Plan (RSP Section 9.7.4) with the following modifications: 1) Use sonar to count the number of salmon-sized fish passing the proposed Watana Dam site (FERC SPD; decision point based on 2013 feasibility study). 2) On the Yentna River, use fishwheels at a new site for recapture, instead of weirs, and deploy fewer Chinook salmon radio tags (RSP Section 9.7.4.1 and 9.7.4.8). 3) Use beach seining in September near Curry, instead of fishwheels, to capture and radio-tag salmon (RSP Section 9.7.4.1.1 and FERC SPD). 4) Operate three fishwheels near Curry, instead of two, and not operate a fishwheel at Devils Canyon (RSP Section 9.7.4.1.1).

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	5) Radio tag 650 Chinook salmon at Curry (RSP Section 9.7.4.1). 6) Operate a picket weir and underwater video system on the Indian River to enumerate tagged and untagged Chinook salmon (RSP Sections 9.7.4.1.3 and 9.7.4.1.5). 7) Tag fish at the Curry fishwheels as soon as they are caught, thus precluding the need to examine any effects of holding times and density (RSP Section 9.7.4.1.6). 8) Not use sex and age composition of radio-tagged fish to assess fishwheel selectivity (RSP Section 9.7.4.1.7). 9) Increase the frequency of aerial telemetry surveys in the Middle River between Curry and Impediment 1 to every three days (RSP Section 9.7.4.2.2). 10) Change some of the fixed-station receiver sites that were proposed in the Study Plan (RSP Section 9.7.4.2.1). 11) Use ARIS sonar only to confirm Chinook salmon spawning activity in turbid waters (RSP Section 9.7.4.4.2).
Highlighted Results and Achievements	Key findings of the 2013 study were: 1) The catch of adult salmon in fishwheels was strong, which enabled tagging goals to be met or exceeded. AEA tagged 603 Chinook salmon (536 large, 67 small) in the Middle Susitna River, and ADF&G tagged 698 large Chinook salmon in the Lower Susitna River and 692 large Chinook salmon in the Yentna River. 2) Chinook salmon continue to be the only salmon species tracked upstream of the three passage impediments within Devils Canyon. In 2013, three radio-tagged Chinook salmon passed Devils Canyon, all of which were tagged in the Middle River. 3) None of the 698 Chinook salmon radio-tagged and released in the Lower River were tracked into the Upper River. However, three of these fish were tracked moving in Devils Canyon upstream of Impediment 2 but they never moved upstream of the third impediment. 4) This study documented the timing and flows that occurred when fish were moving through and upstream of Devils Canyon. The first successful Chinook salmon passage past Impediment 1 occurred on June 30 when flows exceeded 28,000 cfs at the Tsusena Creek Gage. No other fish passed until July 11–17, when flows declined to between 14,383 and 16,876 cfs at the Tsusena Creek Gage. There was a period with no fish passage from July 18–22 (in which flows exceeded 17,000 cfs at the Tsusena Creek Gage), and then the final passage event occurred on July 24 with flows of 16,884 cfs at the Tsusena Creek Gage. Flows at the Tsusena Creek Gage ranged from 14,383 cfs (July 13) to 18,848 cfs (July 30) when

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	the three Chinook salmon moved past Impediment 3. 5) Of the 621 Chinook salmon radio-tagged in the Lower River in 2013 that were tracked to spawning destination, 617 (99 percent) were tracked to tributaries (mainly the Deshka, Talkeetna, Chulitna, or Yentna rivers), and 4 (1 percent) went to destinations in the mainstem Susitna River. Of the 500 coho salmon tagged in the Lower River that were classified by destination, 478 (96 percent) went to tributaries (mainly the Yentna, Deshka, Talkeetna, or Chulitna rivers) and 22 (4 percent) went to destinations in the mainstem Susitna River. Of the 116 pink salmon tagged in the Lower River that were classified by destination, 98 (84 percent) went to tributaries (mainly the Deshka or Yentna rivers, or Montana or Willow creeks) and 18 (16 percent) went to mainstem Susitna River destinations. 6) Of the 621 Chinook salmon radio-tagged in the Lower River in 2013 that were tracked to spawning destination, 617 (99 percent) were tracked to tributaries (mainly the Deshka, Talkeetna, Chulitna, or Yentna rivers), and 4 (1 percent) went to destinations in the mainstem Susitna River. Of the 500 coho salmon tagged in the Lower River that were classified by destination, 478 (96 percent) went to tributaries (mainly the Yentna, Deshka, Talkeetna, or Chulitna rivers) and 22 (4 percent) went to destinations in the mainstem Susitna River. Of the 116 pink salmon tagged in the Lower River that were classified by destination, 98 (84 percent) went to tributaries (mainly the Deshka or Yentna rivers, or Montana or Willow creeks) and 18 (16 percent) went to mainstem Susitna River destinations. 7) Of the 449 large Chinook salmon radio-tagged in the Middle River in 2013 that were tracked to a spawning destination, 422 (94 percent) were tracked moving into Middle River tributaries (mainly Portage Creek or Indian River) and 27 (6 percent) went to destinations in the mainstem Susitna River. Of the 45 small Chinook salmon tagged in the Middle River that were classified by destination, 42 (93 percent) went to tributaries (mainly Indian River or Portage Creek), and 3 (7 percent) went to destinations in the mainstem Susitna River. Of the 164 chum salmon radio-tagged in the Lower River that were classified by destination, 147 (90 percent) went to tributaries (mainly Portage Creek, or Indian or Talkeetna rivers) and 17 (10 percent) went to destinations in the mainstem Susitna River. Of the 173 coho salmon classified by destination, 154 (89 percent) went to tributaries (mainly Talkeetna, Chulitna, or Indian rivers) and 19 (11 percent) went to mainstem Susitna River destinations. Of the 166 pink salmon radio-tagged in the Middle River that were classified by destination, 151 (91 percent) went to tributaries (primarily Indian or Talkeetna rivers, and Portage, Fourth of July, or Lane creeks), and 15 (9 percent) went to destinations in the mainstem Susitna River. Of the 92

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	sockeye salmon classified by destination, 44 (48 percent) went to tributaries (mainly Chulitna, Talkeetna, or Indian rivers, or Portage Creek) and 48 (52 percent) went to destinations in the mainstem Susitna River. 8) A weir and underwater video system were operated successfully on the lower Indian River from June 26 to August 20. The number of fish moving upstream past the weir included 1,405 Chinook (6.3 percent were tagged), 12,906 chum, 525 coho, 37,181 pink, and 127 sockeye salmon adults. 9) Based on the 411 coho salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and 22,906 fish inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of coho salmon to the Susitna River above the Yentna River confluence was 130,026 (SE = 24,342). Of these, an estimated 29,215 (SE = 6,875) spawned in the Deshka River drainage, 13,372 (SE = 3,762) spawned in the Talkeetna River drainage, 11,038 (SE = 3,280) spawned in east side tributaries below the Talkeetna River, 31,204 (SE = 8,010) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 36,844 (SE = 8,144) spawned in the Chulitna River drainage, and 8,313 (SE = 2,961) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon. 10) Based on 568 Chinook salmon radio-tagged in the Lower River that appeared to spawn above the tagging site, and an estimated 19,952 Chinook salmon measuring 50 cm METF or greater inspected for tags at the Deshka River and Montana Creek weirs, the estimated escapement of Chinook salmon to the Susitna River above the Yentna River confluence was 89,463 (SE = 9,523). Of these, an estimated 18,469 (SE = 2,262) spawned in the Deshka River drainage, 24,408 (SE = 3,545) spawned in the Talkeetna River drainage, 16,867 (SE = 1,873) spawned in east side tributaries below the Talkeetna River, 2,432 (SE = 757) spawned in west side tributaries or in or near the mainstem between the Chulitna and Deshka rivers, 19,607 (SE = 2,823) spawned in the Chulitna River drainage, and 7,680 (SE = 1,494) spawned in tributaries or in or near the mainstem between the Chulitna River and Devils Canyon.

7. COMPLETING THE STUDY

7.1. Proposed Methodologies and Modifications

To complete this study, AEA will implement the methods in the Study Plan except as described in Sections 7.1.1 (and 7.1.2). These activities include:

1. Capture, radio-tag, and track adults of five species of Pacific salmon in the Middle and Upper Susitna River in proportion to their abundance. Capture and tag Chinook, coho and pink salmon in the Lower Susitna River (RSP Section 9.7.4.1).

2. Characterize the migration behavior and spawning locations of radio-tagged fish in the Lower, Middle, and Upper Susitna River (RSP Section 9.7.4.2).

3. Characterize adult salmon migration behavior and timing within and above Devils Canyon (RSP Section 9.7.4.3).

4. If shown to be an effective sampling method, and where feasible, use sonar to aid in documenting salmon spawning locations in turbid water (RSP Section 9.7.4.4).

5. Compare historical and current data on run timing, distribution, relative abundance, and specific locations of spawning and holding salmon (RSP Section 9.7.4.5).

6. Generate counts of adult Chinook salmon spawning in the Susitna River and its tributaries to estimate the proportions of fish with tags for populations in the watershed (RSP Section 9.7.4.6).

7. Collect tissue samples to support the Fish Genetic Baseline Study (Study 9.14; RSP Section 9.7.4.7).

8. Estimate the system-wide Chinook salmon escapement to the entire Susitna River, the coho salmon escapement to the Susitna River above its confluence with the Yentna River, and the distribution of Chinook, coho, and pink salmon among tributaries of the Susitna River (upstream of Yentna River confluence; RSP Section 9.7.4.8).

7.1.1. Decision Points from Study Plan

The FERC SPD (February 1, 2013 SPD at B-20) requested a feasibility assessment in 2013 of "putting a weir or sonar counting station at or near the dam site during the 2014 study season to provide an accurate count of any resident or anadromous fish that are successfully able to migrate upstream through Devils Canyon into the project area."

In 2013, AEA conducted a pilot investigation and concluded that it was feasible to count salmon near Watana with a quantifiable degree of accuracy. See ISR Study 9.7 Section 4.3.4 and Appendix G. AEA has concluded it is not feasible to operate a weir, provide an accurate count of resident fish, or to know if a fish has migrated upstream through Devils Canyon (except for anadromous adult salmon). However, given several assumptions, it appears feasible to count

salmon-sized fish, in particular Chinook salmon, and to quantify the accuracy of those counts using corroboration with the passage of radio-tagged Chinook salmon. It is anticipated that this approach will achieve Study Objective 3.

AEA plans to implement a new study component with the objective to count the number of salmon-sized fish passing the proposed Watana Dam site using ARIS sonar technology. As described in Appendix G, the design and potential success of this component depends on factors such as the target species (Chinook salmon, anadromous adults or all fish species), the type of counts required (total counts vs. index counts), the channel configuration at potential sites (which will determine the number of ARIS units required), and access to potential sites. At a minimum, AEA would attempt to operate sonar from July 7 to July 28 to count adult Chinook salmon.

Details regarding the proposed use of sonar at the Watana Dam site were presented at a Technical Workgroup Meeting held on March 20, 2014 (See March 20, 2014 meeting notes [http://www.susitna-watanahydro.org/wp-content/uploads/2014/03/Salmon-escapement-for-Mar-20-2014.pdf]).

7.1.2. Modifications to Study Plan

AEA will implement the methods as described in the Study Plan with the exception of the following modifications.

7.1.2.1. Objective 1: Capture, radio-tag, and track adults of five species of Pacific salmon in the Middle and Upper Susitna River in proportion to their abundance. Capture and tag Chinook, coho, and pink salmon in the Lower Susitna and Yentna rivers.

7.1.2.1.1. Yentna River

The Study Plan provided that 700 Chinook salmon be radio-tagged in the Yentna River (RSP Section 9.7.4.1). However, modification of the recapture methods to support estimation of Chinook salmon abundance in the Yentna River under Objective 8 will decrease AEA's reliance on radio tags (see Section 7.1.2.5). Instead, all healthy Chinook salmon captured at Yentna River at river mile (RM) 6 will be marked with uniquely-numbered dart tags. Both fishwheels and drift gillnets will be used to capture fish at both sites in order to minimize size selectivity by capture gear. The goal is to tag 5,000 Chinook salmon at Yentna River RM 6. Given the catch rates in 2013, additional fishing effort is planned, by increasing fishwheel operation from 12 hr/day to 16 hr/day, and drift gillnetting a minimum of 12 hr/day. A subsample of dart-tagged Chinook salmon will also receive a radio tag (300 total), to assess handling effects and estimate spawning distribution dart tags will be applied to Chinook captured in the lower Yentna River. This modification to the strategy for tagging on the Yentna River will better support AEA's objective to estimate the escapement of Chinook salmon to the Yentna River as described in Section 7.1.2.5.

7.1.2.1.2. Middle River

Beach Seining in September near Curry

The FERC SPD recommended that AEA extend the period of Curry fishwheel operation throughout the month of September. RSP Section 9.7.4.1.1 states that fishwheels will be used to capture adult salmon for tagging at Curry. In 2014, AEA will modify the Study Plan and use a beach seine near Curry in September to supplement or replace fishwheels for capturing and radio-tagging late-run coho salmon, and any other salmon species. No significant method changes will be required to implement this modification. Analysis of sonar data from 2013 showed that fishwheels were not effective in September when river discharge and turbidity decreased substantially from summer conditions. Further, pilot seining operations conducted in 2013 demonstrated that it is feasible to capture and radio-tag salmon during September in the vicinity of Curry. This method is consistent with gillnetting as conducted in the Lower River tagging operation. Therefore, AEA plans to add beach seining as an alternative method for sampling in September, in order to increase the likelihood of achieving Objectives 1 and 2.

Third Curry Fishwheel

RSP Section 9.7.4.1.1 states that two fishwheels will be used at Curry. AEA plans to operate three fishwheels near Curry starting in early June 2014. In 2013, AEA began the season with two fishwheels at the same sites as in 2012, and in July deployed a third fishwheel. This was needed due to changes in the river channel that occurred following the 2012 field season which made water velocities slower at the right bank fishwheel site (PRM 124); considerable effort was required to keep this fishwheel operating effectively, particularly during low water. The third (Site 3) fishwheel will start operating in June 2014 (as opposed to mid-July when it was sited and became operational in 2013). Although the Site 3 fishwheel is more exposed to debris, it may provide a meaningful increase in Chinook salmon catch by operating early. This modification was implemented as a variance in 2013 as described in Section 4.1.8.1. Operating the third fishwheel in 2014 will increase the likelihood of achieving Objective 1.

Devils Canyon Fishwheel

RSP Section 9.7.4.1.1 provided that AEA would examine the feasibility of applying additional radio tags to Chinook salmon in the Middle River by operating a fishwheel at Devils Canyon, below Impediment 1. As described in Section 4.1.8.1, this feasibility study was not an option in 2013 due to CIRWG land-access limitations. Instead, in 2013, AEA showed that it was feasible to capture and tag over 600 Chinook salmon with the Curry fishwheels, and this increase in sample size helped achieve study Objectives 1, 2, and 3.

In 2014, AEA plans to operate fishwheels near Curry for capturing and tagging all salmon species in the Middle River, but does not plan to operate a fishwheel at Devils Canyon. AEA will operate a fishwheel at Site 3 near Curry beginning in June, to increase the number of Chinook salmon caught and available for tagging. Chinook salmon that are tagged at Curry can be inspected for tags at the Indian River weir to produce mark rates (used to estimate abundance above the canyon), and test for size selectivity; whereas Chinook salmon tagged in Devils Canyon would not provide this information. Further, if fish are tagged in Devils Canyon, then there is less distance (and possibly time) for potential 'drop-back' effects to attenuate before they pass the impediments, compared to fish tagged at Curry.

Tagging an additional 250 Chinook salmon at Curry will provide a more certain and larger sample size of radio-tagged fish entering Devils Canyon than attempting to catch fish in a location heretofore unproven. In 2012, 9.1 percent of fish tagged at Curry approached within 1 km (0.6 miles) of Impediment 1, and in 2013, the metric was 11.2 percent of those tagged at Curry. If 650 fish were tagged at Curry in 2014, AEA expects 59 to 73 of them to approach Impediment 1. This range in sample size exceeds the most optimistic expectation of the number of tags that could be applied from a fishwheel operation in Devils Canyon. Also, as noted above, the additional tags applied at Curry will improve the estimate of the mark rate from Curry (based on fish sampled at the Indian River weir), which in turn will improve the precision of any estimate of the total number of Chinook salmon above Devils Canyon. It will not be possible to determine the fraction of the run at Devils Canyon that is tagged because so few tagged and untagged fish can be examined above the tagging site.

Significant logistical effort and cost would also be required to effectively operate a fishwheel in the Middle River downstream of Impediment 1. For example, a new field camp would need to be established in the vicinity of the fishwheel, and the camp would need to be re-supplied via helicopter from Talkeetna.

In summary, fishwheel effectiveness at Devils Canyon is unproven, additional effort there instead of Curry may lead to fewer radio-tagged fish in Devils Canyon, and will likely provide a poorer estimate of the total number of Chinook salmon that make it above Devils Canyon and the proposed dam site in 2014.

Target 650 Chinook for radio-tagging near Curry

RSP Section 9.7.4.1 states that 400 radio tags will be applied to Chinook salmon at Curry, and RSP Section 9.7.4.1.2 states that only large Chinook salmon will be tagged.

AEA will radio-tag a total of 650 Chinook salmon in the Middle River near Curry in 2014. As in 2013, the focus of Chinook salmon tagging will be on large fish, and all available large fish will be tagged up to 550 individuals. A to-be-determined fraction of the small Chinook salmon will also be tagged, with a goal of up to 100 small fish, depending on the catch of large fish. Increasing the number of radio tags applied to Chinook salmon, as well as tagging a portion of small Chinook salmon, were both variances to the Study Plan implemented in 2013 (see Sections 4.1.8.1 and 4.1.8.2). In 2013, once it was determined that CIRWG land access was not available, AEA increased the tagging goal for Chinook salmon at Curry as an alternative to increasing the numbers of tagged fish in Devils Canyon. By late June 2013, it became apparent that small Chinook salmon comprised a substantial portion of the total Chinook salmon catch, and the revised radio tagging target for large Chinook salmon (560 in 2013) might not be met. A total of 603 tags (536 large, 67 small) were applied to Chinook salmon in 2013. Both of these modifications for 2014 will help achieve Objectives 1, 2, and 3, especially as it relates to maximizing the number of tagged fish migrating above Devils Canyon.

Indian River Weir

RSP Sections 9.7.4.1.3 and 9.7.4.1.5 provide for implementing spawning ground surveys to provide data on mark rates and relative abundance. In 2014, AEA will not conduct spawning ground surveys, but instead plans to operate the Indian River weir and underwater video system

to enumerate tagged and untagged Chinook salmon over the Chinook salmon run, and over as much of the other salmon runs as discharge will permit. AEA expects that high flows, due to rain in August, could preclude weir operations by topping the panels, although AEA plans to replace a portion of the Indian River weir in 2014 with additional picket panels to improve the operational range of the weir with respect to flow levels. This was a variance to the Study Plan implemented in 2013, and additional rationale for operating the weir was presented in Section 4.1.8.3. The proposed Indian River weir operation, as conducted in 2013, provides substantially more useful data (e.g., the number of fish examined upstream of the fishwheels for marks, and generating a mark rate) and helps achieve Objectives 1, 2, 6, and 8.

Continuous Tagging at Fishwheels

RSP Section 9.7.4.1.6 states that AEA will assess the effects of holding times and density on the behavior of tagged fish. As implemented in 2013 and described in Section 4.1.8.3, AEA plans to tag fish as they are caught in the fishwheels in 2014, rather than allowing fish to be held in the live tanks. This procedure will thereby preclude the need to examine any effects of holding times and density on subsequent behavior. Modifying the protocol to tag fish as they arrive eliminates the potential bias of holding time and fish density, and thereby helps achieve study Objective 1.

Sex and Age Composition

RSP Section 9.7.4.1.7 states that contingency table analyses and Chi-square tests will be used to compare the sex and age composition of fish radio-tagged by species. AEA does not plan on using sex or age composition of radio-tagged fish to assess fishwheel selectivity in 2014. Early on in the 2013 field season, it became clear that correctly identifying fish sex based on external morphological characteristics would be difficult at the Middle River fishwheels. In light of the fact that size selectivity will be tested, and that fish will be randomly selected for tagging, testing for age selectivity was deemed unnecessary. This modification was implemented in 2013 and additional rationale for this modification from the Study Plan was provided in Section 4.1.8.3. This modification will not affect AEA's ability to achieve Objective 1.

7.1.2.2. Objective 2: Determine the migration behavior and spawning locations of radio-tagged fish in the Lower, Middle, and Upper Susitna River

RSP Section 9.7.4.2.2 provides that aerial surveys will be conducted approximately every five days. The plans and modifications for Objective 2 in 2014 include increasing the frequency of aerial telemetry surveys in the Middle River between Curry and Impediment 1 to every three days to ensure sufficient in-season data is available to identify potential spawning locations for Chinook salmon. Efforts during the 2013 spawning surveys were focused on potential spawning sites identified in 2012, and weekly to bi-monthly detection histories for fish tracked in 2013. The increased frequency of aerial telemetry surveys in the Middle River between Curry and Impediment 1 will improve the resolution of the geographic positions of tagged fish necessary to support inseason determination of potential spawning locations, and will help achieve Objectives 1 and 2.

RSP Section 9.7.4.2.1 lists ten fixed-station receiver sites to be used in the Middle and Upper River. AEA plans to use eleven fixed-station receiver sites in 2014, seven of which were listed

in RSP Section 9.7.4.2.1 (Lane Creek, Gateway, Indian River confluence, Cheechako Creek, Chinook Creek, Devil Creek area, and Kosina Creek). Four sites not listed in RSP Section 9.7.4.2.1 will be used in 2014 (Indian River Weir, Watana Dam Sonar, Watana Creek, and Oshetna River). Some of these modifications differ from the variances implemented in 2013 (as described in Section 4.2.4). In 2013, five sites listed in RSP Section 9.7.4.2.1 were used (Lane Creek, Gateway, Indian River confluence, Devil Creek area, and Kosina Creek), and six sites not listed in the Study Plan were used (Whiskers Creek, Fourth of July Creek, Indian River Weir, Powerline, Deadman Creek, and Oshetna River). Three sites listed in RSP Section 9.7.4.2.1 which were not used in 2013 will also not be used in 2014 (Slough 11, Slough 21, and Portage Creek).

In 2014, the Indian River Weir site will be used to detect radio-tagged salmon passing through the weir, which in turn will be used to estimate mark rates for Chinook salmon to help achieve Objectives 1 and 6. The Watana Dam Sonar site will be added to detect radio-tagged salmon passing the sonar site described in Section 7.1.1. The Watana Creek and Oshetna River sites will be added specifically for ISR Study 9.6, but it is possible that radio-tagged salmon will be detected at these sites. Too few fish were detected at the Slough 11 and Slough 21 sites in 2012 to justify their use in 2013 (see Section 4.2.4 for variance details) and 2014. These changes will help achieve Objectives 2 and 3.

7.1.2.3. Objective 3: Characterize adult salmon migration behavior and timing within and above Devils Canyon

RSP Section 9.7.4.2.2 provided for aerial surveys at five-day intervals. In 2013, daily aerial surveys of Devils Canyon were conducted (Section 4.3.5) due to limited access for fixed station receivers on CIRWG lands. In 2014, AEA plans to deploy fixed-station receiver sites at each of the three Devils Canyon impediments which is consistent with the Study Plan (RSP Sections 9.7.4.2.1 and 9.7.4.3). Operating these stations will have a substantial positive logistical effect relative to 2013. Carefully deployed and serviced fixed-stations are a more cost-effective method of monitoring fish passage at the impediments compared to daily aerial telemetry surveys. Furthermore, it is safer for staff, because they log less flight time. Technically, daily surveys provide a more precise method of assessing detailed geographic movements and holding periods below impediments for tagged fish, but they do not add benefit to the key aspect of identifying movement past the impediments. Surveys at three-day intervals will enhance AEA's ability to characterize migration behavior with respect to the approved study methods.

7.1.2.4. Objective 4: Use available technology to document salmon spawning locations in turbid water in 2013 and 2014

RSP Section 9.7.4.4 states that sonar will be used to characterize "any suspected salmon spawning" in turbid water of the mainstem habitats of the Susitna River. It is also indicated in the Study Plan that the aspect of feasibility will be considered as based on the data collected. AEA has determined that sonar is not a feasible method for characterizing sockeye, chum, or pink salmon spawning activity. The plans and modifications for Objective 4 in 2014 include using ARIS to confirm only Chinook salmon spawning activity in turbid waters. Due to the issues described in Section 6.5, ARIS sonar was not an adequate method for surveying shallow sites to document spawning activity associated with chum, coho, pink, or sockeye salmon.

Chinook salmon typically spawn far enough away from shore, such that disturbance with a boat is not a major concern. Also, Chinook salmon spawn entirely within a period when flows and turbidity in the Middle River mainstem remain relatively high, and they can be identified with a high level of certainty (due to their difference in body size and run timing compared to other species). This modification will limit AEAs ability to document spawning locations in turbid water for chum, coho, pink, and sockeye salmon as described for Objective 4.

RSP Section 9.7.4.4 states that side-scan sonar and/or DIDSON will be used for the turbid water surveys. AEA will use ARIS instead of DIDSON or side-scan sonar in 2014. The rationale for using ARIS instead of DIDSON and side-scan sonar was provided in Section 4.4.3, as this was a variance implemented in 2013. This modification for 2014 will not change AEAs ability to meet Objective 4.

7.1.2.5. Objective 6: Generate counts of adult Chinook salmon spawning in the Susitna River and its tributaries

AEA will implement the methods for Objective 6 (RSP Section 9.7.4.6) in 2014. Modifications to the Study Plan as related to Objective 6 were described in Section 7.1.2.1.2 (Indian River Weir).

7.1.2.6. Objective 8: Estimate the system-wide Chinook and coho salmon escapement to the Susitna River above Yentna River and the distribution of those fish among tributaries of the Susitna River in 2013 and 2014

7.1.2.6.1. Yentna River Chinook

The Study Plan provided that weirs be used as a recapture method to support a two-event, capture-recapture experiment to estimate abundance of Chinook salmon in the Yentna River (RSP Section 9.7.4.8). In 2013, no suitable weir sites could be found for recapturing tagged fish. A sonar was operated on the Talachulitna River, but the operation of only sonar at one site to recover tagged fish was insufficient to test abundance model assumptions and generate a defensible abundance estimate. The radio telemetry fixed stations and aerial telemetry surveys adequately described the distribution of radio tags, but without estimates of the marked fraction by stratum, expanding the radio tag distribution into the spawning distribution of the Chinook salmon population was not possible. Water depth and velocity at the accessible sites in Lake Creek and the Talachulitna River were never low enough to install and operate a weir in 2013, and it appears that would be the case every year. Instead, AEA plans a capture-recapture abundance experiment for Chinook salmon using a fishwheel-to-fishwheel design. Fishwheel-to-fishwheel capture-recapture experiments are a proven methodology in the Susitna River that have been used to estimate chum and coho salmon abundance (Cleary et al. 2013). The capture fishwheels would be the capture fishwheels described in the Study Plan (Yentna River RM 6). A new fishwheel site for tag recapture would be installed at RM 18.7 of the Yentna River. Both fishwheels and drift gillnets will be used to capture fish at both sites in order to minimize size selectivity by capture gear. The goal is to tag 5,000 Chinook salmon at Yentna River RM 6 and examine 5,000 Chinook salmon at Yentna River RM 18.7. Given the catch rates in 2013, additional fishing effort is planned, by increasing fishwheel operation from 12 hr/day to 16 hr/day, and drift gillnetting a minimum of 12 hr/day. This methodology will be more robust to

high flow conditions in the Yentna River and will better support the objective to develop escapement estimates.

7.2. Schedule

In general, the schedule for completing the FERC-approved Study Plan is dependent upon several factors, including Project funding levels authorized by the Alaska State Legislature, availability of required data inputs from one individual study to another, unexpected weather delays, the short duration of the summer field season in Alaska, and other events outside the reasonable control of AEA. For these reasons, the Study Plan implementation schedule is subject to change, although at this time AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the ILP schedule issued by FERC on January 28, 2014.

In 2014, all field activities described in Section 7.1 for this Study will be completed. In 2015, AEA plans to complete all remaining data analysis and reporting for this study.

7.3. Conclusion

In 2013, one component of Objective 8 was not completed; namely, estimating the system-wide Chinook salmon escapement to the entire Susitna River, including the Yentna River. As stated in Section 7.1.1.5, operating a sonar on the Talachulitna River as the only recovery site was insufficient to generate a defensible abundance estimate for fish returning to the Yentna River. However, modifications to plans for 2014 should allow for a drainage-wide estimate to be generated in 2014.

Given the combination of 2013 efforts and variances (see Section 4), and the plans for 2014 with modifications (see Section 7.1), AEA will achieve the approved Study Plan 9.7 objectives (see Section 2).

7.4. Literature Cited

Cleary, P. M., R. A. Merizon, R. Y. Yanusz, and D. J. Reed. 2013. Abundance and spawning distribution of Susitna River chum *Oncorhynchus keta* and coho *O. kisutch* salmon, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 13-05. Anchorage.